EXHIBIT 1

Joint Declaration of Lucy Bates and Richard M. Byrne

We, Lucy Bates and Richard M. Byrne, declare as follows:

I. Introduction and Qualifications

A. Lucy Bates

1. My name is Lucy Bates. I graduated with a Bachelor of Arts (with Honors) in Experimental Psychology from Oriel College at the University of Oxford in 2000. I earned a Master's of Science in Human Biology from the Institute of Biological Anthropology, University of Oxford in 2001 and earned a Ph.D. in Evolutionary Biology from the University of St. Andrews in 2005. From January 2016 to December 2017, I was a Daphne Jackson Trust Postdoctoral Research Fellow at the School of Psychology, University of Sussex, studying culture in elephants. As of January 2018 I have held the title of Visiting Research Fellow at Sussex, and since September 2019 have been additionally employed as an Associate Lecturer within the School of Psychology and Counselling of the Open University. I currently reside in Paris, France.

2. I submit this declaration in support of the Nonhuman Rights Project, Inc.'s petition for a writ of habeas corpus regarding the captive elephants at the Cheyenne Mountain Zoo. I am a nonparty to this proceeding.

3. I study the evolution of cognition and social behavior, and my research focuses on the evolution of cognitive skills which allow social mammals to thrive in close-knit groups. My research has focused on the social and cognitive skills of African elephants since 2005, when I became a Leverhulme Trust Post-Doctoral Research Fellow at the University of St. Andrews. I was an Honorary Research Associate at the University of St. Andrews from 2008 – 2016, and since January 2016 I have continued my research as a Research Fellow at the School of Psychology, University of Sussex, and since 2022 as a lecturer at the University of Portsmouth.

4. I have been studying elephant cognition and social behaviour for eighteen years, since 2005. During this time, I have worked with the world's pre-eminent elephant biologists, many of whom are also submitting declarations in this matter, and spent months observing wild African elephants in both Kenya and South Africa, working in collaboration with the Amboseli Trust for Elephants, Elephant Voices, and Save the Elephants. In order to be more efficient, my colleagues and I agreed that I would draft the main declaration, which I would circulate to my colleagues for them to add or delete anything they believed was appropriate.

5. I have authored 24 scientific articles and book chapters on social cognition in African elephants and primates. These articles have been published in many of the world's premier scientific journals and books, including: APA Handbook of Personality and Social Psychology, Animal Behaviour, Biology Letters, Current Biology, Neuron, and PLoS One. I have also co-authored a field guide to elephant behaviour, and researched and fully drafted ('ghost-wrote') a popular science book about African elephants for a British media personality.

6. In addition to my research work, I also currently serve as a Director and Management Committee Member for the Elephant Specialist Advisory Group (ESAG), South Africa, a non-profit organisation that offers advice on elephant behaviour and management policy for government departments and managers of reserves within South Africa. I have previously acted as a consultant in elephant welfare and conservation, including freelance work for Save the Elephants, Kenya; Ezevelo KwaZulu Natal Wildlife, South Africa; and Society for the Prevention of Cruelty to Animals, Zimbabwe.

7. I have previously served as a consulting expert in legal matters, including: (1) in 2010/11, where I commented on licensing documents and attended a workshop for Ezemvelo KZN (Kwa Zulu Natal) Wildlife authority (South Africa), which resulted in tighter controls being implemented in the license agreement, considerably improving the elephants' welfare; and (2) in 2009, at the request of the Zimbabwe SPCA, I conducted a site visit and inspection

of a private farm where 10 juvenile elephants were being held. The elephants had been illegally captured from the wild and were undergoing training for the elephant-back safari industry. The ZNSPCA presented our reports to the then Minister for Environment and Tourism, who intervened and said that the elephants were to be rehabilitated and released back in to the wild. They were released six months later, and have adapted well.

8. My Curriculum Vitae fully sets forth my educational background and experience and is annexed hereto as "Exhibit A".

Basis for opinions

9. The opinions I state in this Declaration are based on my professional knowledge, education, training, and over 10 years of experience observing and studying elephants, as well as my knowledge of peer-reviewed literature about elephant behaviour and intelligence published in the world's most respected journals, periodicals and books that are generally accepted as authoritative in the field, and many of which were written by myself or colleagues whom I have known for several years and with whose research and field work I am personally familiar. A full reference list of peer-reviewed literature cited herein is annexed hereto as "Exhibit B".

B. Richard Byrne

10. My name is Richard William Byrne. I earned my Master of Arts with 1st Class Honours in Natural Sciences from St. John's College, Cambridge between 1969-1972. I received my Ph.D. from the University of Cambridge in 1975 for my thesis entitled "Memory in complex tasks." I am a Fellow of the Royal Society of Edinburgh. I reside and work in St. Andrews, Scotland.

11. I submit this declaration in support of the Nonhuman Rights Project, Inc.'s petition for a writ of habeas corpus regarding the captive elephants at the Cheyenne Mountain Zoo. I am a nonparty to this proceeding.

12. I have studied the evolution of cognition and social behavior throughout my career. As a Professor of Evolutionary Psychology at the University of St Andrews, Scotland, I have studied the evolution of cognition with a particular focus on the origins of uniquely human characteristics, utilizing evidence from a number of mammalian species including great apes, elephants, and domestic pigs, among other animals. I have studied the evolutionary basis of gestural communication, the use of tools, spatial mapping, cognition, and social behaviour.

13. Over the course of my career, I have received several awards and honors related to my research, including; (1) the Wright Prize & Hughes Prize, St Johns College, Cambridge, in 1972; (2) an MRC Studentship, tenure at MRC Applied Psychology Unit, Cambridge, from 1972-1975; (3) a Development Fellowship from the Association of Commonwealth Universities in 1993; (4) *British Psychology Society* Book Award for my Oxford University Press monograph "The Thinking Ape" in 1997; (5) awarded *Convenorship* of Focus Group 2003, "Precursors to Culture," from the Institute of Advanced Study, Collegium Budapest, Hungary in 2001; (6) elected Fellow of the *Royal Society of Edinburgh* (FRSE) in 2002; and (7) elected Fellow of the *Higher Education Academy* in 2007; (8) awarded *British Psychology Society* Lifetime Achievement Award in 2017.

14. In 1987, I founded (along with Bill McGrew at Stirling University, Liz Rogers at Edinburgh University, and Andy Whiten at St. Andrews University) the *Scottish Primate Research Group*, in order to coordinate the research interests of the 3 centers, promote new joint grant applications, encourage outside visitors to Scotland and postgraduate admissions, and coordinate joint seminars and lectures. The *Scottish Primate Research Group* now boasts national and international acclaim and attendance at hosted research presentations and seminars, and it is now larger and more productive than ever with 21 faculty members and over 50 affiliated researchers, including at Aberdeen and Abertay Universities. The focus of SPRG research is the natural behaviour, mentality, and ecology of primates. Field studies are carried

out by core SPRG members at several sites in Africa, Asia, and South America; captive primate studies rely on well-housed breeding groups at Edinburgh Zoo, particularly the SPRG Living Links Research Centre, as well as primate centers in France, Japan, and the USA. (Full Group member and affiliated researcher information can be found at the SPRG website: http://psy.st-andrews.ac.uk/research/sprg/).

15. I have conducted field work as part of my scientific research in multiple sites over my career, including: (1) at Mont Assirik, Senegal from January to April 1979, studying the Guinea baboon (*Papio papio*); (2) at Giant's Castle Game Reserve, South Africa from August to December 1983, studying the Chacma baboon (*Papio ursinus*); (3) at the Mahale Mountains, Tanzania from July to December 1984, studying the Chimpanzee (*Pan troglodytes*); (4) at the Virunga Volcanoes, Rwanda from July to December 1989, studying the Mountain gorilla (*Gorilla b. beringei*); and (5) at Mbeli Bai, Republic of the Congo from August to October 2010, studying the Western gorilla (*Gorilla g. gorilla*).

16. Throughout my career, I have been involved with Editorial work in a variety of capacities. Since 2000, this editorial work has included: (1) Serving on the Editorial Board of *Current Biology*, ongoing since 2006; (2) Serving on the Editorial Board of *Biology Letters*, from 2007-2013; (3) serving on the Editorial Board of *Animal Cognition*, from 1997-2011; (4) Serving on the Editorial Board of the *Journal of the Royal Anthropological Institute*, from 1995-2010; (5) Refereeing of book proposals for a number of publishers, including Basil Blackwell, Cambridge University Press, Curzon Press, Lawrence Erlbaum Associates, Oxford University Press, and John Wiley; (6) Refereeing of manuscripts for many premier scientific journals, including *Science, Nature, PNAS, Proc.Roy.Soc.B., Phil.Trans.B, TICS, TINS, Psychological Science, Psychological Bulletin,* and *Current Biology*; (7) Refereeing of promotion applications for a number of Universities in both the USA and United Kingdom, including Arizona State University, University of California San Diego, University of

Colorado, University of Florida (Gainesville, FL), Max Planck Institute for Evolutionary Anthropology (Leipzing), Miami University of Ohio, University of Natal (Republic of South Africa), University of Portsmouth (UK), University of Stirling (UK), and York University (Toronto); (8) Refereeing of research grants for many research foundations including the Biomedical and Biological Sciences Research Council (BBSRC), the Economic and Social Research Council (ESRC), Israel Academy of Sciences and Humanities (Basic Research Foundation), LSB Leakey Foundation (Oakley, California), Leverhulme Trust, Medical Research Council (MRC, United Kingdom), National Science Foundation (NSF, USA), National Environment Research Council (NERC, United Kingdom), and the National Science and Engineering Research Council (NSERC, Canada); and (9) Refereeing of research programmes for the Leverhulme Trust, Max-Planck-Society (Germany), and Earthwatch Europe.

17. I am affiliated with a number of professional organizations and have engaged in a variety of professional activities throughout my career. Since the year 2000, this has included: (1) Focus Group Convenor, "Precursors to Culture," at the Collegium Budapest Institute for Advanced Studies, Hungary, from Oct-Dec 2003; (2) Member of the Subgroup on *Use of non-human primates in research and testing* from 2000-2002 for the Boyd Group; (3) Vice-President for the *International Primatological Society* from 1996-2001; (4) organized symposium of 18th Congress of the *International Primatological Society*, Adelaide, 2001; (5) discussant at *Perspectives on Imitation*, France, 2002; (6) discussant at *Nijmegen Lectures*, Max Planck Institute for Psycholinguistics/University of Nijmegen, Holland, 2002; (7) organized symposium of St Andrews International Conference on *Animal Social Learning*, June 2005; (8) discussant at symposium *The cognitive triangle: Primates, Cetaceans, and Corvids*, Kyoto, 2006; (9) organized symposium of the 23rd Congress of the *International Primatological Society*, Kyoto, 2010; and (10) served as part of the Steering Committee for

Assessment for the *Quality Assurance Agency /Scottish Higher Education Funding Council* from 2003-2005.

18. I have written two books concerning my work with cognition: (1) *The Thinking Ape: evolutionary origins of intelligence* (1995, Oxford University Press, Oxford, 266 pages; 1997 *British Psychological Society* Book Award winner; Reprinted annually; Japanese edition published by Otsuki Shoten, Tokyo, 1998; Chinese edition, in translation, published by Hunan Education Publishing House, 2006); (2*) Evolving Insight* (2016, Oxford University Press, Oxford, 304 pages).

19. I have co-edited two books concerning my work with cognition: (1) *Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes and Humans* (Co-edited with A. Whiten, 1988, Oxford University Press, Oxford, 413 pages; Japanese edition published by Nakanishiya Shuppan Press, Kyoto, 2004); (2) *Machiavellian Intelligence II: Extensions and Evaluations* (Co-edited with A. Whiten, Cambridge University Press, Cambridge, 1997, 403 pages; Japanese edition published by Nakanishiya Shuppan Press, Kyoto, 2004).

20. I have published 165 peer-reviewed scientific articles over my career. These articles have been published in many of the world's premier scientific journals, including: *Science*, *Biology Letters, Animal Cognition, Animal Behaviour, Biosemiotics, Behavioural Ecology and Sociobiology, Current Biology, International Journal of Primatology, Annals of the New York Academy of Sciences, Journal of Comparative Psychology, American Journal of Primatology, Trends in Evolution & Ecology, PLoS Biology, PLoS One*, *Trends in Cognitive Sciences, Philosophical Transactions of the Royal Society of London – Series B Biological Sciences, The Behavioral and brain sciences, Methods, American Journal of Physical Anthropology, Canadian Journal of Psychology, and The British Journal of Mathematical and Statistical Psychology*. Over the last four years, specific topics of these publications have

included: African elephants interpret a trunk gesture as a clue to direction of interest, Interpretation of human pointing by African elephants – generalization and rationality, African elephants recognize visual attention from face and body orientation, Flexibility and survival of Apes in the Anthropocene, Wild baboons (*Papio ursinus*) remember single foraging episodes, The what as well as the why of animal fun, Change point analysis of travel routes reveals novel insights into foraging strategies and cognitive maps of wild baboons, Age-dependent social learning in a lizard, Isolation rearing does not constrain social plasticity in a family-living lizard, The animal origins of disgust: reports of basic disgust in nonhuman great apes, The gestural repertoire of the wild bonobo (*Pan paniscus*): a mutually understood communication system, The meanings of chimpanzee gestures, Bonobo and chimpanzee gestures overlap extensively in meaning, Using cross correlations to investigate how chimpanzees use conspecific gaze cues to extract and exploit information in a foraging competition, Complexity in animal behaviour: towards common ground, African elephants can use human pointing cues to find hidden food, Deictic gesturing in wild chimpanzees – some possible cases, Laterality in the gestural communication of wild chimpanzees, Age-related differences in the use of the "moo" call in black howler monkeys, Evolutionary origins of human handedness – evaluating contrasting hypotheses, Titi monkey call sequences vary with predator location and type, Animal curiosity, Evidence for semantic communication in Titi monkey alarm calls, The alarm call system of wild black-fronted Titi monkeys, From parsing actions to understanding intentions, Serial gesturing by wild chimpanzees – its nature and function for communication, What are we learning from teaching? Local traditions in gorilla manual skill – Evidence for observational learning of behavioural organization, Animal behaviour in a human world: A crowdsourcing study on horses that open door and gate mechanisms, and Cognition in the wild – exploring animal minds with observational evidence.

21. My scientific work has also been published as chapters in 71 books. Over the last four years, these books have included *The Amboseli Elephants: A Long-Term Perspective on a Long-Lived Mammal* (2011, University of Chicago Press), *Integrating Gestures. The interdisciplinary nature of gesture* (2011, John Benjamins Publishing Company, Amsterdam), *Current research in applied ethology* (2011, Kuratorium für Technik und Bauwesen in der Landwirtschaft e.V. (KTBL), Darmstadt, Germany), *Developments in Primate Gesture Research* (2012, John Benjamins Publishing Company, Amsterdam), *Tool Use in Animals: Cognition and Ecology* (2013, Cambridge University Press), *New Perspectives on the symbolic species* (new edition in press, Springer-Verlag, Heidelberg, Germany), *The Emergence of Personhood: A Quantum Leap?* (in press, William B. Eerdmans Publishing Company, Grand Rapids, Michigan), and *Formal Models in Evolutionary Cognitive Archaeology* (in press, New York: Oxford University Press).

22. I have given major invited lectures at international research meetings and symposia throughout the world over the course of my career. Since the year 2000, these have included: (1) a public lecture and discussion on the topic of deception and fake news, with Evan Davies, BBC, at the Royal Institution, London; (2) the 85th James Arthur Lecture at the American Museum of Natural History (Public lecture, 2015), and a public lecture at Emory University, Atlanta; (3) two lectures in 2013: (a) the Tarragona Laterality Conference (invited lecture to closed conference) and (b) a public lecture at the University of Portsmouth; (4) an Invited lecture in the 2012 Workshop "Unpacking intentionality in animal vocal communication: an integrative approach" at the Institute of Evolutionary Biology, University of Zurich; (5) three lectures in 2011: (a) an invited lecture to a symposium entitled "The Emergence of Personhood" for the John Templeton Foundation, (b) a lecture at a closed workshop entitled "The evolution of human handedness" at the Hanse-Wissenschaftskolleg in Delmenhorst, Germany, and (c) a public lecture at the Institute of Evolutionary Biology at the University of

Zurich; (6) a referential communication for a workshop at the 2010 INCORE Thematic Meeting in Berlin; (7) three lectures in 2009: (a) a Plenary lecture at the 11th Congress of the German Society for Primatology in Hanover, Germany, (b) a public "Year of Darwin Lecture" for the School of Biosciences at Birmingham University, and (c) a lecture at the Workshop "Understanding Tool Use" at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany; (8) an invited lecturer at the 2008 Summer School on "Social Cognition" at the Institute of Cognitive Sciences in Montreal; (9) four lectures in 2007: (a) an inter-faculty series "The evolution of social cognition" for the Faculty of Life Sciences at the University of Vienna, (b) a Plenary lecture at the Second Congress of the European Federation of Primatology, at Charles University, Prague, (c) an invited lecture at a Workshop on "Social Cognition" by the MRC/Cold Spring Harbor at St Anne's College, Oxford, and (d) a Plenary lecture at the "Missing Links" conference at Carlsberg Academy, Copenhagen; (10) two lectures in 2006: (a) a lecture at the symposium "From Brain to Culture" hosted by The Royal Society, London, and (b) a Plenary lecture at the 66th Annual Meeting of the Japan Society for Animal Psychology in Kyoto; (11) two lectures in 2005: (a) Plenary lectures at the Portuguese Primatological Association's 2nd International Conference in Lisbon, and (b) a lecture in the "Evolutionary Cognitive Sciences" series at the University of Tokyo; (12) two lectures in 2004: (a) a Public lecture at the Institute of Cognitive & Decision Sciences at the University of Oregon, and (b) a lecture at the closed conference "Roots of Human Sociality" for the Wenner-Gren Foundation for Anthropological Research in North Carolina; (13) an International Workshop in 2003 for the European Workshop in Cognitive Neuropsychology in Bressanone, Italy; (14) three lectures in 2002: (a) a lecture in the Annual Autumn School in Cognitive Neuroscience with the theme "Rational animals?" for the McDonnell-Pew Centre at the University of Oxford, (b) a lecture at an International Workshop called "Perspectives on Imitation" in Royaumont Abbey, France, and (c) Public lectures for the Fundacio "la Caixa"

Museum of Science in Barcelona and the Social & Cultural Centre in Tarragona, Spain; (15) six lectures in 2001: (a) the Keynote Address to the VIIth European Congress of Psychology, forming part of the BPS Centenary in London, (b) a lecture at the "Human Cognition" symposium at the Institute of Cognitive Neurology at UCL, London, (c) a lecture and Press Conference on "Constraints on Culture" for the British Association for the Advancement of Science in Glasgow, (d) the Keynote Lecture for the Consciousness & Experiential Psychology section of the British Psychological Society, (e) a lecture entitled "Knapping Stone: a uniquely hominid behaviour?" for an International Workshop in Abbaye des Premontres, France, and (f) a lecture at an International Workshop "Malingering & Illness Deception" in Blenheim, Oxford; and (16) seven lectures in 2000: (a) a Plenary lecture to the Millennial Meeting "The social brain" for the British Neuropsychiatry Association, (b) the Invited Main Lecture entitled "Primate Cognition" for the International Congress for Cognitive Science in Inuyama, Japan, (c) a lecture at the Symposium "Animal Architecture" for the Gaia Research Project in Edinburgh, (d) a lecture at the International Conference "Human Nature" for the Royal Society of Edinburgh in Edinburgh, a lecture at the Workshop "Cognitive Science" at Sorbonne University in Paris, (e) a lecture at the Symposium "The Social Brain" at the Max Planck Institute in Andechs, Germany, and (f) a lecture at the Symposium "Science and Philosophy of Pain" for the University of Ghent, in Ghent, Belgium.

23. In addition to the major invited lectures listed above, I have given invited, funded talks at: Auckland University (Psychology, Zoology); BAAS SET7 Week (St Andrews); Gesamthochschule, Kassel (Primatenbiologie); Deutsches Primatenzentrum, Gottingen; Duke University, North Carolina (Biological Anthropology); Dundee University (teaching forum); Durham University (Psychology, Anthropology); Eotvos Lorand University, Budapest (Ethology); Hang Sen Centre for Cognitive Studies, Sheffield (twice); Hawaii University, Honolulu (Psychology); Kyoto University; Living Links Center, Emory University; MRC

Cognitive Brain Research Unit, Cambridge (twice); Max Planck Institute, Leipzig; Max Planck Institute, Seewiesen, Bavaria; Miami University, Ohio (Zoology); University of Otago, New Zealand (Psychology); Queens University, Kingston Ontario (Psychology); Universite de Rennes 1 (Zoology); Royal Anthropological Institute, London; Royal (Dick) School of Veterinary Studies, Edinburgh; Yerkes Regional Primate Research Center, Atlanta GA; UCSD (Psychology); York University, Toronto (Psychology); Universities of Aberdeen (Psychology), Abertay (Psychology), Cambridge (Psychology), Archaeology & Anthropology), Reading (Archaeology), St Andrews (Divinity, Modern Languages, Zoology, Psychology), Stirling (Psychology), UCL (Archaeology), Sussex (Neuroscience & Robotics), York (Centre for Human Palaeontology & Human Origins); and the Zoological Society of London.

24. Throughout my scientific career, I have had the privilege of supervising PhD level students. Since the year 2000, these have included: (1) R. Noser, (self-funded), "Navigation by chacma baboons within the home-range" from 1999-2004; (2) R. da Cunha (funded by CAPES, Brazil), "Long distance communication of howler monkeys" from 2000-2004; (3) A. Valero (funded by CONACYT, Mexico), "Social interactions of spider monkeys" from 2000-2004; (4) L. Bates (funded by BBSRC), "Foraging skills of female chimpanzees" from 2001-2005; (5) E. Cartmill (funded by Univ. St Andrews), "Gestural communication in great apes" from 2004-2008; (6) F. Moore (joint supervision), "Effects of resource control on female reproductive strategies from 2005-2006; (7) A. Ruiz (funded by James Cook Foundation and ORS), "Monkeys' understanding of intention and attention" from 2005-2009; (8) C. Hobaiter (funded by own EC grant), "Gestural communication in great apes" from 2007-2010; (9) C. Casar (funded by CAPES, Brazil), "Vocal communication of wild Titi monkeys" from 2007-2011; (10) K. Hall (funded by Janet Anderson Trust and ORSAS), "Theory of mind in chimpanzees" from 2008-2012; (11) L. Orr (funded by NSF Studentship), "Gestural

communication in gorillas" from 2010-2014; (12) A. Smet (funded by Univ. St Andrews), "Cognition in the African Elephant" from 2011-2015; (13) B. Fallon (self-funded), Gestural communication by sexually consorting male chimpanzees" 2012 - 2016; and (14) K. Graham (funded by Univ. St Andrews), "Negotiation of sexual relationships among bonobos" 2013 - 2016.

25. In addition to direct supervision of PhD students, I have also served as an External Postgraduate Examiner for individuals. Since the year 2000, these have included: (1) L. Ambrose, Ph.D. Oxford Brookes University (Anthropology) in 2000; (2) A. Nowell, M.Sc. University of Stirling (Psychology) in 2001; (3) B. A. Whiting, M.Sc. University of Durham (Anthropology) in 2002; (4) K. Rigby, Ph.D. London School of Economics (Psychology) in 2002; (5) P. Citrynell, Ph.D. Exeter University (Psychology) in 2003; (6) J. Dally Ph.D. University of Cambridge (Psychology) in 2004; (7) P. Citrynell Ph.D. Exeter University (Psychology, re-examination) in 2004; (8) J. Dalley Ph.D. University of Cambridge (Psychology); (9) Dr. Thomal Bugnyar, Habilitation, University of Vienna (Faculty of Life Sciences) in 2008; (10) C. Bird University of Cambridge (Psychology) in 2009; (11) P. Bertolani University of Cambridge (Archaeology & Anthropology) in 2012; (12) J. Trosciano University of Birmingham (Psychology) in 2012; (13) J. Wathen University of Sussex in 2015; (14) A. Picard, University of York, 2016; (15) A. Frohnwieser, University of Lincoln, 2017; (16) M. de Guinea, Oxford Brookes University, 2020.

26. I have been interviewed and my scientific research has been featured on a number of radio broadcasts, including: (1) interviews with BBC Radio 4 "Today" in 2000 and 2008; (2) with BBC Radio 4 as an interview with Jonathan Miller, "Self-made things" in 2005; (3) interview on Australian Radio with an article on my own research in "The Science Show" in 2001; (4) interview on Radio Netherlands with an article on my own research in 2001. Additionally, other interviews on my own research have been featured on: ABC Radio

Australia, Austrian Broadcasting Corporation, US Public Broadcasting Network, Breakfast Radio Auckland (NZ), Radio Canada, Western Australia Radio, Discovery Canada, Radio New Zealand "Morning Report," Radio Ireland, Talkback Radio (Ireland), BBC World Service, BBC Radio Scotland, Radio Wales, Radio Cambridgeshire, BBC Radio Jersey, BBC Radio 5 Live, Radio Tay, Kingdom FM, Talk 107, Voice of Russia, and Wave 102.

27. I have appeared and been featured in a number of Television broadcasts, including: (1) Interview with BBC1 6 O' Clock News (Scotland) on my own great ape research in 2008; (2) Interview with BBC1 6 O' Clock News (UK) on my own elephant research in 2013; (3) as a consultant for the BBC2 Program "The Secret Life of Pigs" in 2010; (4) Interview with BBC World/BBC4 Evening News on my own elephant research in 2013; (5) Interview with ITV/STV (ITN News) on my own elephant research in 2013; and (6) Interview with Australian ABC Channel TV as part of a programme on my research in the "Catalyst" series.

28. My Curriculum Vitae fully sets forth my educational background and experience and is annexed hereto as "Exhibit C".

Basis for opinions

29. The opinions I state in this Declaration are based on my professional knowledge, education, training, and years of experience observing and studying elephants, as well as my knowledge of peer-reviewed literature about elephant behaviour and intelligence published in the world's most respected journals, periodicals and books that are generally accepted as authoritative in the field, and many of which were written by myself or colleagues whom I have known for several years and with whose research and field work I am personally familiar. A full reference list of peer-reviewed literature cited herein is annexed hereto as "Exhibit B".

II. Opinions

A. Premise

30. Elephants are autonomous beings. Autonomy in humans and nonhuman animals is defined as self-determined behaviour that is based on freedom of choice. As a psychological

concept it implies that the individual is directing their behaviour based on some non-observable, internal cognitive process, rather than simply responding reflexively. Although we cannot directly observe these internal processes in other humans, we can explore and investigate them by observing, recording and analysing their behaviour. We can explore autonomy in non-human animals in a similar way, by observing similar behaviour and recording evidence of shared cognitive capacities in elephants.

31. We shall indicate which species, African (*Loxodonta Africana*) or Asian (*Elephus maximus*), specific observations relate to. If the general term 'elephants' is used with no specific delineation, it can be assumed the comment relates to both species.

B. Brain And Development

32. Elephants are large-brained, with the biggest absolute brain size of any land animal (Cozzi et al. 2001; Shoshani et al. 2006). Even relative to their body sizes, elephant brains are large. Encephalization quotients (EQ) are a standardised measure of brain size relative to body size, and illustrate by how much a species' brain size deviates from that expected for its body size. An EQ of one means the brain is exactly the size expected for that body, and values greater than one indicate a larger brain than expected (Jerison 1973). Elephants have an EQ of between 1.3 and 2.3 (varying between sex and African and Asian species). This means an elephant's brain can be more than twice as large than is expected for an animal of its size. These EQ values are similar to those of the great apes, with whom elephants have not shared a common ancestor for almost 100 million years (Eisenberg 1981, Jerison 1973). Given how metabolically costly brain tissue is, the large brains of elephants must confer significant advantages; otherwise their size would be reduced. The advantage of a large brain is to allow greater cognitive skill and behavioural flexibility (Bates et al. 2008a).

33. Typically, mammals are born with brains weighing up to 90% of the adult weight. This figure drops to about 50% for chimpanzees. Human baby brains weigh only about 27%

of the adult brain weight, increasing in size over the prolonged childhood period (Dekaban & Sadowsky 1978). This long period of brain development over many years (termed 'developmental delay') is a key feature of human brain evolution. It provides a longer period in which the brain may be shaped by experience and learning (Fuster 2002), and plays a role in the emergence of our complex cognitive abilities such as self-awareness, creativity, forward planning, decision making, and social interaction (Bjorkland 1997). Likewise, elephant brains at birth weigh only about 35% of their adult weight (Eltringham 1982), and elephants show a similarly protracted period of growth, development and learning (Lee 1986). This similar developmental delay in the elephant brain is likewise associated with the emergence of analogous cognitive abilities.

34. Despite nearly 100 million years of separate evolution (Hedges 2001), elephants share certain characteristics of our large brains, namely deep and complex folding of the cerebral cortex, large parietal and temporal lobes, and a large cerebellum (Cozzi et al. 2001). The temporal and parietal lobes of the cerebral cortex manage communication, perception, and recognition and comprehension of physical actions (Kolb and Whishaw 2008), while the cerebellum is involved in movement, planning, empathy, and predicting and understanding the actions of others (Barton 2012). The physical similarities between human and elephant brains occur in areas that are relevant to capacities necessary for autonomy and self-awareness.

35. Elephant brains hold three times more neurons than do human brains, with 97% of their found neurons in the cerebellum and 5.6 billion neurons in the cerebral cortex (Herculano-Houzel et al. 2014). (This figure for cortical neurons is lower than previous estimates, which suggested 11 billion cortical neurons for elephants and 11.5 billion for humans (Roth & Dicke 2005)). Elephants' pyramidal neurons (a class of neuron that is found in the cerebral cortex, particularly the pre-frontal cortex - the brain area that controls executive functions) are larger than in humans and most other species (Cozzi et al. 2001; Jacobs et al. 2011). (This term

"executive function" refers to controlling operations, for example paying attention, inhibiting inappropriate responses, deciding how to use memory search, and so on. These abilities develop late in human infancy and are often impaired in dementia).

36. Elephant pyramidal neurons have a large dendritic tree, i.e. a large number of connections with other neurons for receiving and sending signals (Cozzi et al. 2001; Jacobs et al. 2011; Maseko et al. 2012). The degree of complexity of pyramidal neurons is linked to cognitive ability, with more (and more complex) connections between pyramidal neurons being associated with increased cognitive capabilities (Elston 2003).

37. As described below, evidence demonstrates that along with these common brain and life-history characteristics, elephants share many behavioural and intellectual capacities with humans, including: self-awareness, awareness of death, empathy, intentional communication, learning, memory, and categorisation abilities. Many of these capacities have previously been considered – erroneously – to be uniquely human, and each relates to autonomy and self-determination.

C. Awareness Of Self And Others

38. An Asian elephant has exhibited Mirror Self Recognition (MSR) using Gallup's classic 'mark test' (Gallup 1970; Plotnik et al. 2006). MSR is the ability to recognise a reflection in the mirror as oneself, and the mark test involves surreptitiously placing a coloured mark on an individual's forehead that it could not see or be aware of without the aid of a mirror. If the individual uses the mirror to investigate the mark, the individual must recognise the reflection as herself. (See video here). Despite numerous attempts and trials in other species, the only other mammals (beyond humans) who have successfully passed the mark test and exhibit MSR are the great apes (chimpanzees, bonobos, gorillas and orangutans) (Parker, Mitchell & Boccia 1994) and one bottlenose dolphin Reiss and Marino 2001). MSR is significant because it is a key identifier of self-awareness. Self-awareness is intimately related

to autobiographical memory in humans (Prebble et al. 2013) and is central to autonomy and being able to direct one's own behaviour to achieve personal goals and desires. ("Autobiographical memory" refers to what one remembers about his or her own life; for example, not that "Paris is the capital of France", but the recollection that you had a lovely time when you went there). By demonstrating that they can recognize themselves in a mirror, elephants must be holding a mental representation of themselves from another perspective, and thus be aware that they are a separate entity from others (Bates and Byrne 2014).

39. Related to possessing a sense of self is an understanding of death. Observing reactions to dead family or group members appears to demonstrate an awareness of death in two known animal genera beyond humans; chimpanzees and elephants (Anderson et al. 2010, Douglas-Hamilton et al. 2006; Sharma et al. 2020). Having a mental representation of the self – a pre-requisite for mirror-self recognition – likely also confers an ability to comprehend death. Wild African elephants have been shown experimentally to be more interested in the bones of dead elephants than the bones of other animals (McComb et al. 2006) (See video here), and they have frequently been observed using their tusks, trunk or feet to attempt to lift sick, dying or dead individuals (see Poole & Granli 2011; Goldenberg & Wittemyer 2020). Although they do not give up trying to lift or elicit movement from the body immediately, elephants appear to realise that once dead, the carcass cannot be helped anymore, and instead they engage in more 'mournful' behaviour, such as standing guard over the body and protecting it from the approaches of predators (Poole & Granli 2011; Goldenberg & Wittemyer 2020) (See photographs here). They also have been observed to cover the bodies of dead elephants with dirt and vegetation (Moss 1992; Poole 1996). In the particular case of mothers who lose a calf, although they may remain with the calf's body for an extended period, they do not behave towards the body as they would a live calf. Indeed, the general demeanour of elephants who are attending to a dead elephant is one of grief and compassion, with slow movements and

few vocalisations (Poole, pers. comm.; Goldenberg & Wittemyer 2020). These behaviours are akin to human responses to the death of a close relative or friend, and illustrate that elephants possess some understanding of life and the permanence of death.

40. The capacity for mentally representing the self as an individual entity has been linked to general empathic abilities (Gallup 1982), where empathy can be defined as identifying with and understanding another's experiences or feelings by relating personally to their situation. Empathy is an important component of human consciousness and autonomy, and is a cornerstone of normal social interaction. It goes beyond merely reading the emotional expressions of others. It requires modeling of the emotional states and desired goals that influence others' behaviour both in the past and future, and using this information to plan one's own actions; empathy is only possible if one can adopt or imagine another's perspective, and attribute emotions to that other individual (Bates et al. 2008b). Empathy is, therefore, a component of and reliant on 'Theory of Mind' - the ability to mentally represent and think about the knowledge, beliefs and emotional states of others, whilst recognising that these can be distinct from your own knowledge, beliefs and emotions (Premack and Woodruff 1978; Frith and Frith 2005).

41. Elephants clearly and frequently display empathy in the form of protection, comfort and consolation, as well as by actively helping those who are in difficulty, such as assisting injured individuals to stand and walk, or helping calves out of rivers or ditches with steep banks (Bates et al. 2008b; Lee 1987). Elephants have even been observed feeding those who are not able to use their own trunks to eat (Poole and Granli 2011).

42. In an analysis of behavioural data collected from wild African elephants over a 40-year continuous field study, we concluded that as well as possessing their own intentions, elephants can diagnose animacy and goal directedness in others, understand the physical

competence and emotional state of others, and attribute goals and mental states (intentions) to others (Bates et al. 2008b), as evidenced in the examples below:

> *'IB family is crossing river. Infant struggles to climb out of bank after its mother. An adult female [not the mother] is standing next to calf and moves closer as the infant struggles. Female does not push calf out with its trunk, but digs her tusks into the mud behind the calf's front right leg which acts to provide some anchorage for the calf, who then scrambles up and out and rejoins mother.'*
>
> (See video here).
>
> *'At 11.10ish Ella gives a 'lets go' rumble as she moves further down the swamp . . . At 11.19 Ella goes into the swamp. The entire group is in the swamp except Elspeth and her calf [<1 year] and Eudora [Elspeth's mother]. At 11.25 Eudora appears to 'lead' Elspeth and the calf to a good place to enter the swamp — the only place where there is no mud.'*

Examples such as these demonstrate that the acting elephant (the adult female in the first example, and Eudora in the second) was able to understand the intentions of the other (the calf in the first case, and Elspeth in the second) – i.e. to either climb out of or into the water – and they could adjust their own behaviour in order to counteract the problem being faced by the other. Whilst humans may act in this helpful manner on a daily basis, such interactions have been recorded for very few non-human animals (Bates et al. 2008b).

43. Experimental evidence from captive African elephants further demonstrates that elephants attribute intentions to others, as they follow and understand human pointing gestures - the only wild animal so far shown to do so spontaneously – and can also read direction information in the trunk movements of other elephants (Smet and Byrne 2020). The elephants understood that the human experimenter was pointing in order to communicate information to them about the location of a hidden object (Smet and Byrne 2013) (See video here). Attributing

intentions and understanding another's reference point is central to empathy and theory of mind.

44. Our analysis of simulated oestrus behaviours in African elephants – whereby a non-cycling, sexually experienced older female will simulate the visual signals of being sexually receptive, even though she is not ready to mate or breed again – shows that these knowledgeable females adopt false oestrus behaviours in order to demonstrate to naïve young females how to attract and respond appropriately to suitable males. The experienced females may be taking the youngsters lack of knowledge into account and actively showing them what to do; an example of true teaching as it is defined in humans. This evidence, coupled with the data showing that they understand the ostensive cues in human pointing, demonstrates that elephants do share some executive theory of mind skills with humans, namely understanding the intentions and knowledge states (minds) of others. (Ostension is the way that we can "mark" our communications to show people that that is what they are. If you do something that another copies, that's imitation; but if you deliberately indicate what you are doing to be helpful, that's "ostensive" teaching. Similarly, we may "mark" a joke, hidden in seemingly innocent words; or "mark" our words as directed towards someone specific, by catching their eye. Ostension implies that the signaler knows what they are doing).

45. Further related to empathy, coalitions and cooperation have been documented in wild African elephants, particularly to defend family members or close allies from (potential) attacks by outsiders, such as when a family group tries to 'kidnap' a calf from an unrelated family (Lee 1987; Moss and Poole 1983). These behaviours are based on one elephant understanding the emotions and goals of the coalition partner (Bates et al. 2008b).

46. Cooperation is also evident in experimental tests with captive Asian elephants, whereby elephants demonstrated they can work together in pairs to obtain a reward, and understood that it was pointless to attempt the task if their partner was not present or could not

access the equipment (Plotnik et al. 2011) (See video here). Problem-solving and working together to achieve a collectively desired outcome involve mentally representing both a goal and the sequence of behaviours that is required to achieve that goal; it is based on (at the very least) short-term action planning.

47. Wild elephants have frequently been observed engaging in cooperative problem solving, for example when retrieving calves that have been kidnapped by other groups, or when helping calves out of steep, muddy river banks (Bates et al. 2008b; Moss 1992). These behaviours demonstrate the purposeful and well-coordinated social system of elephants, and show that elephants can hold particular aims in mind and work together to achieve those goals. Such intentional, goal-directed action forms the foundation of independent agency, self-determination, and autonomy.

48. Elephants also show innovative problem solving in experimental tests of insight (Foerder et al. 2011), where insight can be defined as the 'a-ha' moment when a solution to a problem 'suddenly' becomes clear. (In cognitive psychology terms, insight is the ability to inspect and manipulate a mental representation of something, even when you can't physically perceive or touch the something at the time. Or more simply, insight is thinking and using only thoughts to solve problems (Richard Byrne, *Evolving Insight*, Oxford Online Press, 2016[1]). A juvenile male Asian elephant demonstrated just such a spontaneous action by moving a plastic cube and standing on it to obtain previously out-of-reach food. After solving this problem once, he showed flexibility and generalization of the technique to other, similar problems by using the same cube in different situations, or different objects in place of the cube when it was not available (See video here). This experiment again demonstrates that elephants can choose the appropriate action and incorporate it into a sequence of behaviour in order to achieve a goal, which they kept in mind throughout the process.

[1] Available at https://global.oup.com/academic/product/evolving-insight-9780198757078?cc=us&lang=en&.

49. Further observations and experiments also demonstrate Asian elephants' ability to understand goal-directed behaviour (Irie-Sugimoto et al. 2008; Mizuno et al. 2016). When presented with food that was out of reach, but with some bits resting on a tray that could be pulled within reach, the elephants learned to pull only those trays that were baited with food (Irie-Sugimoto et al. 2008). Success in this kind of 'means-end' task is a demonstration of causal knowledge, which requires understanding not just that two events are associated with each other but also that there is some mediating force that connects and affects the two which may be used to predict and control events. Moreover, understanding causation and inferring object relations may be related to understanding psychological causation, i.e., the appreciation that others are animate beings that generate their own behaviour and have mental states (e.g., intentions).

D. Communication and social learning

50. Speech is a voluntary behaviour in humans, whereby a person can choose whether to utter words and thus communicate with another. Therefore, speech and language are reflections of autonomous thinking and intentional behaviour. Elephants also use their vocalisations to share knowledge and information with others (Poole 2011). Male elephants primarily communicate about their sexual status, rank, and identity, whereas females and dependents call to emphasise and reinforce their social units. Call types can generally be separated into calls produced by the larynx (such as rumbles) or calls produced by the trunk (such as trumpets), with different calls in each category being used in different contexts (Poole 2011; Poole and Granli 2009; Soltis et al. 2005; Stoeger-Horwarth et al. 2007; Wood et al. 2005). Field experiments have shown that African elephants distinguish between different call types (for example, contact calls – rumbles that travel long distances to maintain associations between elephants that could be several kilometres apart, or oestrus rumbles – that occur after a female has copulated) and these different call types elicit different responses in the listeners.

Elephant vocalisations are not simply reflexive, they have distinct meanings to listeners and they are truly communicative, similar to the volitional use of language in humans (Leighty et al. 2008; Pardo et al. 2019; Poole 1999; Poole 2011; Stoeger & Baotic 2016, 2017).

51. Furthermore, elephants have been shown to vocally imitate the sounds they hear around them, from the engines of passing trucks to the commands of human zookeepers (Poole et al. 2005; Stoeger et al. 2012). Imitating another's behaviour can be demonstrative of a sense of self, as it is necessary to understand how one's own behaviour relates to the behaviour of others.

52. Elephants display a wide variety of gestures, signals and postures, used to communicate information to the audience (Poole and Granli 2011). Such signals are adopted in many different contexts, such as aggressive, sexual, or socially integrative situations, and each signal is well defined and results in predictable responses from the audience. That is, each signal or gesture has a specific meaning both to the actor and recipient. Elephants' use of gestures demonstrates that they communicate intentionally and purposefully to share information with others and/or alter the others' behaviour to fit their own will.

53. Experimental evidence demonstrates that African elephants recognize the importance of visual attentiveness of the intended recipient (in this case, human experimenters) of gestural communication (Smet & Byrne 2014), further supporting that elephants' gestural communication is intentional and purposeful. Furthermore, the ability to understand the visual attentiveness and perspective of others is crucial for empathy and mental-state understanding.

E. Memory And Categorisation

54. Elephants have both extensive and long-lasting memories, just as the folk stories and adages encourage us to believe. McComb et al. (2000), using experimental playback of long-distance contact calls in Amboseli National Park, Kenya, showed that African elephants remember and differentiate the voices of at least 100 other elephants. Each adult female

elephant tested was familiar with the contact-call vocalizations of individuals from an average of 14 families in the population. When the calls were from the test elephants' own family, they contact-called in response and approached the location of the loudspeaker and when they were from another non-related but familiar family— that is, one that had previously been shown to have a high association index with the test group— they listened but remained relaxed. However, when a test group heard unfamiliar contact calls (from groups with a low association index with the test group), they bunched together and retreated from the area.

55. McComb et al. (2001) went on to show that this social knowledge accumulates with age, with older females having the best knowledge of the contact calls of other family groups. McComb et al. (2011) also showed that older females are better leaders, with more appropriate decision-making in response to potential threats (in this case, in the form of hearing lion roars). Younger matriarchs under-reacted to hearing roars from male lions, elephants' most dangerous predators. Sensitivity to the roars of male lions increased with increasing matriarch age, with the oldest, most experienced females showing the strongest response to this danger. These experimental studies show that elephants continue to learn and remember information about their environments throughout their lives, and this accrual of knowledge allows them to make better decisions and better lead their families as they grow older.

56. Further demonstration of elephants' long-term memory comes from data on their movement patterns. African elephants are known to move over very large distances in their search for food and water. Leggett (2006) used GPS collars to track the movements of elephants living in the Namib Desert. He recorded one group traveling over 600 km in five months, and Viljoen (1989) showed that elephants in the same region visited water holes approximately every four days, even though some of them were more than 60km apart. Elephants inhabiting the deserts of both Namibia and Mali have been described traveling hundreds of kilometers to arrive at remote water sources shortly after the onset of a period of rainfall (Blake et al. 2003;

Viljoen 1989), sometimes along routes that researchers believe have not been used for many years. These remarkable feats suggest exceptional cognitive mapping skills, reliant on the long-term memories of older individuals who traveled that path sometimes decades earlier. Indeed, it has been confirmed that family groups with older matriarchs are better able to survive periods of drought. The older matriarchs lead their families over larger areas during droughts than those with younger matriarchs, again apparently drawing on their accrued knowledge (this time about the locations of permanent, drought-resistant sources of food and water) to better lead and protect their families (Foley et al. 2008).

57. Significantly, it has recently been shown that long-term memories, and the decision-making mechanisms that rely on this knowledge, are severely disrupted in elephants who have experienced trauma or extreme disruption due to 'management' practices initiated by humans. Shannon et al. (2013) demonstrated that elephants in South Africa who had experienced trauma decades earlier showed significantly reduced social knowledge. During historic culling practices, juvenile 'cull-orphan' elephants were forcibly separated from family members and subsequently translocated to new locations. Two decades later, they still showed impoverished social knowledge and skills, with impaired decision-making abilities compared to elephants from an undisturbed population in Kenya. Disrupting elephants' natural way of life has substantial negative impacts on their knowledge and decision-making abilities, much as it can with humans.

58. Elephants demonstrate advanced 'working memory' skills. Working memory is the ability to temporarily store, recall, manipulate, and coordinate items from memory. Working memory directs attention to relevant information, and results in reasoning, planning, and coordination and execution of cognitive processes through use of a 'central executive' (Baddeley 2000). Adult human working memory is generally thought to have a capacity of around seven items. In other words, we can keep about seven different items or pieces of

information in mind at the same time (Miller 1956). We conducted experiments with wild elephants in Amboseli National Park, Kenya, manipulating the location of fresh urine samples from related or unrelated elephants. The elephants' responses to detecting urine from known individuals in surprising locations showed that they are able to continually track the locations of at least 17 family members in relation to themselves, as either absent, present in front of self, or present behind self (Bates et al. 2008c). This remarkable ability to hold in mind and regularly update information about the locations and movements of a large number of family members is best explained by the fact that elephants possess an unusually large working memory capacity, apparently much larger than that of humans.

59. Elephants show sophisticated categorisation of their environment, with skills on a par with those of humans. We experimentally presented the elephants of Amboseli National Park, Kenya, with garments that gave olfactory or visual information about their human wearers - either Maasai warriors (men who traditionally attack and spear elephants on occasion as part of their rite of passage), or Kamba men (who are agriculturalists and traditionally pose little threat to elephants). In the first experiment, the only thing that differed between the cloths was the smell, derived from the ethnicity and/or lifestyle of the wearers. The elephants were significantly more likely to run away when they sniffed cloths worn by Maasai men than those worn by Kamba men or no one at all (See video here). In a second experiment, we presented the elephants with two cloths that had not been worn by anyone, but here one was white (a neutral stimulus) and the other was red—the color that is ritually worn by Maasai warriors. With access only to these visual cues, the elephants showed significantly greater reaction to red garments than white, often including signs of aggression. We concluded that elephants are able to categorize a single species (humans) into sub-classes (i.e. 'dangerous' or 'low risk') based on either olfactory or visual cues alone (Bates et al. 2007). McComb et al. went on to show that the same elephants can also distinguish between human groups based on our voices.

The elephants reacted differently (and appropriately) depending on whether they heard Maasai or Kamba men speaking, and also when they heard male or female Maasai (where female Maasai pose no threat as they are not involved in spearing events), and adult Maasai men or young Maasai boys (McComb et al. 2014). Scent, sounds and visual signs associated specifically with Maasai men are categorized as ‘dangerous’, while neutral signals are attended to but categorized as ‘low risk’. Two captive Asian elephants have also recently been shown to differentiate between familiar and unfamiliar humans based on visual and olfactory signals (Polla et al. 2018). Asian elephants have also shown remarkable skills in judging quantities, using both visual and olfactory information (Irie et al. 2019; Plotnik et al. 2019), leading to the statement in one peer-reviewed paper that elephants ‘have cognitive characteristics partially identical to human counting’ (Irie et al. 2019). These sophisticated, multi-modal categorization and numerical skills may be exceptional among non-human animals. Moreover, these experiments demonstrate elephants’ acute sensitivity to the human world – monitoring our behavior and learning to recognize when we might cause them harm.

III. Conclusion

60. Both African and Asian elephants demonstrate highly adapted cognitive abilities, and share many key traits of advanced cognition and autonomy with humans. Based on the evidence, it is clear to us they should also be considered autonomous beings.

61. Scientific knowledge about elephant intelligence has been increasing rapidly in the past decade: what we currently know is only a tiny fraction of what elephant brains are likely capable of, and yet more amazing abilities are still likely to be discovered.

I declare under penalty of perjury under the law of Colorado that the foregoing is true and correct.

Executed on the 20th (date) of April (month), 2023(year)

at VAUCRESSON, FRANCE
(city or other location, and state or country)

Lucy Bates, Ph.D.

(signature)

I declare under penalty of perjury under the law of Colorado that the foregoing is true and correct.

Executed on the 26th (date) of 2nd (month), 2023 (year)

at St Andrews Fife UK
(city or other location, and state or country)

Richard W. Byrne, Ph.D

RWByrne
(signature)

Exhibit A

Lucy Anne **BATES**

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EMPLOYMENT

Oct 2019 – Present
Associate Lecturer, School of Psychology, The Open University
Tutoring on final year 'Investigating Psychology' research module for undergraduate students. (0.2FTE)

Jan 2018 – Present
Visiting Research Fellow, School of Psychology, University of Sussex
Continuing *Culture in elephants* research project; finalizing publications, developing future funding proposals, continuing to supervise related MSc and BSc research projects and deliver lectures. (0.6FTE)

Jan 2016 – Jan 2018
Daphne Jackson Research Fellow, School of Psychology, University of Sussex
Culture in elephants? Exploring social traditions across elephant populations
Conceived, designed and led survey-based, collaborative research project working with 10 independent elephant research sites across east and southern Africa, supervised by Prof. Karen McComb. (0.5FTE)

Oct 2012 – Dec 2015
Maternity leave for my two children born in 2012 and 2014.

Jun 2008 – Present
Director, Elephant Specialist Advisory Group (ESAG), South Africa (0.2 FTE since 2012)
Freelance Elephant Conservation Advisor, Pretoria, South Africa
Committee member advising national and local government on elephant management and conservation policy. Consultancy including report writing, assessment, analysis for: Save the Elephants, Kenya; Ezemvelo Kwa Zulu Natal Wildlife, South Africa; and Society for the Prevention of Cruelty to Animals, Zimbabwe.

Mar 2005 – May 2008
Research Fellow, School of Psychology, University of St Andrews
Leverhulme Trust funded project: Socio-Cognitive skills of the African Elephant
Designed, conducted and published high-impact experimental and observational field research exploring elephant cognition and social skills in Amboseli, Kenya; grant co-written with PI Prof. Richard Byrne.

EDUCATION

Nov 2001 – Mar 2005
PhD Evolutionary Psychology, School of Psychology, University of St Andrews
Title: *Travel and food location by chimpanzees of the Budongo Forest Reserve, Uganda*
Supervised by Prof. Richard Byrne. Supported by a BBSRC Studentship.

Oct 2000 – Oct 2001
MSc Human Biology, Institute of Biological Anthropology, University of Oxford
Dissertation: *Gregariousness in female chimpanzees of the Budongo Forest Reserve, Uganda*
Supervised by Prof. Vernon Reynolds.

Oct 1997 – Jun 2000

BA (Hons) Experimental Psychology, Oriel College, University of Oxford

Papers completed: Animal Behaviour; Biology of Learning and Memory; Brain and Behaviour; Individual Differences; Memory and Cognition; Perception; Social Psychology.

RESEARCH

Publications h-index: 16

Bates LA (2020) Cognitive abilities in elephants. In: *The Cambridge Handbook of Evolutionary Perspectives on Human Behaviour*. Eds. L. Workman, W. Reader & J. Barkow. Cambridge University Press, Cambridge.

van der Water A, Henley M, **Bates LA** & Slotow R (2020) A transformative conservation future for Thailand's captive elephants: A commentary on Baker & Winkler Elephant Rewilding. Animal Sentience.

Bates LA & Byrne RW (2019) The Evolution of Intelligence: Reconstucting the Pathway to the Human Mind. In: *The Cambridge Handbook of Intelligence*, 2nd Edition. Ed. R. Sternberg. Cambridge University Press, Cambridge.

Pretorius Y, Garai M & **Bates LA** (2018) The status of African elephant *Loxodonta africana* populations in South Africa. *Oryx*. doi:10.1017/S0030605317001454.

Garai ME, **Bates LA**, Bertschinger H, Delsink A, Pretorius Y, Selier J, Zitzer HR (2018) Non-lethal elephant population control methods: Summary of the first workshop of the Elephant Specialist Advisory Group of South Africa. *Bothalia – African Biodiversity and Conservation* 48 (2) a2357.

Bates LA (2018) Elephants – Studying Cognition in the African Savannah. In: *Field and Laboratory Methods in Animal Cognition.* Eds. N. Bueno-Guerra & F. Amici. Cambridge University Press, Cambridge.

Bates LA & Byrne RW (2014) Primate Social Cognition: What we have learned from nonhuman primates and other animals. In: *APA Handbook of Personality and Social Psychology Vol. 1. Attitudes and Social Cognition*. Eds. M.Mikulincer & P.R. Shaver. APA, Washington, DC.

Byrne RW & **Bates LA** (2011). Elephant cognition: What we know about what elephants know. In: *The Amboseli Elephants: A long-term perspective on a long-lived mammal*. Edited by CJ Moss, H Croze, & PC Lee. University of Chicago Press, Chicago.

Byrne RW & **Bates LA** (2011) Cognition in the wild: exploring animal minds with observational evidence. *Biology Letters* 7 619-622.

Bates LA, Handford R, Lee PC, Njiraini N, Poole JH, Sayialel K, Sayialel S, Moss CJ & Byrne RW (2010) Why do African elephants simulate oestrus? An analysis of longitudinal data. *PLoS One* 5 (4) 1-6.

Byrne RW & **Bates LA** (2010) Primate social cognition: uniquely primate, uniquely social, or just unique? *Neuron* 65 815-830.

Bates LA & Byrne RW (2010) Imitation: what animal imitation tells us about animal cognition. *WIREs Cognitive Science* 1 (5) 685-695.

Bates LA & Byrne RW (2009) Sex differences in the movement patterns of free-ranging chimpanzees: foraging and border checking. *Behavioral Ecology and Sociobiology* 64 247-255.

Byrne RW, **Bates LA** & Moss CJM (2009) Elephant cognition in primate perspective. *Comparative Cognition and Behavior Reviews* 4 1-15.

Byrne RW, Noser RG, **Bates LA** & Jupp PE (2009) How did they get here from there? Detecting changes of direction in terrestrial ranging. *Animal Behaviour* 77 (3) 619-631.

Bates LA, Lee PC, Njiraini N, Poole JH, Sayialel K, Sayialel S, Moss CJ & Byrne RW (2008) Do elephants show empathy? *Journal of Consciousness Studies* 15 (10-11) 204-225.

Bates LA, Sayialel K, Njiraini N, Poole JH, Moss CJ & Byrne RW (2008) African elephants have expectations about the locations of out-of-sight family members. *Biology Letters* 4 (1) 34-36.

Bates LA, Poole JH, & Byrne RW (2008) Elephant cognition: A Quick Guide. *Current Biology* 18 (13) R544-R546.

Bates LA, Sayialel K, Njiraini NW, Poole JH, Moss CJ & Byrne RW (2007) Elephants classify human ethnic groups by odour and garment colour. *Current Biology* 17 (22) 1938-1942.

Byrne RW & **Bates LA** (2007). Sociality, Evolution and Cognition. *Current Biology* 17 (16) R714-723.

Bates LA & Byrne RW (2007). Creative or created: Using anecdotes to investigate animal cognition. *Methods* 42 (1) 12-21.

Byrne RW & **Bates LA** (2007) Animal Brain Evolution: When is a group not a group? *Current Biology* 17 (20) R883-R884.

Byrne RW & **Bates LA** (2006) Why are animals cognitive? *Current Biology* 16 (12) 445-448.

Bates LA & Chappell J (2002). Inhibition of optimal behaviour by social transmission in the guppy depends on shoaling. *Behavioural Ecology* 13 827-831.

Popular Books

Wood L (2020) *The Last Giants.* Hodder, London.

ESAG (Garai ME, **Bates LA,** Pretorius Y, Hofmeyr M, Henley M, Selier J) (2017) *Understanding Elephants: Guidelines for safe and enjoyable elephant viewing.* Struik Nature: South Africa.

Oral Presentations (selected)

Keynote presentation: Bates, LA (2019) The role of women in conservation and ethology. *Workshop: Herding together for conservation,* organised by Elephants Alive, Elephants for Africa and Southern African Conservation Trust, **Hoedspruit, South Africa.**

Invited Presentation: Bates, LA (2018) Elephant conservation: Does culture have a role to play? *Workshop: The Conservation Applications of Research on Elephant Behaviour and Ecology,* **Wissenschaftskolleg zu Berlin, Germany.**

Invited Presentation: Bates, LA (2017) Culture in elephants? *Daphne Jackson Trust Research Conference,* **Royal Society, London, UK.**

Plenary Lecture: Bates, LA (2017) Studying elephant minds: What can primatologists learn? *Primate Society of Great Britain Spring Meeting,* **Manchester, UK.**

Bates, LA (2010) Using observational data to study cognition: elephants and primates. *International Primatology Society XXIII Congress,* **Kyoto, Japan.**

Invited Presentation: Bates, LA (2009) Social knowledge in African elephants.
Department of Zoology & Entomology, **University of Pretoria, South Africa.**

Bates, LA (2006) Travel and food location in chimpanzees.
Animal Behaviour Society Conference, **Utah, USA.**

Funding Obtained

Apr 2016
University of Sussex Research Development Fund
£8,200. Wrote application for support including temporary Research Assistant and field-trip expenses.

Jan 2016
Daphne Jackson Trust Research Fellowship, University of Sussex
0.5FTE salary plus £10,000 research expenses. Conceived & wrote application for fellowship research.

Mar 2005
Leverhulme Trust Research Project Grant - Named Post-Dcotoral Fellow
£102,000. Prepared and wrote application with PI Prof. Richard Byrne.

Oct 2001
Biotechnology and Biological Sciences Research Council PhD Studentship
Full funding award, including fees, stipend and field-work expenses.

TEACHING

Student Supervision and Examining

Oct 2019 – Present
Research Methods and BSc research projects, School of Psychology, The Open University
Teaching on final year *Investigating Psychology* module. Supervising BSc research projects on topics within Individual Differences and Social Psychology and writing lectures delivered both face-to-face and online.

Sep 2016 – Present
Co-supervising PhD, MSc and BSc research projects, School of Psychology, University of Sussex
Supervised 11 BSc Honours projects, four MSc projects and two PhD projects (ongoing) on various topics detailing elephant cognition and behaviour.

Oct 2016
External examiner for MSc thesis, Faculty of Natural and Agricultural Sciences, University of Pretoria, South Africa. Thesis title: Social organisation of African elephants in Pilanesberg.

Lectures and Seminars

Feb 2017, 2018, 2019
Lectures: *Animal Culture*, Psychology Now 2nd year module, University of Sussex
Devised and delivered two lectures; devised essay questions and marking scheme, supervised calibration.

Feb 2016
Lectures: *Primate Cognition*, Psychobiology 1st year module, University of Sussex
Delivered two lectures previously prepared by Prof. Karen McComb.

Mar 2006 & 2007
Seminar series: *Evolutionary Psychology*, School of Psychology, University of St Andrews
Led seminars tied to associated second-year lecture course by Prof. Richard Byrne.

DEVELOPMENT, TRAINING AND ENGAGEMENT

Jul 2019 – Oct 2019

Researched, planned, drafted popular science book 'The Last Giants' for Mr Levison Wood. Wrote complete first draft of this book at the request of the named author and edited subsequent drafts.

Aug 2017 – Aug 2018

Supervising student research project for Junior Science Symposium, Briarcliff High School, New York State, USA. Supervising internet-based research project on tool-use in elephants for student participating in USA-wide high school science competition.

Jan 2016 – Nov 2017

Daphne Jackson Trust and University of Sussex training courses: Funding and professional skills; Leadership skills; Media and PR skills; Presentation skills; Time-management and work-life balance. Completing courses which have eased the transition back to academia and enhanced my professional development, readying me for the multi-facted challenges of a lectureship role.

Oct 2007 – Present

Media interviews about my research, Numerous internet, print, radio, and tv media. Including for: *BBC One*; *BBC World Service*; *Discovery Channel*; *National Geographic*; *New Scientist*; *Off the Fence Productions*; *Radio New Zealand; Scientific American*; *The Guardian*; *The Times*; *The Psychologist; Tortoise*.

ADMINISTRATION

Jan 2016 – Present

Member of working group '*Culture and Social Complexity*', Convention on the Conservation of Migratory Species (UNEP-CMS). Analysing the conservation implications of culture in priority species.

Oct 2015 – Present

Member of working groups: '*Translocating elephants*', '*Elephant welfare*' and '*Policy and legislation*', ESAG. Ensuring activities in these areas are compatible with latest scientific knowledge.

Oct 2003 – Present

Peer reviewing, Reviewed manuscripts and book proposals for numerous international journals and publishers, including *Animal Cognition*, *Animal Behaviour*, *Biology Letters* and *Current Biology*.

Mar 2011

Co-editor of Special Feature 'Cognition in the Wild', *Biology Letters*, with Prof. Richard Byrne.

Sep 2010

Symposium Co-ordinator: 'Cognition in the Wild', IPS XXIII Congress, Kyoto, Japan. Proposed and organised symposium with Prof. Richard Byrne, involving eight speakers.

Exhibit B

Exhibit B

References cited

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Bates L.A., J.H. Poole & R.W. Byrne (2008a) Elephant cognition. *Current Biology* **18** (13): R544-R546.

Bates L.A., P.C. Lee, N. Njiraini, J.H. Poole, K. Sayialel, S. Sayialel, C.J. Moss & R.W. Byrne (2008b) Do elephants show empathy? *Journal of Consciousness Studies* **15** (10-11): 204-225.

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Bates L.A. & R.W. Byrne (2014) Primate Social Cognition: What we have learned from nonhuman primates and other animals. In: *APA Handbook of Personality and Social Psychology Vol. 1. Attitudes and Social Cognition*. Eds. M.Mikulincer & P.R. Shaver. APA, Washington, DC.

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Michael A Pardo, Joyce H Poole, Angela S Stoeger, Peter H Wrege, Caitlin E O'Connell-Rodwell, Udaha Kapugedara Padmalal, Shermin de Silva, (2019) Differences in combinatorial calls among the 3 elephant species cannot be explained by phylogeny, *Behavioral Ecology*, Volume 30, Pages 809–820.

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Smet, A.F. & R.W. Byrne (2014) African elephants recognize visual attention from face and body orientation. *Biology Letters*, **10**: 20140428.

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Wood, J.D., B. McCowan, W.R. Langbauer, J.J. Viloen & L.A. Hart (2005) Classification of African elephant *Loxodonta africana* rumbles using acoustic parameters and cluster analysis. *Bioacoustics*, **15**: 143–161.

Exhibit C

Richard William Byrne FRSE Emeritus Professor
6th September 2018 University of St Andrews

Education

1969-1972	M.A. in Natural Sciences, St John's College, Cambridge (1st Class Honours)
1972-1975	Ph.D., University of Cambridge, *"Memory in complex tasks"*

Career

1976-1991	Lecturer in Psychology, University of St Andrews
1991-1997	Reader in Psychology, University of St Andrews
1997-2017	Professor of Evolutionary Psychology, University of St Andrews

Awards

1972	Wright Prize & Hughes Prize*, St Johns College, Cambridge*
1972-1975	MRC Studentship, tenure at MRC Applied Psychology Unit, Cambridge
1993	*Association of Commonwealth Universities*: Development Fellowship
1997	*British Psychological Society*: Book Award
2001	*Collegium Budapest*: Institute of Advanced Study. Awarded *Convenorship* of Focus Group 2003 "Precursors to Culture".
2002	Elected Fellow of the *Royal Society of Edinburgh*
2007	Elected Fellow of the *Higher Education Academy*
2017	*British Psychological Society*: Research Board Lifetime Achievement Award 2017

Professional activities (since 2000)

Focus Group Convenor, *Precursors to Culture*, Collegium Budapest Institute Advanced Studies, Hungary. Oct-Dec 2003.
Boyd Group Member of Subgroup on *Use of non-human primates in research and testing.* 2000-2002
Vice-President, *International Primatological Society* 1996 – 2001
National teaching: *Quality Assurance Agency/ Scottish Higher Education Funding Council*: Steering Committee for Assessment (2003-5)

H-Index: 64 (H-Index since 2013: 43)

Scottish Primate Research Group

In 1987 I set up (with McGrew, Stirling; Rogers, Edinburgh; Whiten, St Andrews) the *Scottish Primate Research Group*, to co-ordinate the cognate research interests of the 3 centres, promote new joint grant applications, encourage outside visitors to Scotland and postgraduate admissions, and co-ordinate joint seminars and lectures. The *Scottish Primate Research Group* now attracts international notice (e.g. US researchers coming to spend Sabbatical with Group), and it is now larger and more productive than ever, with 21 faculty members and over 50 researchers.

Fieldwork Periods

Mont Assirik, Senegal. January-April 1979. (Guinea baboon *Papio papio*)
Giant's Castle Game Reserve, South Africa. August-December 1983. (Chacma baboon, *Papio ursinus*)
Mahale Mountains, Tanzania. July-December 1984. (Chimpanzee, *Pan troglodytes*)
Virunga Volcanoes, Rwanda. July-December 1989. (Mountain gorilla, *Gorilla b. beringei*)
Mbeli Bai, Republic of Congo. August-October 2010. (Western gorilla, *Gorilla g. gorilla*)

Editorial work (since 2000)

Current Biology, **Editorial Board**, 2006 - present
Biology Letters, **Editorial Board**, 2007 - 2013
Animal Cognition, **Editorial Board**, 1997 - 2011
Animal Behaviour, **Consulting Editor**, 1996 – 2000
Journal of the Royal Anthropological Institute, **Editorial Board**, 1995 - 2010
Refereeing of **book proposals**: Basil Blackwell, Cambridge University Press, Curzon Press, Lawrence Erlbaum Associates, Oxford University Press, John Wiley.
(And refereeing of **manuscripts**: numerous journals, including Science, Nature, PNAS, Proc.Roy.Soc.B., Phil.Trans.B , TICS, TINS, Psychological Science, Psychological Bulletin, Current Biology.)
Refereeing of **promotion applications***:* Arizona State University; University of California, San Diego; University of Colorado; University of Florida, Gainsborough, FL; Max Planck Institute for Evolutionary Anthropology, Leipzig; Miami University, Ohio; University of Natal, RSA; University of Portsmouth, UK; University of Stirling, UK; York University, Toronto
Refereeing of **research grants**: BBSRC, ESRC, Israel Academy of Sciences and Humanities (Basic Research Foundation), L S B Leakey Foundation (Oakland, California), Leverhulme Trust, MRC, NSF (USA), NERC, NSERC (Canada)
Refereeing of **research programmes**: Leverhulme Trust, Max-Planck-Society, Germany, Earthwatch Europe

Major invited lectures (since 2000)

2018 *The Royal Institution, London*. (**Public lecture and discussion**, 8th November)
2016 *University of Emory, Atlanta*. (**Public lecture**, 12th April)
2015 *85th James Arthur Lecture*, *American Museum of Natural History*. (**Public lecture**, 5th March)
2013 *Tarragona Laterality Conference*. (Invited lecture to Closed Conference)
University of Portsmouth. (**Public lecture**, 25th April)
2012 *Institute of Evolutionary Biology, University of Zurich*. (Invited lecture in Workshop, *Unpacking intentionality in animal vocal communication: an integrative approach*.)
2011 *John Templeton Foundation*. (Invited lecture to Symposium, *The Emergence of Personhood*)
Hanse-Wissenschaftskolleg, Delmenhorst. (Closed Workshop, *The evolution of human handedness*)
Institute of Evolutionary Biology, University of Zurich. (**Public lecture**, 29th September)
2010 *INCORE Thematic Meeting, Berlin*. (Workshop, *Referential communication)*
2009 *German Society for Primatology* (**Plenary lecture**, 11th Congress, Hanover)
Year of Darwin Lecture, School of Biosciences, Birmingham University (**Public lecture**)
Max Planck Institute for Evolutionary Anthropology, Leipzig. (Workshop, *Understanding Tool Use*)
2008 *Institute of Cognitive Sciences, Montréal*. (Invited lecturer, Summer School on *Social Cognition)*
2007 *University of Vienna, Faculty of Life Sciences*. (Inter-faculty series, "The evolution of social cognition")
European Federation of Primatology. (**Plenary lecture**, Second Congress, Charles University Prague)
MRC / Cold Spring Harbor. (Invited lecturer, Workshop on *Social Cognition*, St Anne's College, Oxford)
Carlsberg Academy, Copenhagen. (**Plenary lecture**, conference *Missing Links*)
2006 *The Royal Society, London*. (Symposium, *From Brain to Culture*)
Japan Society for Animal Psychology (**Plenary lecture**, 66th Annual Meeting, Kyoto.)
2005 *Portuguese Primatological Association, 2nd Int. Conf.* (**Plenary lectures** to conference, Lisbon)
University of Tokyo, "Evolutionary Cognitive Sciences" series (Lecture)
2004 *Institute of Cognitive & Decision Sciences, University of Oregon*. (**Public Lecture**).
Wenner-Gren Foundation for Anthropological Research. (Closed conference "Roots of Human Sociality", North Carolina.)
2003 *European Workshop in Cognitive Neuropsychology*. (International workshop, Bressanone, Italy.)
2002 *University of Oxford, McDonnell-Pew Centre Centre*. (Annual Autumn School in Cognitive Neuroscience.)
Perspectives on Imitation. (International workshop, Royaumont Abbey, France.)
University of Oxford, McDonnell-Pew Centre for Cognitive Neuroscience. (Theme "Rational animals?" Autumn School)
Fundació "la Caixa" Museum of Science, Barcelona; & Social & Cultural Centre, Tarragona (**Public lectures**)
2001 *VIIth European Congress of Psychology*. (**Keynote address** to Congress, forming part of BPS Centenary, London.)
Institute of Cognitive Neurology. (Symposium, "Human Cognition", UCL, London.)
British Association for the Advancement of Science. (Lecture, **press conference**. "Constraints on Culture", Glasgow.)
British Psychological Society. (**Keynote lecture**, Consciousness & Experiential Psychology section.)
Knapping Stone: a uniquely hominid behaviour? (International workshop, Abbaye des Prémontrés, France.)
Malingering & Illness Deception. (International workshop, Blenheim, Oxford.)
2000 *British Neuropsychiatry Association*. (**Plenary lecture** to Millennial Meeting, "The social brain")
International Congress for Cognitive Science. (**Invited main lecture**, "Primate Cognition", Inuyama.)
Gaia Research Project. (Symposium, "Animal Architecture", Edinburgh.)
Sorbonne University. (Workshop, "Cognitive Science", Paris.)
The Royal Society of Edinburgh. (International Conference, "Human Nature", Edinburgh.)
Max Planck Institute, Andechs. (Symposium, "The Social Brain", Bochum.)
University of Ghent. (Symposium, "Science and Philosophy of Pain", Gent.)

Additional invited, funded talks at: Auckland University (Psychology, Zoology); BAAS SET7 Week (St Andrews); Gesamthochschule, Kassel (Primatenbiologie); Deutsches Primatenzentrum, Gottingen; Duke University, North Carolina (Biological Anthropology); Dundee University (teaching forum); Durham University (Psychology, Anthropology); Eötvos Lorand University, Budapest (Ethology); Hang Sen Centre for Cognitive Studies, Sheffield (twice); Hawaii University, Honolulu (Psychology); Kyoto University; Living Links Center, Emory University; MRC Cognitive Brain Research Unit, Cambridge (twice); Max Planck Institute, Leipzig; Max Planck Institute, Seewiesen, Bavaria; Miami University, Ohio (Zoology); University of Otago, New Zealand (Psychology); Queens University, Kingston Ontario (Psychology); Université de Rennes 1 (Zoology); Royal Anthropological Institute, London; Royal (Dick) School of Veterinary Studies, Edinburgh; Yerkes Regional Primate Research Center, Atlanta GA; UCSD (Psychology); York University, Toronto (Psychology); Universities of Aberdeen (Psychology), Abertay (Psychology), Cambridge (Psychology, Archaeology & Anthropology), Durham (Psychology, Anthropology), Edinburgh (Psychology, Zoology), Exeter (Psychology), Leeds (Psychology), Liverpool (Psychology, Zoology), Manchester (Psychology), Oxford (Zoology), Oxford Brookes (Anthropology), Reading (Archaeology), St Andrews (Divinity, Modern Languages, Zoology, Psychology), Stirling (Psychology), UCL (Archaeology), Sussex (Neuroscience & Robotics), York (Centre for Human Palaeontology & Human origins); Zoological Society of London.

Broadcasting (since 2000)

BBC1 6 O'Clock News (Scotland) interview on own great ape research 2008; *6 O'Clock news (UK)* interview on own elephant research 2013

BBC2 "The Secret Life of Pigs" (consultant 2010)

BBC World/BBC4 Evening News interview on own elephant research 2013

ITV/STV (ITN News) interview on own elephant research (2013)

Australian ABC Channel TV (programme on my research in *Catalyst* series)

BBC Radio 4 "Today" (interviews 2008, 2000)

BBC Radio 4 Interview with Jonathan Miller, *Self-made things* (2005)

Australian Radio (article on own research in "The Science Show", 2001); *Radio Netherlands* (article on own research, 2001)

Numerous other interviews on own research: *ABC Radio Australia, Austrian Broadcasting Corporation, US Public Broadcasting Network, Breakfast Radio Auckland (NZ), Radio Canada, Western Australia Radio, Discovery Canada, Radio New Zealand "Morning Report" Radio Ireland, Talkback Radio (Ireland),BBC World Service, BBC Radio Scotland, Radio Wales*, *Radio Cambridgeshire, BBC Radio Jersey, BBC Radio 5 Live*, *Radio Tay, Kingdom FM, Talk 107, Voice of Russia, Wave 102*

External Postgraduate Examining (since 2000)

2000 *Ph.D. Oxford Brookes University (Anthropology)* L. Ambrose.
2001 *M*.Sc. *University of Stirling (Psychology)* A Nowell.
2002 *M*.Sc. *University of Durham (Anthropology)* B A Whiting.
Ph.D. London School of Economics (Psychology) K Rigby.
2003 *Ph.D. Exeter University (Psychology)* P.Citrynell.
2004 *Ph.D. University of Cambridge (Psychology)* J Dally
Ph.D. Exeter University (Psychology) P.Citrynell, re-examination
2005 *Ph.D. University of Cambridge (Psychology)* J Dally
2008 *Habilitation. University of Vienna (Faculty of Life Sciences)* Dr Thomas Bugnyar
2009 *Ph.D. University of Cambridge (Psychology)* C Bird
2012 *Ph.D. University of Cambridge* (Archaeology & Anthropology) P Bertolani
Ph.D. University of Birmingham (Psychology) J Trosciano
2016 *Ph.D. University of York* (*Psychology*) Alejandra Picard
2017 *Ph.D. University of Lincoln (Psychology)* A Frohnwieser
2018 *PhD Oxford Brookes University (Psychology)* M de Guinea

PhD Supervision (since 2000)

1999-04 R Noser (self-funded), "Navigation by chacma baboons within the home-range"
2000-04 R da Cunha (funded by CAPES, Brazil), "Long distance communication of howler monkeys"
2000-04 A Valero (funded by CONACYT, Mexico), "Social interactions of spider monkeys"
2001-05 L Bates (funded by BBSRC), "Foraging skills of female chimpanzees"
2004-08 E Cartmill (funded by Univ. St Andrews) "Gestural communication in great apes"
2005-06 F Moore (joint supervision) "Effects of resource control on female reproductive strategies"
2005-09 A Ruiz (funded by ORS) "Monkeys' understanding of intention and attention"
2007-10 C Hobaiter (funded by own EC grant) "Gestural communication in great apes"
2007-11 C Casar (funded by CAPES, Brasil) "Vocal communication of wild titi monkeys"
2008-12 K Hall (funded by Janet Anderson trust and ORSAS) "Theory of mind in chimpanzees"
2010-14 L Orr (funded by NSF Studentship) "gestural communication in gorillas"
2011-15 A Smet (funded by Univ. St Andrews) "Cognition in the African elephant"
2012-16 B Fallon (self-funded) "Gestural communication by sexually consorting male chimpanzees"
2013-17 K Graham (funded by Univ. St Andrews) "Negotiation of sexual relationships among bonobos"

Books

1. Byrne, R W (2016) *Evolving Insight*. Oxford University Press, Oxford.
2. Byrne, R W and Whiten A (Eds.) (1988) *Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes and Humans*. Oxford University Press, Oxford; 413 pages. [Japanese edition published by Nakanishiya Shuppan Press, Kyoto, 2004.]
3. Byrne, R W (1995) *The Thinking Ape: evolutionary origins of intelligence.* Oxford University Press, Oxford; 266 pages. [*British Psychological Society* Book Award 1997. Reprinted annually; Japanese edition published by Otsuki Shoten, Tokyo, 1998. Chinese edition, in translation, published by Hunan Education Publishing House, 2006.]
4. Whiten, A and Byrne, R W (Eds.) (1997) *Machiavellian Intelligence II: Extensions and Evaluations*. Cambridge University Press, Cambridge; 403 pages. [Japanese edition published by Nakanishiya Shuppan Press, Kyoto, 2004.]

Refereed Journal Articles

1. Byrne, R W (1977) Planning meals: problem-solving on a real data-base. *Cognition*, *5,* 287-232.
2. Byrne, R W (1979) Memory for urban geography. *Quarterly Journal of Experimental Psychology*, *31*, 147-154.
3. Byrne, R W (1981) Mental cookery: an illustration of fact-retrieval from plans. *Quarterly Journal of Experimental Psychology*, *33A*, 31-37.
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EXHIBIT 2

Declaration of Joyce Poole

I, Joyce Poole, declare as follows:

Introduction and Qualifications

1. My name is Joyce Poole. I graduated with a Bachelor of Art with High Honors in Biological Sciences from Smith College in 1979. I received my PhD from the University of Cambridge in 1982 from the Sub-Department for Animal Behaviour, under the supervision of Professor Robert Hinde. I completed a Postdoctoral Research Fellowship from 1984-1988 at Princeton University under the guidance of Professor Daniel Rubenstein. I reside and work in Sandefjord, Norway, and in Il Masin, Kajiado County, Kenya. I run elephant behavior and conservation projects in Maasai Mara ecosystem, Kenya, and in Gorongosa National Park, Mozambique.

2. I submit this Declaration in support of the Nonhuman Rights Project, Inc.'s petition for a writ of habeas corpus regarding the captive elephants at Cheyenne Mountain Zoo. I am a nonparty to this proceeding.

3. I have studied wild elephants in Africa and worked toward their conservation and welfare for more than 40 years. My research interests are focused on social and reproductive behavior, acoustic and gestural communication, cognitive science, decision-making, and conservation. I am currently Co-Director of ElephantVoices, a California 501(c)(3) non-profit organization I co-founded in 2002, which aims to inspire wonder in the intelligence, complexity and voices of elephants, and to secure a kinder future for them. We advance the study of elephant cognition, communication and social behavior, and promote the scientifically sound and ethical management and care of elephants through research, conservation, advocacy, and the sharing of knowledge. Specifically, I direct the research, conservation, and welfare work for ElephantVoices.

4. In addition to co-directing ElephantVoices, I have worked and conducted research for a number of organizations, including: (1) as the Research Director of the Amboseli Elephant Research Project from 2002-2007, for the Amboseli Trust for Elephants, where I oversaw the elephant monitoring, collaborative research projects, and training programs for the then 3 decades-long study of elephants; (2) as a scientific advisor for Discovery in July, 1996 and July, 1997, for the IMAX production *Africa's Elephant*

Kingdom; (3) as a Consultant for Richard Leakey & Associates from 1994-1997 performing training, lecturing, and advising for wildlife documentaries; (4) as an Author from 1994-1995 for *Coming of Age with Elephants* (Hyperion Press, 1996; Hodder & Stoughton, 1996); (5) as a Coordinator of the Elephant Program for the Kenya Wildlife Service from 1991-1994, setting and implementing Kenya's elephant conservation and management policy, supervising management-oriented research, reconciling land use and other conflicts between elephants and people, and building local expertise; (6) as a Consultant for the World Bank, from 1990-1991, developing Pre-Project Facility by drafting the Elephant Conservation and Management Policy and Research Policy Framework and Investment Program for the Kenya Wildlife Service; (7) as a Consultant for the International Union for the Conservation of Nature, in 1990, compiling an overview of elephant conservation in Eastern Africa for the Paris Donors Conference; (8) as a Consultant for the Tanzanian Wildlife Department in 1989, drafting a successful proposal to the Convention on Trade in Endangered Species to up list the African elephant to Appendix I of the Convention; (9) as a Consultant to the World Wildlife Fund in 1989, engaging in discussions with Japanese and Chinese government officials and ivory carvers regarding detrimental impacts of the ivory trade on elephant survival; (10) as a Researcher for the African Wildlife Foundation in 1989, assembling data on effects of poaching on East African elephant populations; and (11) as a Researcher for the Amboseli Elephant Research Project from 1975-1980.

5. I have conducted field work as part of my scientific research in multiple sites in multiple countries over my career, including: (1) elephant monitoring, conservation and research as part of the Gorongosa Restoration Project in Mozambique, ongoing since 2011; (2) elephant monitoring and conservation project in the Maasai Mara ecosystem in Kenya, ongoing since 2010; (3) the initiation of Asian elephant monitoring and conservation in the Minneriya-Kaudulla National Parks in Sri Lanka in 2008; (4) the study of elephant communication, cognition, and social behavior, conducting playback experiments, and recording elephant vocalizations and behavior in the Amboseli National Park in Kenya, 1998-2009; (5) recording elephant vocalizations and behavior in Maasai Mara National Park, Tsavo National Park, and Laikipia District in Kenya in 1998; (6) assessing the numbers and habitat use of elephants in West Kilimanjaro, Tanzania in 1997; (7) overseeing numerous elephant surveys and studies of elephants carried out under my direction by the Kenya Wildlife Service Elephant Program in

Kenya from 1990-1994; (8) studying elephant vocal and olfactory communication via vocal, visual, and chemical signaling and assessment between musth males in Amboseli National Park, Kenya from 1984-1990; (9) studying the contextual use of very low frequency calls by elephants and assessing the effects of poaching on the age structure and social and reproductive patterns of elephant populations in Amboseli, Tsavo, Queen Elizabeth, and Mikumi National Parks in Kenya, Uganda, and Tanzania in 1989; (10) Focal animal sampling musth and male-male competition among elephants in Amboseli National Park, Kenya from 1980-1982; and (11) participating in Cynthia Moss' long-term studies of elephants in Amboseli National Park, Kenya from 1975-1979.

6. Over the course of my career, I have received several awards and honors related to my research, including: (1) the Horace Dutton Taft Alumni Medal awarded by the Taft School in 2017, for "going beyond the call of duty in service"; (2) an Outstanding Lifetime Achievement Award from the Jackson Hole Wildlife Film Festival in 2015; (3) a Certificate of Recognition from the California State Legislature and Assembly in 2007, for "tireless efforts in educating people on elephant captivity"; (4) the Smith College Medal in 1996 for elephant research and conservation work "exemplifying the true purpose of a liberal arts education"; (5) an F32 National Research Service Award (NRSA) Individual Postdoctoral Fellowship from the National Institute of Mental Health from 1985-1988; (6) a Research Fellowship from the Harry Frank Guggenheim Foundation in 1984; (7) a Research Fellowship from the New York Zoological Society from 1980-1981; (8) a Graduate Study Fellowship from Smith College in 1981; (9) the Sarah. W. Wilder and Sarah W. Whipple Fellowship from 1979-1980; (10) Sigma Xi from 1979-1980; and (11) the A. Brazier Howell Award in 1979 for my paper on *musth* in African elephants, presented at the 1979 American Society of Mammalogists meetings.

7. I am affiliated with a number of professional organizations and hold several board and advisory memberships, including: (1) member of the Board for the Global Sanctuary for Elephants, from 2014-present; (2) member of the Advisory Board for the Kimmela Center for Animal Advocacy, from 2013-present; (3) member of the Scientific Advisory Board for Elephant Aid International, from 2010-present; (4) member of the Alliance for Captive Elephants, in 2010; (5) member of the Board of Directors for ElephantVoices, from 2008-present; (6) member of Ethologists for the

Ethical Treatment of Animals, from 2002-present; (7) member of the Scientific Advisory Committee for the Amboseli Elephant Research Project, from 2002-present; (8) member of the Science Advisory Board for the Captive Elephant Management Coalition, from 1988-2001; (9) member of the Panel of Experts for the Species Survival Network, in 2004; (10) Trustee for the Amboseli Trust for Elephants, from 2002-2011; and (11) member of the African Elephant Specialist Group, as part of the Species Survival Commission for the IUCN, from 1988-2001.

8. I have written two books concerning my work with elephants: (1) *Elephants* (1997, Colin Baxter Photography, Grantown-on-Spey, Scotland), and (2) *Coming of Age with Elephants* (1996, Hyperion Press, New York; 1996, Hodder & Stoughton, London).

9. I have published 39 peer-reviewed scientific articles over my career. These articles have been published in many of the world's premier scientific journals, including: *Nature, Science, Frontiers in Zoology, Biology Letters, Proceedings of the Royal Society B, Immunogenetics, PLoS ONE, The Ecologist, Animal Behaviour, Oryx, Behavioral Ecology and Sociobiology, Behavior, Journal of Reproduction and Fertility, Molecular Ecology, Journal of Consciousness Studies, Current Biology, Journal of the Acoustical Society of America, Etica and Animali,* and *Conservation Biology*. Specific topics of these publications include: Persistence of effects of social disruption in elephants decades after culling; Persistence of early life experiences 40 decades later on survival and success among African elephants; Poaching and wildlife conservation; Leadership in elephants: The adaptive value of age; Elephants, ivory, and trade; Simulated oestrus behavior in African elephants; Major histocompatibility complex variation and evolution in two genera of elephants; Fine-scaled population genetic structure in a fission-fusion society; Do elephants show empathy?; Elephant cognition; Behavioural inbreeding avoidance in wild African elephants; African elephants have expectations about locations of out-of-sight family members; Elephants can classify human ethnic groups by odour and garment colour; Age, musth, and paternity success in wild male African elephants; Wild African elephants discriminate between familiar and unfamiliar conspecific seismic alarm calls; Social trauma early in life can affect physiology, behavior, and culture of animals and humans over generations; Elephants are capable of vocal learning; Older bull elephants control young males; African elephants assess acoustic signals; The Aggressive state of musth in African elephants; Mate guarding, reproductive success, and female choice in

African elephants; Rutting behavior in African elephants; and Musth in the African elephant. Additionally, my research has been published in six non-peer reviewed publications.

10. My scientific work has also been published as chapters in several peer-refereed books, including *Mammals of Africa* (2013, Academic Press), *The Amboseli Elephants: A Long-Term Perspective on a Long-Lived Mammal* (2011, University of Chicago Press), *An Elephant in the Room: The Science and Well Being of Elephants in Captivity* (2008, Tufts University Cummings School of Veterinary Medicine's Center for Animals and Public Policy), *Elephants and Ethics: Toward a morality of Co-existence* (2003, Johns Hopkins University Press), *Behavioral Ecology and Conservation Biology* (1998, Oxford University Press), *The Differences Between the Sexes* (1994, Cambridge University Press), *Primate Social Relationships* (1983. Blackwell Scientific Publications). In addition to these peer-reviewed book chapters, my scientific work has been published in three additional book chapters, which were not refereed.

11. My scientific research has additionally been published in several peer-reviewed symposia proceedings, including "Vocal imitation in African savannah elephants (Loxodonta Africana)" in *Razprave IV* (2006, Rezreda Sazu XLVII-3); "Conservation biology: The ecology and genetics of endangered species," in *Genes in Ecology* (1991, Blackwell Scientific Publications, London, The 33rd Symposium of the British Ecological Society); "Elephant mate searching: Group dynamics and vocal and olfactory communication" and in *The Biology of Large African Mammals in their Environment* (1989, Clarendon Press, Oxford, Proceedings of the Symposium of the Zoological Society of London.

12. In addition to my peer-reviewed scientific publications, I have also published numerous technical reports for various foundations, working groups, and organizations. These reports include: (1) a series of reports relating to our work on elephants in the Maasai Mara from 2012-2015; (2) a series of reports relating to our work on elephants in Gorongosa National Park from 2012-2015 (3) a 2010 critique of "The status of African elephants (*Loxodonta africana*) in the 2008 IUCN Red List of Threatened Species"; (4) a 1997 Typescript Report describing a survey of elephants and other wildlife of the West Kilimanjaro Basin, Tanzania; (5) a 1996 report in "Decentralization and Biodiversity Conservation" as part of a World Bank Symposium; (6) a 1994 report in the *Proceedings of the 2nd International Conference on Advances*

in Reproductive Research in Man and Animals about the Logistical and ethical considerations in the management of elephant populations through fertility regulation; (7) a 1993 report detailing Kenya's Initiatives in Elephant Fertility Regulation and Population Control Techniques in *Pachyderm*; (8) a 1992 survey of the Shimba Hills elephant population for the Elephant Programme, Kenya Wildlife Service; (9) a 1992 report on the Status of Kenya's Elephants by the Kenya Wildlife Service and the Department of Resource Surveys and Remote Sensing; (10) a 1991 Elephant Conservation Plan for the Kenya Wildlife Service, Ministry of Tourism and Wildlife; (11) a 1990 Regional Overview of Elephant Conservation in Eastern Africa, in *Regional Perspectives and Situation Regarding Elephant Conservation and the Ivory Trade,* produced for the Paris Donors Meeting of the IUCN; (12) a 1990 report on Elephant Conservation and Management in *The Zebra Book, Policy Framework and Five-year Investment Programme* for the Kenya Wildlife Service; and (13) a 1989 report on The effects of poaching on the age structures and social and reproductive patterns of selected East African elephant populations in *The Ivory Trade and the Future of the African Elephant* for the 7th CITES Conference of the Parties.

13. In addition to my scientific publications, I have published 17 popular articles in more general publications, including: National Geographic's blog *A Voice for Elephants, Basecamp Explorer AS, Swara, Care for the Wild News, Sotokoto, Wildlife News, Komba, Animal Kingdom,* and *Natural History.*

14. I have been an invited speaker at international meetings and symposia throughout the world, including: (1) Keynote, Jackson Hole Wildlife Film Festival, 2015; (2) National Geographic Retreat, International Council of Advisors in Stockholm, Sweden, 2014; (3) Chinese Zoo Directors Meeting on Animal Welfare, in Shenzhen, China in 2013; (4) the Royal Geographical Society, Hong Kong, China in 2013; (5) the Explorer's Club in New York, 2013; (6) the Explorer's Symposium for National Geographic, in Washington, DC in 2012; (7) "Nature's great masterpiece: Stories of Elephants," the 2012 Sabine Distinguished Lecture in Psychology, Colorado College; (8) Panel discussion for the National Geographic Society, Washington DC in 2008; (9) Seminar on Language Evolution and Cognition held by Communication Research Centre, Northumbria University & Language Evolution and Computation Research Unit, University of Edinburgh, Scotland in 2007; (10) Public lecture at the Explorer's Club, New York in 2007; (11) lecture on communication, behavior, and social life

among elephants, for the Science Museums of the la Caixa Foundation, Barcelona, Spain in 2006; (12) speaker in series of lectures on Animal Communication, for the Science Museums of the la Caixa Foundation, in Madrid, Spain in 2006; and (13) lecture on Animal Cognition and Communication, at the Tufts Center for Animals and Public Policy in Boston in 1999.

15. In addition to my scientific research, I have also focused extensively throughout my career on public education and outreach. I have utilized many different media formats in pursuit of this goal. I currently maintain several web channels, including: (1) www.ElephantVoices.org - about elephant social behavior, communication and welfare; (2) www.facebook.com/elephantvoices; (3) www.Intagram.com/elephantvoices; (4) www.twitter.com/elephantvoices; (5) www.vimeo.com/elephantvoices; (6) www.YouTube.com/elephantvoices; (7) www.soundcloud.com/elephantvoices; and (8) http://www.theelephantcharter.info – The Elephant Charter, co-written in 2008 by Joyce Poole, Cynthia Moss, Raman Sukumar, Andrea Turkalo and Katy Payne. I also currently maintain The Elephant Ethogram: A Library of African Elephant Behavior (on The Elephant Ethogram), which documents close to 500 behaviors with written descriptions and some 2,300 video clips.

16. My research concerning elephant social behavior and communication, as well as my conservation work, has been featured in a number of printed articles, including publications such as *Readers' Digest, Scientific American, Science, National Geographic Kids, National Geographic Magazine, National Geographic Adventure, New York Times Magazine, National Geographic Explorer, LA Times, Highlights for Children, Scholastic, The New York Times, Science Times, Science, Science News, Spektrumdirekt, National Geographic News, Kyodo News Washington Bureau, Daily Telegraph, and The Guardian*. Additionally, my life and work have been featured in several books, including: (1) Jodi Picoult's novel Leaving Time; (2) Martin Meredith's 2001 *Africa's Elephant,* a biography, and (3) Doug Chadwick's 1992 *Fate of the Elephant*. My work was also highlighted by Doug Chadwick in his 1992 feature article for National Geographic Magazine. My elephant recordings have featured in (1) Paul Winter's Summer Solstice Concert in New York Cathedral, in 2013; (2) in the Emmy award winning work by Paul Winter, Miho in 2010; (3) in Avatar in 2009; (4) in Pulse of the Planet.

17. I have been interviewed and my research has been featured on a number of radio programs, including: (1) a 2012 Sam Litzinger interview on The Animal House/NPR (WAMU 88.5); (2) Elephant welfare views featured on WBUR's Inside Out Documentary on American Zoos with Diane Toomey in 2009; (3) Elephant communication research featured in Up Front Radio, San Francisco with Sandip Roy Chowdhury in 2008; (4) Elephant communication, cognition, and welfare with Karl Losken Animal Voices 102.7fm in Vancouver, BC Canada in 2008; (5) Science Update, American Association for the Advancement of Science (AAAS) in 2005; (6) BBC Radio Science, the Leading Edge in 2005; (7) German Public Radio (SWR) program Campus in 2005; (8) NPR in 2005 about elephant vocal learning; (9) BBC News Scotland in 2005 about vocal learning in elephants; (10) ABC's Radio 702 with Rory McDonald about elephant welfare in 2005; (11) Elephant communication research featured in BBC's Beyond our Senses program Sounds of Life with Grant Sonnex, in 2004; (12) Elephant communication research featured in NPR program on elephant language in 2004; (13) WETA-FM, News 820's Openline & WNYC in 1996; and (14) Musth in the African elephant, BBC Radio 4, The living World in 1981. In addition to these radio appearances, I have also appeared on the Science and the city Podcast, in 2007.

18. I have also appeared and been featured in a variety of Television programs, including in: (1) Gorongosa Park: Rebirth of Paradise (2015), a PBS six-part series about the restoration of Gorongosa National Park in which my elephant work is highlighted in episodes 2 and 5; (2) An Apology to Elephants, an award winning 2013 documentary that explores abuse and brutal treatment of elephants; (3) War Elephants (2012), an award winning documentary about the traumatized elephants in Gorongosa National Park, Mozambique, and their recovery, by National Geographic Wild, worldwide; (4) Elephant communication research is featured in "Elephant having tales to tell" (2008), NHK, Japan (Japanese and English versions); (5) Interview on elephant communication and cognition for Smart Planet for REDES-TVE, Spain (2006); (6) Elephants and vocal learning, Daily Planet Discovery Channel Canada (2005); (7) Elephant cognition and conservation views featured on National Geographic Explorer *Elephant Rage* (2005); (8) Elephant recordings featured in Discovery Channel's Echo III (2004); (9) Elephant communication research, Elephant's Talk, featured in BBC documentary *Talking with Animals* (2002); (10) Work featured on News and Talk

shows such as CNN (1993), ABC news Women and Science, The Today Show, (1996), West 57th Street CBS News (1989), PM Magazine (1987); (11) Research featured in *Inside the Animal Mind Part 3 Animal Consciousness, WNET Nature* (1999); (12) Featured on Episode 16, *Elephants*, in series, *Champions of the Wild*, Omni Film Productions, Vancouver, Canada (1998); (13) Life, elephant research, and conservation work subject of National Geographic Special, *Coming of Age with Elephants* (1996); (14) *Wildlife Warriors,* National Geographic Special (1996); (15) *A Voice for Elephants USIA AfricaPIX* (1996); (16) Discovery Channel documentary "Ultimate Guide to Elephants" (1996); (17) *Elephants like us*, Rossellini and Associates (1990); (18) *The language of the elephants*, Rossellini and Associates (1990); (19) Elephant research and conservation work featured in National Geographic Special *Ivory Wars* (1989); (20) Research highlighted in BBC production *Trials of Life* with David Attenbourgh (1988); (21) Work on elephant infrasound featured in *Supersense* BBC Natural History Unit series on animal senses (1988); and (22) Featured in Sports and Adventure, *Women of the World* (1987).

19. I have testified as an expert witness in court cases in several countries, including: (1) In 1998 in South Africa in the Case of NSPCA v. Riccardo Ghiazza regarding the capture, mistreatment of 34 baby elephants. Ghiazza was eventually found guilty of cruelty; (2) In 2005 via video link in International Fund for Animal Welfare, et al. v. Minister for the Environment and Heritage et al., N2005/916 regarding the export of Asian elephants from Thailand to Australia; (3) In 2008 in Washington DC in American Society for the Prevention of Cruelty to Animals, Animal Welfare Institute, The Fund for Animals, Animal Protection Institute & Tom Rider Plaintiffs in ASCPA v. Ringling Brothers and Barnum & Bailey Circus; and (4) In 2012 in Los Angeles in Aaron Leider vs. John Lewis, City of Los Angeles, in a case regarding the welfare of the elephants of Los Angeles Zoo. I am currently involved in another case in South Africa but have not yet appeared in court.

20. My Curriculum Vitae fully sets forth my educational background and experience and is annexed hereto as "Exhibit A".

Basis for Opinions

21. The opinions I state in this Declaration are based on my professional knowledge, education, training, and years of experience observing and studying elephants, as well

as my knowledge of peer-reviewed literature about elephant behavior and intelligence published in the world's most respected journals, periodicals, and books that are generally accepted as authoritative in the field, and many of which were written by myself or colleagues whom I have known for several years and with whose research and field work I am personally familiar. A full reference list of peer-reviewed literature cited herein is annexed hereto as "Exhibit B".

Opinions

Premise

22. Elephants are autonomous beings. Autonomy in humans and nonhuman animals is defined as self-determined behavior that is based on freedom of choice. As a psychological concept it implies that the individual is directing their behavior based on some non-observable, internal cognitive process, rather than simply responding reflexively. Although we cannot directly observe these internal processes in other beings, we can explore and investigate them by observing, recording and analysing their behavior, as I have done with elephants for my entire career.

23. I shall indicate which species, African (*Loxodonta Africana*) or Asian (*Elephus maximus*), specific observations relate to. If the general term 'elephants' is used with no specific delineation, it can be assumed the comment relates to the African species, though it is likely that it applies to the Asian species as well.

Brain and Development

24. Elephants are large-brained, with the biggest absolute brain size of any land animal (Cozzi et al. 2001; Shoshani et al. 2006). Even relative to their body sizes, elephant brains are large. Encephalization quotients (EQ) are a standardised measure of brain size relative to body size and illustrate by how much a species' brain size deviates from that expected for its body size. An EQ of one means the brain is exactly the size expected for that body, and values greater than one indicate a larger brain than expected (Jerison 1973). Elephants have an EQ of between 1.3 and 2.3 (varying between sex and African and Asian species). This means an elephant's brain can be up to two and a half times larger than is expected for an animal of its size; this EQ is similar to that of the great apes, with whom elephants have not shared a common ancestor for almost 100 million years (Eisenberg 1981, Jerison 1973). Given how metabolically costly brain tissue is, the large brains of elephants must confer significant advantages; otherwise

their size would be reduced. A large brain allows for greater intelligence and behavioral flexibility (Bates et al. 2008a).

25. Generally, mammals are born with brains weighing up to 90% of the adult weight. This figure drops to about 50% for chimpanzees. Human baby brains weigh only about 27% of the adult brain weight (Dekaban & Sadowsky 1978). This long period of brain development over many years (termed 'developmental delay') is a key feature of human brain evolution and is thought to play a role in the emergence of our complex cognitive abilities, such as self-awareness, creativity, forward planning, decision making, and social interaction (Bjorkland 1997). Delayed development provides a longer period in which the brain may be shaped by experience and learning (Fuster 2002). Elephant brains at birth weigh only about 35% of their adult weight (Eltringham 1982), and elephants show a similarly protracted period of growth, development and learning (Lee 1986). This similar developmental delay in the elephant brain is therefore likewise associated with the emergence of similarly complex cognitive abilities.

26. Despite nearly 100 million years of separate evolution (Hedges 2001), elephants share certain characteristics of our large brains, namely deep and complex folding of the cerebral cortex, large parietal and temporal lobes, and a large cerebellum (Cozzi et al. 2001). The temporal and parietal lobes of the cerebral cortex manage communication, perception, and recognition and comprehension of physical actions (Kolb and Whishaw 2008), while the cerebellum is involved in planning, empathy, and predicting and understanding the actions of others (Barton 2012). Thus, the physical similarities between human and elephant brains occur in areas that link directly to the capacities necessary for autonomy and self-awareness.

27. Elephant brains hold nearly as many cortical neurons as do human brains: humans: 1.15×10^{10}; elephants: 1.1×10^{10} (Roth & Dicke 2005). Elephants' pyramidal neurons are larger than in humans and most other species (Cozzi et al. 2001). Pyramidal neurons are found in the cerebral cortex, particularly the pre-frontal cortex – the brain area that controls executive functions (a set of cognitive processes that are required for choosing and monitoring behaviors that facilitate an individual to reach certain goals, e.g., problem solving, planning, working memory, inhibitory and attentional control and cognitive flexibility).

28. The degree of complexity of pyramidal neurons is linked to cognitive ability, with more (and more complex) connections between pyramidal neurons being associated with increased cognitive capabilities (Elston 2003). Elephant pyramidal neurons have a large dendritic tree, i.e. a large number of connections with other neurons for receiving and sending signals (Cozzi et al. 2001).

29. As described below, along with these common brain and life-history characteristics, elephants share many behavioral and intellectual capacities with humans, including: self-awareness, empathy, awareness of death, intentional communication, learning, memory, and categorisation abilities. Many of these capacities have previously been considered – erroneously – to be uniquely human, and each is fundamental to and characteristic of autonomy and self-determination.

Awareness of Self and Others

30. Asian elephants exhibit Mirror Self Recognition (MSR) using Gallup's classic 'mark test' (Gallup 1970; Plotnik et al. 2006). MSR is the ability to recognise a reflection in the mirror as oneself, and the mark test involves surreptitiously placing a coloured mark on an individual's forehead that it could not see or be aware of without the aid of a mirror. If the individual uses the mirror to investigate the mark, the individual recognises the reflection as herself. Besides elephants, the only other mammals that have successfully passed the mark test and exhibited MSR are the great apes (chimpanzees, bonobos, gorillas and orangutans) and bottlenose dolphins (Parker and Mitchell 1994, Reiss and Marino 2001). MSR is significant because it is considered to be the key identifier of self-awareness. Self-awareness is intimately related to autobiographical memory in humans (Prebble et al. 2013) and is central to autonomy and being able to direct one's own behavior to achieve personal goals and desires. By demonstrating that they can recognize themselves in a mirror, elephants holding a mental representation of themselves from another perspective, and thus be aware that they are a separate entity from others (Bates and Byrne 2014).

31. A being who understands the concept of dying and death possesses a sense of self. Based on the research conducted to date, observing reactions to dead family or group members suggests an awareness of death in only two animal genera beyond humans; chimpanzees and elephants (Anderson et al. 2010, Douglas-Hamilton et al. 2006). Having a mental representation of the self – a pre-requisite for mirror-self recognition

– contributes to the ability to comprehend death. Wild African elephants have been shown experimentally to be more interested in the bones of dead elephants than the bones of other animals (McComb et al. 2006), and have frequently been observed using their tusks, trunk or feet to attempt to lift sick, dying or dead individuals (Douglas-Hamilton 1972, Moss 1992, Poole 1996, Payne 2003, Douglas-Hamilton et al. 2006). Although they do not give up trying to lift or elicit movement from the body immediately, elephants appear to realise that once dead, the carcass cannot be helped anymore, and instead engage in more 'mournful' behavior, such as standing guard over the bodies, and protecting it from the approaches of predators (e.g. Douglas-Hamilton 1972, Croze cited in Moss 1982, Moss 1988, Poole 1996, Payne 2003, McComb et al. 2006). Others have observed them covering the bodies of dead elephants with dirt and vegetation (Moss 1992; Poole 1996). In the particular case of mothers who lose a calf, although they may remain with the calf's body for an extended period, they do not behave towards the body as they would a live calf. Indeed, the general demeanour of elephants who are attending to a dead elephant is one of grief and compassion, with slow movements and few, if any, vocalisations (Poole 1996). These behaviors are akin to human responses to the death of a close relative or friend, and illustrate that elephants possess some understanding of life and the permanence of death. Furthermore, elephants' interest in the bodies, carcasses and bones of elephants who have passed is so marked that when one has died, trails to the site of death are worn into the ground by the repeated visits of many elephants over days, weeks, months and even years (Poole, personal observation). The accumulation of dung around the site attests to the extended time that visiting elephants spend touching and contemplating the bones. I have observed that, over years, the bones may become scattered over tens or hundreds of square meters as elephant pick up the bones and carry them away. The tusks are of particular interest and may be carried and deposited many hundreds of meters from the site of death (Poole, personal observation).

32. The capacity for mentally representing the self as an individual entity has been linked to general empathic abilities (Gallup 1982), where empathy can be defined as identifying with and understanding another's experiences or feelings by imagining what it would be like to be in their situation. Empathy is an important component of human consciousness and autonomy and is a cornerstone of normal social interaction. It goes beyond merely reading the emotional expressions of others. It requires

modelling of the emotional states and desired goals that influence others' behavior both in the past and future, and using this information to plan one's own actions; empathy is only possible if one can adopt or imagine another's perspective, and attribute emotions to that other individual (Bates et al. 2008b). Empathy is, therefore, a component of and reliant on 'Theory of Mind' – the ability to mentally represent and think about the knowledge, beliefs and emotional states of others, whilst recognising that these can be distinct from your own knowledge, beliefs and emotions (Premack and Woodruff 1978, Frith and Frith 2005).

33. Elephants clearly and frequently display empathy in the form of protection, comfort and consolation, as well as by actively helping those who are in difficulty, such as assisting injured individuals to stand and walk, or helping calves out of rivers or ditches with steep banks (Bates et al. 2008b, Lee 1987, Poole 1996). Elephants have been observed to react when anticipating the pain of others (e.g. seen to wince when a nearby elephant stretched her trunk toward a live wire – Poole, personal observation) and have even been observed feeding those who are not able to use their own trunks to eat (Moses Kofi Sam, personal communication) and to attempt to feed those who have just died (Croze, cited in Moss 1982).

34. In an analysis of behavioral data collected from wild African elephants over a 40-year continuous field study, I have concluded that as well as possessing their own intentions, elephants can diagnose animacy and goal directedness in others, understand the physical competence and emotional state of others, and attribute goals and mental states (intentions) to others (Bates et al. 2008b), as evidenced in the examples below:

> *'IB family is crossing river. Infant struggles to climb out of bank after its mother. An adult female [not the mother] is standing next to calf and moves closer as the infant struggles. Female does not push calf out with its trunk, but digs her tusks into the mud behind the calf's front right leg which acts to provide some anchorage for the calf, who then scrambles up and out and rejoins mother.'*
>
> *'At 11.10ish Ella gives a 'lets go' rumble as she moves further down the swamp . . . At 11.19 Ella goes into the swamp. The entire group is in the swamp except Elspeth and her calf [<1 year] and Eudora [Elspeth's mother]. At 11.25 Eudora appears to 'lead' Elspeth and the calf to a good*

> *place to enter the swamp — the only place where there is no mud.'*

In addition to the examples analyzed in Bates et al. 2008b, in what appeared to be a spontaneous attempt to prevent injury to the newborn, I observed two adult females rush to the side of a third female who had just given birth, back into her and press their bodies to her. In describing the situation I wrote:

> *'The elephants' sounds* [relating to the birth] *also attracted the attention of several males including young and inexperienced, Ramon, who, picking up on the interesting smells of the mother* [Ella], *mounted her, his clumsy body and feet poised above the newborn. Matriarch Echo and her adult daughter Erin, rushed to Ella's side and, I believe, purposefully backed into her in what appeared to be an attempt to prevent the male from landing on the baby when he dismounted."*

Examples such as these demonstrate that the acting elephant(s) (the adult female in the first example, Eudora in the second, and Erin and Echo in the third) was able to understand the intentions or situation of the other (the calf in the first case, Elspeth in the second; Ella's newborn and the male in the third) – i.e. to either climb out of or into the water, or be trampled on by the male – and they could adjust their own behavior in order to counteract the problem being faced by the other. Whilst humans may act in this helpful manner on a daily basis, such interactions have been recorded for very few non-human animals (Bates et al. 2008b). In footage of Helping behaviour in The Elephant Ethogram an allo-mother in Maasai Mara, Kenya moves a log from under the head of an infant, in what appears to be an effort to make him more comfortable (see video here). There are numerous other examples of empathy in The Elephant Ethogram under Helping behaviour, including a dramatic rescue of an infant by two allomothers who, among other behaviours, prevent him from drowning by lifting his trunk out of the water so he can breathe. In a further example of understanding goal directedness of others, elephants appear to understand that vehicles drive on roads or tracks and furthermore they appear to know where these tracks lead. In Gorongosa, Mozambique, where elephants exhibit a culture of aggression toward humans, charging, chasing and attacking vehicles, adult females anticipate the direction the vehicle will go and attempt to cut it off by taking shortcuts *before* the vehicle has begun to turn (Poole personal observation 2012). The roots of empathetic behavior begin early in elephants. Just as in humans where rudimentary sympathy for others in distress has been recorded in infants as young as 10 months old (Kanakogi et al. 2013, see http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0065292), young elephants exhibit behavior that indicates that they feel sympathy for others. For instance, during fieldwork in the Maasai Mara in 2011 I filmed a mother elephant using her trunk to assist her one-year-old female calf up a steep bank. Once the calf was safely up the bank she turned around to face her five-year-old sister, who was also having difficulties getting up the bank. As the older calf clambered up the bank with effort the younger calf approached her and first touched her mouth (a gesture of reassurance among family members) and then reached her trunk out to touch the leg that had been having difficulty. Only when her sibling was safely up the bank did the calf turn to follow her mother (video filmed by Poole, 2011).

35. Experimental evidence from captive African elephants further demonstrates that elephants attribute intentions to others, as they follow and understand human pointing gestures (the only animal so far shown to do so spontaneously). The elephants understood that the human experimenter was pointing in order to communicate information to them about the location of a hidden object (Smet and Byrne 2013). Attributing intentions and understanding another's reference point is central to empathy and theory of mind.

36. Our analysis of simulated oestrus behaviors (see Simulate-Estrus) in African elephants – whereby a non-cycling, sexually experienced older female will simulate the visual signals of being sexually receptive, even though she is not ready to mate or breed again – shows that these knowledgeable females adopt false oestrus behaviors in order to demonstrate to naïve young females how to attract and respond appropriately to suitable males. The experienced females may be taking the youngsters lack of knowledge into account and actively showing them what to do; a possible example of true teaching as it is defined in humans (see an example here). Whilst this possibility requires further investigation, this evidence, coupled with the data showing that they understand the ostensive cues in human pointing, demonstrates that elephants do share some executive skills with humans, namely understanding the intentions and knowledge states (minds) of others. Ostensive communication refers to the way humans use particular behavior such as tone of speech, eye contact, physical contact to emphasize that a particular communication is important. Lead elephants in family groups use ostensive communication frequently (e.g. Ear-Flap-Slide, Ear-Slap, Walk-

Wait, Foot-Swinging, Trunk-Sweep, Body-Axis-Pointing as described in Poole & Granli 2011 and The Elephant Ethogram; Comment-Rumble described in Poole, 2011) as a way to say, "Heads up – I am about to do something that you should pay attention to."

37. Further related to empathy, coalitions and cooperation have been documented in wild African elephants, particularly to defend family members or close allies from (potential) attacks by outsiders, such as when a family group tries to 'kidnap' a calf from an unrelated family (Lee 1987, Moss and Poole 1983) or during the extraordinary teamwork executed by elephants when they defend themselves against predators, particularly, human beings (Poole and Granli 2011; Poole 2011). These latter behaviors are preceded by gestural and vocal signals typically given by the matriarch and acted upon by family members and have been documented many times amongst the Gorongosa elephants and in elephant behavior footage from there that we are currently analyzing. These behaviors are based on one elephant understanding the signals, emotions and goals of the coalition partner(s) (Bates et al. 2008b).

38. Cooperation is also evident in experimental tests with captive Asian elephants, whereby elephants demonstrated they can work together in pairs to obtain a reward, and understood that it was pointless to attempt the task if their partner was not present or could not access the equipment (Plotnik et al. 2011). Problem-solving and working together to achieve a collectively desired outcome involve mentally representing both a goal and the sequence of behaviors that is required to achieve that goal; it is based on (at the very least) short-term action planning.

39. Wild elephants have frequently been observed engaging in cooperative problem solving, for example when retrieving calves that have been kidnapped by other groups, when helping calves out of steep, muddy river banks (Bates et al. 2008b), when rescuing a calf attacked by a lion (acoustic recording calling to elicit help from others (Poole 2011) by or the vocal and gestural communication used when they are negotiating a plan of action (e.g. when elephants use Cadenced-Rumbling, Poole 2011, or High-Fiving to lend their "voice" to a proposed or targeted plan of action; see video here) or when they must navigate through human-dominated landscapes to reach a desired destination (e.g. habitat, salt-lick, waterhole) as evidenced in video footage of Selengei and her family filmed in 2015. These behaviors demonstrate the purposeful and well-coordinated social system of elephants and show that elephants can hold

particular aims in mind and work together to achieve those goals. Such intentional, goal-directed action forms the foundation of independent agency, self-determination, and autonomy.

40. Elephants also show innovative problem-solving in experimental tests of insight (Foerder et al. 2011), where insight can be defined as the 'a-ha' moment when a solution to a problem 'suddenly' becomes clear. (In cognitive psychology terms, insight is the ability to inspect and manipulate a mental representation of something, even when you can't physically perceive or touch the something at the time.) Or more simply, insight is thinking and using only thoughts to solve problems (Richard Byrne, Evolving Insight, Oxford Online Press, 2016). A juvenile male Asian elephant demonstrated just such a spontaneous action by moving a plastic cube and standing on it to obtain previously out-of-reach food. After solving this problem once, he showed flexibility and generalization of the technique to other, similar problems by using the same cube in different situations, or different objects in place of the cube when it was not available. This experiment again demonstrates that elephants can choose the appropriate action and incorporate it into a sequence of behavior in order to achieve a goal, which they kept in mind throughout the process.

41. Further experiments also demonstrate Asian elephants' ability to understand goal-directed behavior. When presented with food that was out of reach, but with some bits resting on a tray that could be pulled within reach, the elephants learned to pull only those trays that were baited with food (Irie-Sugimoto et al. 2007). Success in this kind of 'means-end' task demonstrates causal knowledge, which requires understanding not just that two events are associated with each other but also that there is some mediating force that connects and affects the two which may be used to predict and control events. Moreover, understanding causation and inferring object relations may be related to understanding psychological causation, i.e., the appreciation that others are animate beings that generate their own behavior and have mental states (e.g., intentions).

Communication and Social Learning

42. Speech is a voluntary behavior in humans, whereby a person can choose whether to utter words and thus communicate with another. Therefore, speech and language reflect autonomous thinking and intentional behavior. Elephants also intentionally use their vocalisations to share knowledge and information with others (Poole 2011). Females

and dependents call to emphasise and reinforce their social units and to coordinate movement. Male elephants primarily communicate about their sexual status, rank and identity, though like females they also use calls to coordinate movement and interactions in their social groups. Call types (47 have been described by Poole 2011) can generally be separated into laryngeal calls (such as rumbles, cries, roars) or trunk calls (such as trumpets, snorts), with different calls in each category being used in different contexts (Poole et al. 1988; Poole 2011; Poole and Granli 2004; Soltis et al. 2005; Wood et al. 2005, examples of each can be found under "sounds of elephants" on the Search Portal on The Elephant Ethogram). Field experiments have shown that African elephants distinguish between different call types (for example, Contact-Calls – rumbles that travel long distances to maintain associations between elephants that could be several kilometres apart, Estrous-Rumbles – that occur after a female has copulated or Musth-Rumbles that are made by males in the heightened sexual and aggressive state of musth) and these different call types elicit different responses in the listeners. Elephant vocalisations are not simply reflexive, they have distinct meanings to listeners and they are truly communicative, similar to the volitional use of language in humans (Leighty et al. 2008; Poole 1999; Poole 2011).

43. Elephants display a wide variety (> 300 described) of gestures, signals and postures, used to communicate information to the audience (Poole and Granli 2011 and The Elephant Ethogram). Such signals are adopted in many different contexts, such as aggressive, sexual or socially integrative situations, and each signal is well defined and results in predictable responses from the audience. That is, each signal or gesture has a specific meaning both to the actor and recipient. Elephants' use of gestures demonstrates that they communicate intentionally and purposefully to share information with others and/or alter the others' behavior to fit their own will.

44. Elephants use specific calls and gestures to plan and discuss a course of action. These may involve responding to a threat by a group retreat or mobbing action (including celebration of successful efforts - See High-Fiving), or planning and discussing where, when and how to move to a new location (Let's-Go-Rumble and Cadenced-Rumble as described earlier). I have studied elephant communication for two decades and have field notes, acoustic recordings, and raw footage of numerous examples of such communication.

45. In group-defensive situations elephants respond with highly coordinated behavior, both rapidly and *predictably*, to specific calls uttered and particular gestures exhibited by group members. In other words, these elephant calls and gestures hold specific meanings not only to elephant listeners, but also, through experience, to human observers. The rapid, predictable and collective response of elephants to these calls and gestures indicates that elephants have the capability of understanding the goals and intentions of the signalling individual. For example, as was documented and described by me in Episode 2 of PBS six-part series *Gorongosa Park: Rebirth of Paradise*, matriarch Provocadora's contemplation of us (Listening, J-Trunk) followed by her purposeful Perpendicular-Walk (in relation to us) toward her family and her Ear-Flap-Slide was a clear indication to her family to begin a Group-Advance (on us). This particular elephant attack is a beautiful example of elephants' use of empathy, coalition and cooperation. Provocadora's instigation of the Group-Advance led to a two and a half minute Group-Charge in which the three other large adult females of the 36-member family took turns to lead the charge, passing the baton, in a sense, from one to the next. Once they succeeded in their goal of chasing us away they celebrated their victory High-Fiving (with their trunks) and engaging in an End-Zone-Dance. High-Fiving is also typically used to initiate a coalition and is both preceded by and associated with other specific gestures and calls that lead to very goal oriented collective behavior. Elephant group defensive behavior is highly evolved and involves a range of different tactical manoeuvres adopted by different elephants. The calls and gestures used are too many to mention here but are described in Poole 2011 and on The Elephant Ethogram.

46. In planning and communicating intentions regarding a movement, elephants use both vocal and gestural communication. For example, I have observed that a member of a family will use the axis of her body, Body-Axis-Pointing, to point in the direction she wishes to go and then vocalize, every couple of minutes, with a specific call known as a "Let's-Go" Rumble (Poole et al. 1988; Poole 2011), "I want to go this way, let's go together." The elephant will also use intention gestures – such as Walk-Wait, Foot-Swinging – to indicate her intention to move and will Look-Back to see whether anyone is coming. Such a call may be successful or unsuccessful at moving the group or may lead to a longer (45 minutes or more) discussion (series of rumble exchanges known as Cadenced-Rumbles) that I interpret as negotiation. A nice example of this behaviour, though without sound, can be seen in this video filmed in the Maasai Mara when

members of Big Mama's family wanted to go in opposite directions. Sometimes such negotiation leads to disagreement and the group may spilt and go different ways for a period of time. In situations where the security of the group is at stake, for instance when a movement is planned through or near to human settlement, all group members are focused on the decision of the matriarch. So while "Let's-Go"-Rumbles are uttered, others adopt a Waiting posture until the matriarch, after much Listening, and Contemplation decides it is safe to proceed (see for example this video of matriarch Selengei), where upon they bunch together and move purposefully, and at a fast pace in a Group-March (see this example led by Selengei in Maasai Mara, 2015). Elephants typically move through dangerous habitat at high speed and at night in a very goal-oriented manner known as "streaking," which has been described and documented through the movements of elephants wearing satellite tracking collars (Douglas-Hamilton et al. 2005). The many different signals – calls, postures, gestures and behaviors elephants use to contemplate and initiate such movement (including others e.g. Ear-Slap, Ear-Flap-Slide) are clearly understood by other elephants (just as they can be by long-term study by human observers), mean very specific things and indicate that elephants 1) have a particular plan which they can communicate with others; 2) can adjust this plan according to their immediate assessment of risk or opportunity 3) can communicate and execute the plan in a coordinated manner.

47. Furthermore, elephants have been shown to vocally imitate the sounds they hear around them, from the engines of passing trucks (see for example Trunk-Like-Call) and the calls of other species to the commands of human zookeepers (Poole et al. 2005, Stoeger et al. 2012). Imitating another's behavior demonstrates a sense of self, as it is necessary to understand how one's own behavior relates to the behavior of others.

48. Experimental evidence demonstrates that African elephants recognize the importance of visual attentiveness of the intended recipient (in this case, human experimenters) of gestural communication (Smet & Byrne 2014), further supporting the conclusion that elephants' gestural communication is intentional and purposeful. Furthermore, the ability to understand the visual attentiveness and perspective of others is crucial for empathy and mental-state understanding.

Memory and Categorisation

49. Elephants have both extensive and long-lasting memories, just as the folk stories

and adages encourage us to believe. McComb et al. (2000), using experimental playback of long-distance contact calls in Amboseli National Park, Kenya, showed that African elephants remember and recognize the voices of at least 100 other elephants. Each adult female elephant tested was familiar with the contact-call vocalizations of individuals from an average of 14 families in the population. When the calls were from a familiar family – that is, one that had previously been shown to have a high association index with the test group – the test elephants contact-called in response and approached the location of the loudspeaker. When a test group heard unfamiliar contact calls (from groups with a low association index with the test group), they bunched together and retreated from the area.

50. McComb et al. (2001) went on to show that this social knowledge accrues with age, with older females having the best knowledge of the contact calls of other family groups. McComb et al. (2011) also showed that older females are better leaders, with more appropriate decision-making in response to potential threats (in this case, in the form of hearing lion roars). Younger matriarchs under-reacted to hearing roars from male lions. Sensitivity to hearing this sound increased with increasing matriarch age, with the oldest, most experienced females showing the strongest response to this danger. These experimental studies show that elephants continue to learn and remember information about their environments throughout their lives, and this accrual of knowledge allows them to make better decisions and better lead their families as they grow older.

51. Elephants' long-term memory is further demonstrated from data on their movement patterns. African elephants are known to move over very large distances in their search for food and water. Leggett (2006) used GPS collars to track the movements of elephants living in the Namib Desert. He recorded one group traveling over 600 km in five months, and Viljoen (1989) showed that elephants in the same region visited water holes approximately every four days, even though some of them were more than 60km apart. Elephants inhabiting the deserts of both Namibia and Mali have been described traveling hundreds of kilometers to arrive at remote water sources shortly after the onset of a period of rainfall (Blake et al. 2003; Viljoen 1989), sometimes along routes that researchers believe have not been used for many years. These remarkable feats suggest exceptional cognitive mapping skills, reliant on the long-term memories of older individuals who traveled that path sometimes decades earlier. Indeed it has been

confirmed that family groups with older matriarchs are better able to survive periods of drought. The older matriarchs lead their families over larger areas during droughts than those with younger matriarchs, again apparently drawing on their accrued knowledge (this time about the locations of permanent, drought-resistant sources of food and water) to better lead and protect their families (Foley, Pettorelli, and Foley 2008).

52. It has recently been shown that long-term memories, and the decision-making mechanisms that rely on this knowledge, are severely disrupted in elephants who have experienced trauma or extreme disruption due to 'management' practices initiated by humans. Shannon et al. (2013) demonstrated that elephants in South Africa who had experienced trauma decades earlier showed significantly reduced social knowledge. During archaic culling practices, these elephants were forcibly separated from family members and subsequently translocated to new locations. Two decades later, they still showed impoverished social knowledge and skills and impaired decision-making abilities, compared with an undisturbed population in Kenya. Disrupting elephants' natural way of life can negatively impact their knowledge and decision-making abilities.

53. Elephants demonstrate advanced 'working memory' skills. Working memory is the ability to temporarily store, recall, manipulate and coordinate items from memory. Working memory directs attention to relevant information, and results in reasoning, planning, and coordination and execution of cognitive processes through use of a 'central executive' (Baddeley 2000). Adult human working memory is generally thought to have a capacity of around seven items. In other words, we can keep about seven different items or pieces of information in mind at the same time (Miller 1956). We conducted experiments with wild elephants in Amboseli National Park, Kenya, manipulating the location of fresh urine samples from related or unrelated elephants. The elephants' responses to detecting urine from known individuals in surprising locations showed that they are able to continually track the locations of at least 17 family members in relation to themselves, as either absent, present in front of self, or present behind self (Bates et al. 2008a). This remarkable ability to hold in mind and regularly update information about the locations and movements of a large number of family members is best explained by elephants possessing an unusually large working memory capacity, apparently much larger than that of humans.

54. Elephants show sophisticated categorisation of their environment, with skills on a

par with those of humans. My colleagues and I experimentally presented the elephants of Amboseli National Park, Kenya, with garments that gave olfactory or visual information about their human wearers – either Maasai moran (male warriors who traditionally attack and spear elephants on occasion as part of their rite of passage), or Kamba men (who are agriculturalists and traditionally pose little threat to elephants). In the first experiment, the only thing that differed between the cloths was the smell, derived from the ethnicity and/or lifestyle of the wearers. The elephants were significantly more likely to run away when they sniffed cloths worn by Maasai than those worn by Kamba men or no one at all. In a second experiment, we presented the elephants with two cloths that had not been worn by anyone, but here one was white (a neutral stimulus) and the other was red—the color that is ritually worn by Maasai moran. With access only to these visual cues, the elephants showed significantly greater reaction to red garments than white, often including signs of aggression. We concluded that elephants are able to categorize a single species (humans) into sub-classes (i.e. 'dangerous' or 'low risk') based on either olfactory or visual cues alone (Bates et al. 2007). McComb et al. went on to show that the same elephant population can also distinguish between human groups based on our voices: The elephants reacted differently (and appropriately) depending on whether they heard Maasai or Kamba men speaking, and also when they heard male or female Maasai (where female Maasai pose no threat as they are not involved in spearing events), and adult Maasai men or young Maasai boys (McComb et al. 2014). Scent, sounds and visual signs associated specifically with Maasai men are categorized as 'dangerous', while neutral signals are attended to but categorized as 'low risk'. These sophisticated, multi-modal categorization skills may be exceptional among non-human animals.

Sanctuary is Often the Best Option for Captive Elephants

55. Elephants are highly intelligent, social animals. In elephant society an intricate network of relationships radiates outward from the mother-offspring bond through the extended family and the bond group, to clan, population and beyond to strangers, including the primary predatory threat to their survival: Humans. Some 300 documented behaviors, gestures and calls have evolved helping to mediate and maintain these relationships, to communicate over miles, and to direct extraordinarily coordinated bonding ceremonies and group defense.

56. Over millions of years elephants have roamed the earth as intelligent and social mammals, capable of planning, negotiating and engaging in collective decision making. Active more than 20 hours each day elephants move many miles across landscapes to locate resources to maintain their large bodies, to connect with friends and to search for mates. Elephants have evolved to move. Holding them captive and confined prevents them from engaging in normal, autonomous behavior and can result in the development of arthritis, osteoarthritis, osteomyelitis, boredom, and stereotypical behavior. Held in isolation elephants become bored, depressed, aggressive, catatonic, and fail to thrive. Human caregivers are no substitute for the numerous, complex social relationships and the rich gestural and vocal communication exchanges that occur between free-living elephants. And while a captive elephant is generally better off with the company of another elephant, this is at best a small comfort and no justification for the deprivation of autonomy and free movement that results.

57. For elephants in captivity, especially those born into it or kept there for a majority of their lives, going back to the "wild" is unfortunately not an option. For these elephants, human-run sanctuaries are currently the best option. The reasons are explained in detail in Poole & Granli, 2008 and relate to the orders of magnitude of greater space that is offered in sanctuaries. Such space permits autonomy and allows elephants to develop more healthy social relationships and to engage in a near natural movement, foraging, and repertoire of behavior.

58. Elephants are highly social animals and, whether male or female, they are suited to the company of other elephants. Elephants in captivity often do not get on with the elephants their captors select to put them with. Being fenced into areas too small to permit them to select between different companions and when to be with them, they have no autonomy. Elephants need a choice of social partners, and the space to permit them to be with the ones they want, when they want, and to avoid particular individuals, when they want.

59. Compliance with Association of Zoos and Aquariums (AZA) Standards for Elephant Management and Care, the United States federal Animal Welfare Act, or similar standards, laws, and regulations is inadequate for ensuring the wellbeing of elephants. I have long promoted the development of elephant sanctuaries and co-founded one of them (Santuário de Elefantes Brasil), because our more than four

decades long study of free living elephants shows that the AZA specifications are woefully inadequate for meeting the needs of elephants (Poole & Granli 2008).

Examples of Successful Releases of Elephants to Sanctuary

60. Elephants with serious physical or psychological problems in zoos have usually become more normal functioning elephants when given more appropriate space in a sanctuary such as the Performing Animal Welfare Society (PAWS) in Northern California.

61. For example, Maggie was considered to be an anti-social, aggressive elephant and by the time she was moved from the Alaska Zoo to PAWS she was in such poor condition she could barely stand. She is now a thriving, socially active elephant. Indeed she is considered to be PAWS' most social elephant (Ed Stewart, pers. comm.).

62. Ruby was transferred from the LA Zoo to the Knoxville Zoo in Tennessee where she did not successfully integrate with their elephants. When she was moved to PAWS she integrated easily with the other elephants and has become respected leader of her group (Ed Stewart, pers. comm.).

63. Sissy is another classic example. She had been transferred four times and had spent a decade and a half alone before being sent to the Houston Zoo, where she was labeled autistic and antisocial. She was returned to her solitary zoo where she killed a person. She was moved again to El Paso Zoo, where she was beaten because she was a killer elephant. In 2000 she was transferred to The Elephant Sanctuary in Tennessee (TES) and within six months of arrival she was calm and cooperative. She became a leader, putting all elephants at ease. In 2000 the United States Department of Agriculture (USDA) had given Sissy only a year to live. Twenty years later she is still going strong (Scott Blais, pers. comm.).

64. Bunny had been transferred four times and had only known a less than half an acre exhibit when she arrived at TES. She was 47 years old and had spent 40 years alone. Within 24 hours of arriving at sanctuary she was completely and seamlessly integrated into the group (Scott Blais, pers. comm.).

65. Maia and Guida, the first two elephants at Santuário de Elefantes Brasil, had lived together for 40 years. For most of these years Maia was aggressive to Guida, knocking her over, pushing her down and pinning her to the ground. Within 12 hours of arriving at the sanctuary the gates were opened up between them. From that day no further

aggression was seen. The sanctuary is currently home to five rescued elephants who share 75 acres, including one area of 40 acres, another of 22 acres and three other smaller areas ranging from 1.5 to 4 acres. The three smaller yards are introductory areas to help assimilate and provide flexible care depending on the physical and emotional needs of the elephants, and they are generally left open into the larger habitats to permit a greater level of exploration and autonomous living. This combination of possible spaces allows easy integration of new elephants. The plan is to expand the space for Asian elephants to multiple hundred acres and possibly a thousand or more, depending upon whether males and females can be integrated. There are also plans to create separate habitat for African elephants. Santuário de Elefantes Brasil owns a total of 2800 acres (Scott Blais, pers. comm.).

66. In South Africa, African elephants that have been released from long-term captivity to the wild, after a period of suitable rehabilitation, have all adapted entirely, successfully resuming life as wild elephants despite decades in captivity, and not having lived in the 'wild' since they were juveniles (see Elephant Reintegration Trust – https://www.elephantreintegrationtrust.com/projects).

67. As the above examples illustrate, the problems seen in captive elephants can usually be mitigated with the proper attention and environment. There is no basis for arguing that captive and wild elephants are fundamentally different. They have the same biology and needs, but the failure of captivity to meet these needs results in physical and psychological problems.

68. Captive elephants have been safely and successfully transferred long distances to sanctuary. For example, PAWS has been involved in moving more than a dozen elephants over the years without incident. These moves include older females and from places as far away as Alaska and Toronto, Canada. Some of these elephants had lived in their prior facilities for over 40 years. There is no evidence that the inevitable stress of these moves has had a long-term effect on any of the elephants. Santuario de Elephantes Brasil moved Rana (https://globalelephants.org/rana/), a confiscated ex-circus elephant in her 50s, 1,675 miles to their sanctuary in late December 2018. In May 2020, in the midst of the global COVID-19 pandemic, an elephant named Mara (https://globalelephants.org/mara/) was transferred nearly 1,700 miles from the Buenos Aires Zoo to the same sanctuary, where she almost immediately bonded with Rana and

has adapted well to life in sanctuary.[1] In November 2020, following an order of the Islamabad High Court, a male Asian elephant named Kaavan was flown about 2,500 miles from the Marghazar Zoo in Islamabad, Pakistan to the Kulen Promtep Wildlife Sanctuary in Cambodia, where he is adjusting and immediately began interacting with other elephant residents.[2]

Summary

69. Scientific knowledge about elephant intelligence has been increasing rapidly in the past decade: what we currently know is only a tiny fraction of what elephant brains are likely capable of, and yet more amazing abilities are still likely to be discovered. But even based on what we know at this stage, including through my own and my colleagues' extensive experience, observations and studies, both African and Asian elephants share many key traits of autonomy with humans and like humans are autonomous beings.

I declare under penalty of perjury under the law of Colorado that the foregoing is true and correct.

Executed on the 20 (date) of March (month), 2023 (year)

at Sandefjord, Norway
(city or other location, and state or country)

Joyce Poole, Ph.D.

(signature)

[1] Brook Jarvis, "How to Move Your Elephant During a Pandemic," New York Times (Aug. 9, 2020), available at: https://www.nytimes.com/2020/08/09/science/coronavirus-elephants-wildlife-zoo.html.

[2] Kelli Bender, "Kaavan the 'World's Loneliest Elephant' Makes an Elephant Friend for the First Time in 8 Years," People (Dec. 1, 2020), available at: https://people.com/pets/kaavan-worlds-loneliest-elephant-meets-first-elephant-in-8-years/.

Exhibit A

CURRICULUM VITAE

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(Updated 2 February 2022)

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Twitter: www.twitter.com/elephantvoices

RESEARCH INTERESTS

Acoustic communication, Cognitive science, Decision-making, Conservation.

EDUCATION

Postdoctoral	Princeton University Research Fellow 1984-1988; Advisor: Daniel Rubenstein.
Ph.D. 1982	University of Cambridge, U.K, Sub-Department Animal Behaviour. Dissertation*: Musth and male-male competition in the African elephant*; Supervisor: Robert Hinde*.*
B.A. 1979	Smith College, High Honours in the Biological Sciences. Dissertation: *Behavioral-Ecology of the African elephant.*

HONOURS AND AWARDS

2017	The Taft School - Horace Dutton Taft Alumni Medal
2015	Jackson Hole Wildlife Film Festival - Outstanding Achievement Award
2007	California Legislature Assembly - Certificate of Recognition *for tireless efforts in educating people on elephant captivity.*
1996	Smith College Medal - for elephant research and conservation work, *exemplifying the true purpose of a liberal arts education.*
1979	American Society of Mammalogists - A. Brazier Howell Award for paper on *musth* in African elephants.

PROFESSIONAL SOCIETIES/ BOARD and ADVISORY MEMBERSHIPS

2019	Member, Honorary Board of Directors, Performing Animal Welfare Society, PAWS
2017-present	Member, African Elephant Specialist Group, IUCN
2015-present	Member, Board of Directors, Global Sanctuary for Elephants
2015-present	Member, Conservation Alliance of Kenya
2010-present	Member, Kenya Elephant Forum
2010	Member, Alliance for Captive Elephants
2008-present	Member, Board of Directors, ElephantVoices
2004	Member, Panel of Experts, Species Survival Network
2002-2009	Member, Scientific Advisory Committee, Amboseli Elephant Research Project
2002-2011	Trustee, Amboseli Trust for Elephants
2001	Member, Science Advisory Board, Captive Elephant Management Coalition
1988-present	National Geographic Explorer
1988-2001	Member, African Elephant Specialist Group, Species Survival Commission, IUCN

EMPLOYMENT

2002-present	**Scientific Director, ElephantVoices:** Directing the research, conservation and welfare work of the US non-profit organisation, ElephantVoices.
2002-2007	**Research Director, Amboseli Elephant Research Project:** Amboseli Trust for Elephants: Overseeing the elephant monitoring and collaborative research projects, and training programs for the 3 decades long study of elephants.
1999-2001	**Consultant**, **Basecamp Explorer AS:** Wildlife issues.
7/96 & 7/97	**Consultant, IMAX**: Scientific Advisor *Africa's Elephant Kingdom*, Discovery.
1994-1997	**Consultant, Richard Leakey & Associates:** Training; Lecturing; Advisor, wildlife documentaries.
1994-1995	**Author**, *Coming of Age with Elephants* (Hyperion Press, 1996; Hodder & Stoughton, 1996).
1991-1994	**Coordinator, Elephant Program, Kenya Wildlife Service:** Setting and implementing Kenya's elephant conservation and management policy; supervising management-oriented research; reconciling land use and other conflicts between elephants and people; building local expertise.
1990-1991	**Consultant, World Bank:** Pre-Project Facility, drafting the Elephant Conservation and Management Policy and Research Policy Framework and Investment Program, Kenya Wildlife Service.
1990	**Consultant, International Union for the Conservation of Nature:** Compiling overview of elephant conservation in Eastern Africa for Paris Donors Conference.
1989	**Consultant, Tanzanian Wildlife Department:** Drafting successful proposal to the Convention on Trade in Endangered Species to up list the African elephant to Appendix I of the Convention.
1989	**Consultant, World Wildlife Fund:** Discussions with Japanese and Chinese government officials and ivory carvers regarding detrimental impacts of the ivory trade on elephant survival.
1989	**Researcher, African Wildlife Foundation:** Assessing effects of poaching on East African elephant populations.

FIELD RESEARCH

2020-ongoing	**Kenya:** Amboseli National Park: Documenting elephant behavior and communication for The Elephant Ethogram
2011-2019	**Mozambique:** Elephant monitoring and research, as part of the Gorongosa Restoration Project, Gorongosa National Park.
2011-2016	**Kenya:** Elephant conservation and citizen-science project in the Maasai Mara ecosystem.
2008	**Sri Lanka:** Minneriya-Kaudulla National Parks: Initiating an Asian elephant conservation project and behavior study.
1998-2009	**Kenya:** Amboseli National Park: Elephant communication, cognition and social behavior, conducting playback experiments and recording elephant vocalisations and behavior.
1998	**Kenya:** Maasai Mara National Park, Tsavo National Park & Laikipia District: Recording elephant vocalisations and behavior.
1997	**Tanzania:** West Kilimanjaro: Assessing elephant numbers and habitat use.
1990-1994	**Kenya:** Overseeing numerous elephant surveys and studies of elephants carried out under my direction by the Kenya Wildlife Service Elephant Program.
1975-1990	**Kenya:** Amboseli National Park: Male elephant behaviour; reproductive behavior; elephant vocal, gestural and olfactory communication.
1989	**Kenya, Uganda, Tanzania:** Amboseli, Tsavo, Queen Elizabeth and Mikumi National Parks: Assessing the effects of poaching on the age structure and social and reproductive patterns of elephant populations in East Africa.
1980-1982	**Kenya:** Amboseli National Park: Focal animal sampling *Musth* and male male competition among elephants.
1975-1979	**Kenya:** Amboseli National Park: participating in Cynthia Moss' long-term studies of elephants, identifying individual elephants, and collecting social behavior, demographic and ranging data.

LANGUAGES

English: Mother tongue
Kiswahili: Fluent
Norwegian: Working knowledge

PUBLICATIONS

Refereed articles, chapters, theses:

Published:

Lee, P.C., Moss, C.J, Njiraini, N., Poole, J.H., Sayialel, K. Fishlock, V.L. 2021. Cohort consequences of drought and family disruption for male and female African elephants. Behavioral Ecology, https://doi.org/10.1093/beheco/arab148

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Lee, P.C., Bussière, L.F., Webber, C.E., Poole, J.H., Moss, C.J. 2013. Enduring consequences of early experiences: 40 year effects on survival and success among African elephants (Loxodonta africana). *Biology Letters*. 04/2013; 9(2):20130011. https://royalsocietypublishing.org/doi/10.1098/rsbl.2013.0011.

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Poole, J., Granli, P. 2014. Gift to the Maasai Mara, a Male Elephant is Born. National Geographic Society Newsroom.

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PUBLIC EDUCATION

Websites and Social Media

ElephantVoices website	www.ElephantVoices.org
ElephantVoices on Facebook	www.facebook.com/elephantvoices
ElephantVoices on Instagram	www.instagram.com/elephantvoices
ElephantVoices on Twitter	www.twitter.com/elephantvoices
ElephantVoices on Vimeo	www.vimeo.com/elephantvoices
ElephantVoices on SoundCloud	www.soundcloud.com/elephantvoices
The Elephant Charter	www.theelephantcharter.info

Online Databases & Apps

The Elephant Ethogram: A Library of African Elephant Behavior Over 400 African savanna elephant behaviors documented with written descriptions, 2,400+ educational video clips and hundreds of audio files and images.

Gorongosa Elephants Who's Who & Whereabouts houses identity, demographic and sightings data for 396 adult elephants from Gorongosa National Park population, Mozambique. (Password-protected)

Mara Elephants Who's Who & Whereabouts houses identity, demographic and sightings data for 1,282 adult elephants from the Maasai Mara population, Kenya.

Mara EleApp: A cellphone application for data collection by scientists and citizen scientists for upload to the Mara Elephants Who's Who & Whereabouts

Gorongosa EleApp: A multi-language (English, Portuguese) cellphone application for data collection by scientists and citizen scientists for upload to the Gorongosa Elephants Who's Who & Whereabouts (Password-protected)

Printed Articles and books highlighting the work of Joyce Poole (a selection)

Elephant social behavior and communication research and conservation work featured in:
Aftenposten, Daily Telegraph, LA Times, Highlights for Children, Kyodo News, National Geographic Adventure, National Geographic Explorer, National Geographic Kids, National Geographic Magazine, National Geographic News, New York Times Magazine, New York Times, Readers' Digest, Science, Science News, Science Times, Scientific American, Scholastic, Spektrumdirekt, The Guardian.

2021 What Has Four Legs, a Trunk and a Behavioral Database, New York Times.

2021 The First Google Translate for Elephants Debuts, Scientific American.

2021 What are elephants saying? First-ever library reveals communication mysteries, National Geographic.

2021 Roat-Rumble And Squeal-Trumpet: Scientists Compile An Elephant Lexicon, Forbes.

2014 Jodi Picoult, *Leaving Time*, a novel.

2005 Kay Redfield Jamison, *Exuberance: A Passion for Life,* non-fiction.

2001 Martin Meredith's *Africa's Elephant*, a biography.

1992 Doug Chadwick, *Fate of the Elephant.*

1992 Doug Chadwick in his feature article for National Geographic Magazine.

Artistic work featuring elephant calls recorded by Joyce Poole (a selection)

2016 Carlos Casas, *Cemetery*, film, a visual and acoustic work in progress.

2013 Paul Winter, *Summer Solstice Celebration Performance* June 22 at the Cathedral in New York.

2010 Paul Winter, *Miho*, *Journey to the Mountain.*

2009 James Cameron, *Avatar*, film.

2002 Ruichi Sakamoto, *Elephantism,* DVD Book interviews and discussions.

2002 Jim Metzner, *Pulse of the Planet: Extraordinary Sounds from the Natural World*.

Radio (a selection)

2021 Scientist Joyce Poole On What Elephants Have To Say, NPR.

2012 Sam Litzinger interview on The Animal House/NPR (WAMU 88.5).

2009 Elephant welfare views featured on WBUR's Inside Out Documentary on American Zoos with Diane Toomey.

2008 Elephant communication research featured in Up Front Radio, San Francisco with Sandip Roy Chowdhury.

2008 Elephant communication, cognition and welfare with Karl Losken Animal Voices 102.7fm in Vancouver BC Canada.

2005 Science Update, American Association for the Advancement of Science (AAAS).

2005 BBC Radio Science, the Leading Edge.

2005 German Public Radio (SWR) program Campus.

2005 NPR Elephant vocal learning.

2005 BBC News Scotland Vocal Learning in elephants.

2005 Elephant welfare ABC's Radio 702 with Rory McDonald.

2004 Elephant communication research featured in BBC's Beyond our Senses program Sounds of Life with Grant Sonnex.

2004 Elephant communication research featured in NPR program on elephant language.

1996 WETA-FM, News 820's Openline & WNYC.

1981 Musth in the African elephant, BBC Radio 4, The living World.

Television (a selection)

2019 *Women of Impact,* National Geographic.

2016 *Mind of a Giant, award winning documentary,* National Geographic and Vulcan Productions.

2015 *Rebirth of Paradise, Episodes 2 and 5* National Geographic and PBS.

2013 *An apology to elephants,* HBO.

2012 *War Elephants*, award winning documentary about the traumatised elephants in Gorongosa National Park, Mozambique, and their recovery. National Geographic Wild, worldwide.

2012 Live conversation on National Geographic's Facebook Page.

2008 Elephant communication research is featured in Elephant having tales to tell, NHK, Japan (Japanese and English versions).

2006 Interview on elephant communication and cognition for Smart Planet for REDES-TVE, Spain.

2005 Elephants and vocal learning, Daily Planet Discovery Channel Canada.

2005 Elephant cognition and conservation views featured on National Geographic Explorer *Elephant Rage.*

2004 Elephant recordings featured in Discovery Channel's Echo III.

2002 Elephant communication research, Elephant's Talk, featured in BBC documentary *Talking with Animals.*

1999 Research featured in *Inside the Animal Mind Part 3 Animal Consciousness, WNET Nature.*

1998 Featured on Episode 16, *Elephants*, in series, *Champions of the Wild*, Omni Film Productions, Vancouver, Canada.

1996 Life, elephant research and conservation work subject of National Geographic Special, *Coming of Age with Elephants.*

1996 *Wildlife Warriors,* National Geographic Special.

1996 *A Voice for Elephants USIA AfricaPIX.*

1996 Discovery Channel documentary "Ultimate Guide to Elephants".

1990 *Elephants like us*, Rossellini and Associates.

1990 *The language of the elephants*, Rossellini and Associates.

1989 Elephant research and conservation work featured in National Geographic Special *Ivory Wars.*

1988 Research highlighted in BBC production *Trials of Life* with David Attenborough.

1988 Work on elephant infrasound featured in *Supersense* BBC Natural History Unit series on animal senses.

1987 Featured in Sports and Adventure, *Women of the World.*

Work also featured on News and Talk shows such as CNN, 1993, ABC news Women and Science, The Today Show, 1996, West 57th Street CBS News, 1989, PM Magazine, 1987.

Exhibit B

Exhibit B

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EXHIBIT 3

Declaration of Karen McComb

I, Karen McComb, declare as follows:

Introduction and Qualifications

1. My name is Karen McComb. I was awarded my Bachelors of Science with 1st Class Honours in Zoology from the University of Edinburgh in 1984. I earned my PhD from the University of Cambridge from 1984-1988, under the supervision of Professor T.H. Clutton-Brock, for a thesis entitled "Roaring and reproduction in red deer (Cervus elaphus)". I completed a Postdoctoral Research Fellowship from 1989-1990 at the University of Minnesota, and then was a Research Fellow at Newnham College, at the University of Cambridge, from 1990-1993. I have worked at the University of Sussex since 1993, where I have been a Lecturer/Senior Lecturer from 1993-2004, a Reader from 2004-2013, and a Professor (of Animal Behaviour and Cognition) since 2013. I work in the School of Psychology at University of Sussex in Brighton, United Kingdom and reside in East Sussex.

2. I submit this Declaration in support of the Nonhuman Rights Project, Inc.'s petition for a writ of habeas corpus regarding the captive elephants at the Cheyenne Mountain Zoo. I am a nonparty to this proceeding.

3. My current research is directed towards the investigation of emotional awareness as a basis for social success in the domestic horse. Although the essential role that emotional intelligence plays in human social behaviour is well recognized, we collectively still know very little of how individual variation in the ability to identify and respond appropriately to emotional signals influences social integration and success in animal groups. My research team is designing a broad array of naturalistic tests to quantitatively assess individual differences in emotional abilities, which we will examine in relation to measures of social success. In addition to the scientific significance of my research, there are considerable implications for animal welfare, and my group's findings will allow us to more accurately understand the emotional capacities and requirements of individual horses within the domestic environment.

4. My research career has centered on using naturalistic experiments to probe and understand vocal communication and cognitive abilities in a wide range of mammals, including African elephants, horses, lions, red deer, and domestic cats and dogs.

Through the design and implementation of novel experiments which provide a window into abilities that animals use to make every-day decisions in their native environments, I have made breakthroughs that have significantly advanced our fundamental understanding of animal minds and social behaviour. My research has contributed significantly towards advances in: (1) Understanding social cognition and conceptual knowledge. My work focusing on social cognition in domestic horses has led to fundamental insights about how individuals within a group recognize each other, and my research team provided the first systematic demonstration of cross-modal individual recognition of conspecifics in a nonhuman. This finding demonstrates how multi-sensory representations can underlie animals' knowledge of each other, and fundamentally advances our understanding of how conceptual knowledge may have arisen evolutionarily; (2) Understanding social intelligence in wild mammals. My original work evaluating social cognition in African lions laid the groundwork for understanding how the potential costs of fighting with larger groups over limited resources may have provided a selective evolutionary pressure for numerical assessment skills in social species. This potential biological basis for the evolution of mathematical abilities has led broadly to new research on other species based largely on my experimental paradigm. In my research with African elephants, I have demonstrated that the collective experiences and knowledge found in the oldest members of a group can influence the social knowledge of the group as a whole, which has provided fundamental insights into how cognitively advanced social mammals acquire and store information in the wild. Subsequent work provided the first empirical evidence that groups benefit from older leaders specifically due to the group's collectively enhanced ability to respond to predators based on the knowledge of the oldest individual, allowing for the development of intriguing hypotheses for the evolutionary benefits of longevity. More recent work demonstrated for the first time that elephants' knowledge of human predators is much more sophisticated than previously recognized, by showing that elephants can determine ethnicity, gender, and age of humans from acoustic cues in human voices; and (3) Understanding sexual signals and the origins of language. My original research on the function of roaring in red deer provided the foundation for a novel, systematic experimental approach to studying the role of vocal signaling in sexual selection in mammals. In a series of influential papers, my research group showed that formants, key parameters in human speech, play a critical role in the communication of non-human mammals. In addition, I have used a comparative approach to demonstrate that increases in non-human primate group size and extent of social bonding are related to the development of larger vocal repertoires, providing new information for the scientific investigation of language evolution.

5. In addition to the scientific implications of my research, it has also had impacts for animal conservation and welfare. Specifically, by demonstrating the crucial role that the oldest individuals play in elephant social groups, we have shown how entire populations of cognitively advanced social mammals can be severely disrupted by the removal of even a few critical individuals. Our recent work has also shown that the effects of social disruption can have severe, long-term effects on the cognitive abilities of elephants. This research has significant implications for the conservation and welfare of both wild and captive animals, not just elephants but also other long-lived, large-brained social mammals such as whales and dolphins. Due to this work, I was invited to contribute to the recommendations of the recent Convention on the Conservation of Migratory Species of Wild Animals (CMS).

6. Along with my colleague David Reby, I developed a very successful research group in Mammal Vocal Communication and Cognition (http://www.lifesci.sussex.ac.uk/cmvcr/Home.html) at the University of Sussex. This research group has attracted and supported many talented postgraduates and independent research fellows. Currently, I have 3 PhD students and a postdoc, working with me on projects ranging from emotional awareness in domestic animals to investigating cultural differences between elephant populations.

7. I have been awarded significant extramural grants to fund my research throughout my career from a number of foundations and organizations, including: (1) Levehulme Trust Research Grants, in both 2009 and 2014; (2) a National Geographic grant in 2006; (3) a Waltham Foundation grant in 2002; (4) an EU Marie Curie grant in 2000; (5) a BBSRC research grant in 1996; (6) Tusk Trust grants, in 1994, 1995, and 1996; (7) a Nuffield Foundation grant in 1994; (8) a Royal Society Research grant in 1994; (9) and an NERC small project grant in 1993. Additionally, I have received a number of Royal Society Conference grants throughout my career, most recently in 2005 and 2009.

8. Over the course of my career, I have received several awards and honors related to my research, including; (1) the 2008 PNAS Cozzarelli Prize for outstanding originality

and scientific excellence for the article "Cross-modal individual recognition in domestic horses (Equus caballus)" with L. Proops and D. Reby; (2) the prize for best talk by a research student at the Association for the Study of Animal Behaviour Spring Conference in 1987 during my PhD at Cambridge; (3) The University of Edinburgh Class Medal & Ashworth Prize in Zoology in 1984; (4) the Class Medal and William Turner Award in Zoology in 1983; (5) the Moira Lyndsay Stewart Award in Zoology in 1982; and (6) the Jack Roberts Memorial Prize in Botany in 1982.

9. I have served with a number of professional organizations throughout my career, including: (1) as an appointed Reviewer for European Research Council grants in 2012; (2) as an academic Editor for *PLoS One* since 2007; (3) as part of the Editorial Board for *Bioacoustics* since 1997; (4) as a consulting Editor for *Animal Behaviour* from 1996-1998; (5) as a Council Member for the Association for the Study of Animal Behaviour (ASAB) from 1993-1997; (6) as a liaison representative for the ASAB with the Institute of Biology from 1995-1997; and (7) as a manuscript reviewer for a number of premier scientific publications, including *Science, Nature, Current Biology, Proceedings of the Royal Society B, Proceedings for the National Academy of Sciences, PLoS One,* and *Animal Behaviour*, as well as other journals.

10. I have organized a number of conferences during my career, including: (1) a symposium on "Mammal Vocal Communication: Insights into cognitive abilities and the origins of language" at the International Ethological Congress in Budapest, in August 2005 (with David Reby); and (2) the 1999 Association for the Study of Animal Behaviour Conference on "Evolution of Mind" in London, attended by more than 200 people.

11. I have given numerous professional academic lectures throughout my career. Some of these include: (1) an invited lecture to the Cetacean Culture Workshop in 2014, organized jointly by the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and Whale and Dolphin Conservation (WDC); (2) a Plenary talk at the 2012 Association for the Study of Animal Behaviour meeting on "Cognition in the Wild"; (3) an invited lecture at the 2011 international workshop on communication and social cognition at the Institute of Evolutionary Biology and Environmental Studies at the University of Zurich; (4) an invited lecture at the 2010 International workshop on referential communication at the Wissenschaftskolleg zu Berlin, Institute for Advanced Study in Berlin; (5) a Plenary lecture at the 2010 Nordic meeting of the International

Society for Applied Ethology, in Kuopia, Finland; (6) an invited lecture at the 2009 International Ethological Congress in Rennes, France; (7) an invited lecture in 2009 at the Ecology and Evolutionary Biology Department at the University of Princeton; (8) an invited lecture at the Novartis day at the 2006 Royal Society Discussion meeting on Social Intelligence, in London; (9) an invited lecture (and conference organizer) at the 2005 International Ethological Congress Symposium on "Mammal Vocal Communication: insights into cognitive abilities and the origin of language" in Budapest; (10) a Keynote lecture at the 2003 British Association for the Advancement of Science Symposium on "Where do numbers come from?" at Salford, England; (11) a Plenary lecture at the 2002 Association for the Study of Animal Behaviour conference on "Information Gathering"; (12) an invited lecture at the 2001 symposium on Alternative Approaches to Studying Social Cognition at the International Ethological Congress in Tubingen, Germany; (13) an invited lecture at a 2000 International workshop on animal signaling, Talkbank, at the University of Philadelphia; and (14) a Plenary lecture at the 1999 Association for the Study of Animal Behaviour Conference on "Communication and Social Behaviour" in Lisbon.

12. In addition to academic lectures, I have given a number of public lectures over the course of my career, including: (1) as an invited panel member/speaker at the 2014 Festival of Sound, organized by Magdalene College at the University of Cambridge; (2) as an invited member/speaker at the 2012 Gulbenkian Foundation Supersonix Festival, organized on behalf of the Exhibition Road Cultural Group to focus on the art and science of sound and music-making; (3) a public lecture on "Animal Communication" in the "Learning about Animals" series in London in 2007; (4) a lecture to the 2006 Pet Care Trust Conference in Edinburgh; (5) a Press conference for the launch of my *Science* paper, organized by the American Academy for the Advancement of Science, at the London Zoo in 2001; (6) a lecture at the British Library National Sound Archive in 2000; and (7) a joint lecture with Cynthia Moss at a Royal Geographical Society lecture, attended by more than 600 members of the public, in 1996.

13. I have published over 50 peer-reviewed scientific articles over my career. These articles have been published in many of the world's premier scientific journals, including: *Nature*, *Science*, *PNAS*, *Frontiers in Zoology*, *Animal Behaviour, Current Biology*, *Biology Letters*, *PLoS ONE*, *Proceedings of the Royal Society B*, *Ethology*,

Animal Cognition, Journal of the Acoustical Society of America, Journal of Comparative Psychology, Advances in the Study of Behaviour, American Journal of Primatology, Behavioural Ecology, and *Trends in Ecology & Evolution*. Six of these publications have been featured as cover articles in the journals *Science, Nature, PNAS, Proceedings of the Royal Society B,* and *Biology Letters.* Specific topics of these publications have included: Animals remember previous facial expressions that specific humans have exhibited; Elephants can determine ethnicity, gender, and age from acoustic cues in human voices; The Equine Facial Action Coding System; The eyes and ears are visual indicators of attention in domestic horses; Cross-modal discrimination of human gender by domestic dogs; Effects of social disruption in elephants persist decades after culling; The responses of young domestic horses (Equus caballus) to human-given cues; Leadership in elephants: the adaptive value of age; African wild dogs as a fugitive species: playback experiments investigate how wild dogs respond to their major competitors; Cross-modal perception of body size in domestic dogs; the use of human-given cues by domestic horses; Acoustic bases of motivational misattributions; Oestrus red deer hinds prefer male roars with higher fundamental frequencies; Size communication in domestic dog (Canis familiaris) growls; Manipulation by domestic cats: the cry embedded within the purr; Context-related variation in the vocal growling behaviour of the domestic dog; Cross-modal individual recognition in domestic horses; Human listeners attend to size information in domestic dog growls; Experimental investigation of referential looking in free-ranging barbary macaques; Female perception of size-related formant shifts in red deer (Cervus elaphus); African elephants show high levels of interest in the skulls and ivory of their own species; Co-evolution of vocal communication and sociality in primates; Long-distance communication of cues to social identity in African elephants; Vocal communication and reproduction in deer; Information content of female copulation calls in yellow baboons; Matriarchs act as repositories of social knowledge in African elephants; Elephant hunting and conservation; Roaring and social communication in African lions; Unusually extensive networks of vocal recognition in African elephants; Perception of female reproductive state from vocal cues; Female grouping as a defense against infanticide by males; Behavioural deception; Roaring and numerical assessment in contests between groups of female lions; Female lions can identify potentially infanticidal males from their roars; Roaring and oestrus; Roaring by red deer stags advances date of oestrus in hinds; and Are talkers the only thinkers?.

14. My scientific work has also been published as chapters in several books and edited volumes, including (1) *The Social Dog* (2014, editors J. Kaminski and S. Marshall-Pescini, Elsevier); (2) *The Amboseli Elephants: A Long-Term Perspective on a Long-Lived Mammal* (2011, University of Chicago Press); (3) *New Encyclopedia of Neuroscience* (2008, editor L.R. Squire, Academic Press); (4) *The Barbary macaque: biology, management, and conservation* (2006, editors J.K. Hodges and J. Cortes, Nottingham University Press); (5) *Animal Communication Networks* (2005, editor P.K. McGregor, Cambridge University Press); (6) *Studying Elephants* (1996, African Wildlife Foundation Technical Handbook series); and (7) *Playback and Studies of Animal Communication* (1992, editor P.K. McGregor, Plenum Publishing Corporation).

15. My work has garnered significant media coverage over the course of career. I have made appearances on British, American, Australian, Canadian, and German TV and radio stations (including BBC TV news, Discovery Channel, Radio 4 Today programme, and BBC Science in Action) and my work has been featured in articles in major British, European, and American newspapers (including The Guardian, Times, Liberation, National Geographic magazine, and New Scientist).

16. In April 2001, *Science* organized a press conference in London for the launch of my paper, which was featured as their cover story. Later cover stories in *Biology Letters* (2006), *PNAS* (2009), and *Proceedings of the Royal Society B* (2011) also generated significant media attention, as did my *Current Biology* paper in 2009 which featured as the most popular story on the BBC website, as well as the top Science and Entertainment story.

17. Several of my recent papers, including *Current Biology* (2018), *PNAS* (2014) and *Frontiers in Zoology* (2013) received unusually extensive world-wide media coverage. This included interviews on the Radio 4 Today Programme, ITV News at Ten, BBC World TV News, Newsround, BBC World Service, and Science in Action, as well as coverage in BBC Breakfast, BBC Radio 2, 3, and 4 news reports, Time magazine, The Economist, *Nature*, *Science*, National Geographic, and by more than 200 other news outlets in the UK and around the world.

18. My elephant research was covered in BBC's "Inside the Animal Mind" in February 2014, and my horse research was filmed for the BBC series "Talk to the Animals" which aired in July 2014. Both programmes were shown in prime-time slots and were

very well received by the public. My recent research on emotional awareness in horses also featured in the award-winning CBC documentary “Equus: story of the horse”.

19. I have done regular consultancies for the BBC and other companies making wildlife documentaries on animal communication. Most recently, I was a scientific consultant for the popular two-part BBC documentary “Talk to the Animals” (2014). I have also provided sound recordings for wildlife documentaries by the BBC and Windfall films, and have a sound recording credit (with Martyn Colbeck) on the BBC’s “Echo of the elephants: the next generation” (1995).

20. My work has been featured in a number of textbooks and popular books, including: (1) John Alcock’s and Lee Dugatkin’s major textbooks on Animal Behaviour; (2) new edition of the Krebs & Davies *An Introduction to Behavioural Ecology*; (3) new edition of Bradbuy and Vehrencamp’s *Principles of Animal Communication*; (4) new edition of Shettleworth’s *Cognition, Evolution, and Behavior*; (5) Brian Butterworth’s *The Mathematical Brain*; (6) Tim Clutton-Brock’s *Mammal Societies*; and (7) as a chapter in the best-selling *Animal Wise* by Virginia Morell.

21. I provided photographic material to The Field Museum, in Chicago, for an exhibition on Mammoths and Mastodons, Titans of the Ice Age. This exhibit has been touring internationally.

22. My Curriculum Vitae fully sets forth my educational background and experience and is annexed hereto as “Exhibit A”.

Basis for opinions

23. The opinions I state in this Declaration are based on my professional knowledge, education, training, and years of experience observing and studying elephants and other social mammals, as well as my knowledge of peer-reviewed literature about elephant behaviour and intelligence published in the world’s most respected journals, periodicals and books that are generally accepted as authoritative in the field, and many of which were written by myself or colleagues whom I have known for several years and with whose research and field work I am personally familiar. A full reference list of peer-reviewed literature cited herein is annexed hereto as “Exhibit B”.

Opinions

Premise

24. Autonomy in humans is defined as self-determined behaviour that is based on freedom of choice. As a psychological concept it implies that the individual is directing their behaviour based on some non-observable, internal cognitive process, rather than simply responding reflexively. Although we cannot directly observe these internal processes in other people, we can explore and investigate them by observing, recording and analysing behaviour. For non-human animals, observing similar behaviour and recording evidence of shared cognitive capacities should, parsimoniously, lead to similar conclusions about autonomy.

25. I shall indicate which species, African (*Loxodonta Africana*) or Asian (*Elephus maximus*), specific observations relate to. If the general term "elephants" is used with no specific delineation, it can be assumed the comment relates to both species.

Brain And Development

26. Elephants are large-brained, with the biggest absolute brain size of any land animal (Cozzi et al 2001; Shoshani et al 2006). Even relative to their body sizes, elephant brains are large. Encephalization quotients (EQ) are a standardised measure of brain size relative to body size, and illustrate by how much a species' brain size deviates from that expected for its body size. An EQ of one means the brain is exactly the size expected for that body, and values greater than one indicate a larger brain than expected (Jerison 1973). Elephants have an EQ of between 1.3 and 2.3 (varying between sex and African and Asian species). This means an elephant's brain can be up to two and a half times larger than is expected for an animal of its size; this EQ is similar to that of the great apes, with whom elephants have not shared a common ancestor for almost 100 million years (Eisenberg 1981, Jerison 1973). Given how metabolically costly brain tissue is, the large brains of elephants would be expected to confer significant advantages; otherwise their size would be reduced. Presumably this advantage is allowing greater cognitive capacities and behavioural flexibility (Bates et al 2008a).

27. Generally, mammals are born with brains weighing up to 90% of the adult weight. This figure drops to about 50% for chimpanzees. Human baby brains weigh only about 27% of the adult brain weight (Dekaban & Sadowsky 1978). This long period of brain development over many years (termed 'developmental delay') is a key feature of human brain evolution and is thought to play a role in the emergence of our complex cognitive abilities, such as self-awareness, creativity, forward planning, decision making and

social interaction (Bjorkland 1997). Delayed development provides a longer period in which the brain may be shaped by experience and learning (Fuster 2002). Elephant brains at birth weigh only about 35% of their adult weight (Eltringham 1982), and elephants show a similarly protracted period of growth, development and learning (Lee 1986). This similar developmental delay in the elephant brain is therefore likely associated with the emergence of similarly complex cognitive abilities.

28. Despite nearly 100 million years of separate evolution (Hedges 2001), elephants share certain characteristics of our large brains, namely deep and complex folding of the cerebral cortex, large parietal and temporal lobes, and a large cerebellum (Cozzi et al 2001). The temporal and parietal lobes of the cerebral cortex manage communication, perception, and recognition and comprehension of physical actions, while the cerebellum is involved in planning, empathy, and predicting and understanding the actions of others (Barton 2012). Thus, the physical similarities between human and elephant brains occur in areas that are relevant to capacities necessary for autonomy and self-awareness.

29. Elephant brains hold three times more neurons than do human brains, with 97% of their found neurons in the cerebellum and 5.6 billion neurons in the cerebral cortex (Herculano-Houzel et al 2014); This figure for cortical neurons is lower than previous estimates, which suggested 11 billion cortical neurons for elephants and 11.5 billion for humans (Roth & Dicke 2005).

30. Elephant pyramidal neurons have a large dendritic tree, i.e. a large number of connections with other neurons for receiving and sending signals (Cozzi et al 2001; Jacobs et al 2011; Maseko et al 2012). The degree of complexity of pyramidal neurons is linked to cognitive ability, with more (and more complex) connections between pyramidal neurons being associated with increased cognitive capabilities (Elston 2003).

31. As described below, research demonstrates that along with these common brain and life-history characteristics, there is evidence that elephants may share many behavioural and intellectual capacities with humans, including: self-awareness, empathy, awareness of death, intentional communication, learning, memory, and categorisation abilities. Many of these capacities have previously been considered – erroneously – to be uniquely human, and each is fundamental to and characteristic of autonomy and self-determination.

Awareness Of Self And Others

32. An Asian elephant has been show to exhibit Mirror Self Recognition (MSR) using Gallup's classic 'mark test' (Gallup 1970; Plotnik et al 2006). MSR is the ability to recognise a reflection in the mirror as oneself, and the mark test involves surreptitiously placing a coloured mark on an individual's forehead that it could not see or be aware of without the aid of a mirror. If the individual uses the mirror to investigate the mark, it is logical to assume that the individual recognises the reflection as itself. (See video here). Almost all animal species tested on this task fail: they do not recognise the image in the mirror as being a reflection of themselves. Indeed, the only other mammals beyond humans who have successfully passed the mark test and exhibit MSR are the great apes (chimpanzees, bonobos, gorillas, and orangutans) and bottlenose dolphins (Parker and Mitchell 1994, Reiss and Marino 2001). MSR is significant because it is considered by many to be a key identifier of self-awareness. Self-awareness is intimately related to autobiographical memory in humans (Prebble et al 2013), and is central to autonomy and being able to direct one's own behaviour to achieve personal goals and desires. By demonstrating that they can recognize themselves in a mirror, elephants appear to be holding a mental representation of themselves from another perspective, and thus be aware that they are a separate entity from others (Bates and Byrne 2014).

33. Related to possessing a sense of self is an understanding of death. Observing reactions to dead family or group members suggests such an awareness of death in only two animal genera beyond humans; chimpanzees and elephants (Anderson et al 2010, Douglas-Hamilton et al 2006). Having a mental representation of the self – a pre-requisite for mirror-self recognition – probably also confers an ability to comprehend aspects of death. Wild African elephants have been shown experimentally to be more interested in the bones of dead elephants than the bones of other animals (McComb et al 2006) (See video here), and they have frequently been observed using their tusks, trunk or feet to attempt to lift sick, dying or dead individuals (Poole & Granli, 2011). Although they do not give up trying to lift or elicit movement from the body immediately, elephants appear to realise that once dead, the carcass cannot be helped anymore, and instead they engage in apparently "grief-stricken" behaviour, such as standing guard over the body, and protecting it from the approaches of predators (Poole & Granli, 2011). They also have been observed to cover the bodies of dead elephants

with dirt and vegetation (Moss 1992; Poole 1996). In the particular case of mothers who lose a calf, although they may remain with the calf's body for an extended period, they do not behave towards the body as they would a live calf. Indeed, the general demeanour of elephants who are attending to a dead elephant is one of grief, with slow movements and few vocalisations (Poole, pers. comm.). These behaviours are akin to human responses to the death of a close relative or friend, and illustrate that elephants appear to possess some understanding of life and the permanence of death (See photographs here).

34. The capacity for mentally representing the self as an individual entity has been linked to general empathic abilities (Gallup 1982), where empathy can be defined as identifying with and understanding another's experiences or feelings by relating personally to their situation. Empathy is an important component of human consciousness and autonomy, and is a cornerstone of normal social interaction. It goes beyond merely reading the emotional expressions of others. It requires modelling of the emotional states and desired goals that influence others' behaviour both in the past and future, and using this information to plan one's own actions; cognitive empathy is possible if one can adopt another's perspective, and attribute emotions to that other individual (Bates et al 2008b). Empathy is, therefore, a component of and reliant on 'Theory of Mind' - the ability to mentally represent and think about the knowledge, beliefs and emotional states of others, whilst recognising that these can be distinct from your own knowledge, beliefs and emotions (Premack and Woodruff 1978/ Frith and Frith 2005).

35. Elephants clearly and frequently display empathy in the form of protection, comfort, and consolation, as well as by actively helping those who are in difficulty, such as assisting injured individuals to stand and walk, or helping calves out of rivers or ditches with steep banks (Bates et al 2008b, Lee 1987) (See video here). Elephants have even been observed feeding those who are not able to use their own trunks to eat (see Poole and Granli, 2011).

36. In an analysis of behavioural data collected from wild African elephants over a 40-year continuous field study, Bates and colleagues concluded that as well as possessing their own intentions, elephants can diagnose animacy and goal directedness in others, understand the physical competence and emotional state of others, and attribute goals

and mental states (intentions) to others (Bates et al 2008b), as evidenced in the examples below:

> *'IB family is crossing river. Infant struggles to climb out of bank after its mother. An adult female [not the mother] is standing next to calf and moves closer as the infant struggles. Female does not push calf out with its trunk, but digs her tusks into the mud behind the calf's front right leg which acts to provide some anchorage for the calf, who then scrambles up and out and rejoins mother.'* (See video here)

> *'At 11.10ish Ella gives a 'lets go' rumble as she moves further down the swamp . . . At 11.19 Ella goes into the swamp. The entire group is in the swamp except Elspeth and her calf [<1 year] and Eudora [Elspeth's mother]. At 11.25 Eudora appears to 'lead' Elspeth and the calf to a good place to enter the swamp — the only place where there is no mud.'*

Examples such as these demonstrate that the acting elephant (the adult female in the first example, and Eudora in the second) was able to understand the intentions of the other (the calf in the first case, and Elspeth in the second) – i.e. to either climb out of or into the water – and they could adjust their own behaviour in order to counteract the problem being faced by the other. Whilst humans may act in this helpful manner on a daily basis, such interactions have been recorded for very few non-human animals (Bates et al 2008b).

37. Experimental evidence from captive African elephants further demonstrates that elephants have the potential to attribute intentions to others, as they follow and understand human pointing gestures. The elephants understood that the human experimenter was pointing in order to communicate information to them about the location of a hidden object (Smet and Byrne 2013) (See video here). Attributing intentions and understanding another's reference point is central to empathy and theory of mind.

38. Evidence of 'natural pedagogy' is rare among non-human animals, with only a few potential examples of true teaching (whereby the teacher takes into account the knowledge states of the learner as they pass on relevant information) recorded anecdotally in chimpanzees (Boesch 1991) and killer whales (Guinet and Bouvier

1995)[1]. Teaching is therefore still widely considered to be unique to humans (Csibra and Gergely 2009). Bates & Byrne's analysis of simulated oestrus behaviours in African elephants – whereby a non-cycling, sexually experienced older female will simulate the visual signals of being sexually receptive, even though she is not ready to mate or breed again – shows that these knowledgeable females can adopt false oestrus behaviours in order to demonstrate to naïve young females how to attract and respond appropriately to suitable males. The experienced females may be taking the youngster's lack of knowledge into account and actively showing them what to do; a possible example of true teaching as it is defined in humans. Whilst this possibility requires further investigation, this evidence, coupled with the data showing that they understand the ostensive cues in human pointing, suggests that elephants do share some executive skills with humans, namely understanding the intentions and knowledge states (minds) of others.

39. Further related to empathy, the occurrence of coalitions and cooperation have been documented in wild African elephants, particularly to defend family members or close allies from (potential) attacks by outsiders, such as when a family group tries to 'kidnap' a calf from an unrelated family (Lee 1987, Moss and Poole 1983). These behaviours are based on one elephant understanding the emotions and goals of the coalition partner (Bates et al 2008b).

40. Cooperation is also evident in experimental tests with captive Asian elephants, whereby elephants demonstrated they can work together in pairs to obtain a reward, and understood that it was pointless to attempt the task if their partner was not present or could not access the equipment (Plotnik et al. 2011) (See video here). Problem-solving and working together to achieve a collectively desired outcome involve mentally representing both a goal and the sequence of behaviours that is required to achieve that goal; it is based on (at the very least) short-term action planning.

41. Wild elephants have frequently been observed engaging in cooperative problem solving, for example when retrieving calves that have been kidnapped by other groups, or when helping calves out of steep, muddy river banks (Bates et al 2008b, Moss, 2011) These behaviours demonstrate the purposeful and well-coordinated social system of

[1] Functional teaching has been experimentally demonstrated in various animal species including ants, babblers, meerkats, cheetahs and some primates, but this is not the same as deliberate pedagogy, as it does not rely on representing the knowledge states of the learners.

elephants, and show that elephants can hold particular aims in mind and work together to achieve those goals. Such intentional, goal-directed action forms the foundation of independent agency, self-determination, and autonomy.

42. Elephants also show innovative problem solving in experimental tests of insight (Foerder et al 2011), where insight can be described as the 'a-ha' moment when a solution to a problem 'suddenly' becomes clear. (In cognitive psychology terms, insight is the ability to inspect and manipulate a mental representation of something, even when you can't physically perceive or touch the something at the time. Or more simply, insight is thinking and using only thoughts to solve problems (*see* Richard Byrne, *Evolving Insight*, Oxford Online Press, 2016[2]). A juvenile male Asian elephant demonstrated just such a spontaneous action by moving a plastic cube and standing on it to obtain previously out-of-reach food. After solving this problem once, he showed flexibility and generalization of the technique to other, similar problems by using the same cube in different situations, or different objects in place of the cube when it was not available. (See video here). This experiment again demonstrates that elephants can choose the appropriate action and incorporate it into a sequence of behaviour in order to achieve a goal, which they kept in mind throughout the process.

43. Further experiments also demonstrate Asian elephants' ability to understand goal-directed behaviour. When presented with food that was out of reach, but with some bits resting on a tray that could be pulled within reach, the elephants learned to pull only those trays that were baited with food (Irie-Sugimoto et al 2008). Success in this kind of 'means-end' task is a demonstration of causal knowledge, which requires understanding not just that two events are associated with each other but also that there is some mediating force that connects and affects the two which may be used to predict and control events. Moreover, understanding causation and inferring object relations may be related to understanding psychological causation, i.e., the appreciation that others are animate beings that generate their own behaviour and have mental states (e.g., intentions).

Communication and social learning

[2] Available at https://global.oup.com/academic/product/evolving-insight-9780198757078?cc=us&lang=en&.

44. Speech is a voluntary behaviour in humans, whereby a person can choose whether to utter words and thus communicate with another. Therefore speech and language are reflections of autonomous thinking and intentional behaviour. Elephants also use their vocalisations to share knowledge and information with others, apparently intentionally (Poole 2011). Male elephants primarily communicate about their sexual status, rank and identity, whereas females and dependents call to co-ordinate and reinforce their social units. Call types can generally be separated into calls produced primarily by the larynx (such as rumbles) or trunk calls (such as trumpets), with different calls in each category being used in different contexts (Poole 2011; Poole and Granli 2004; Soltis et al 2005; Wood et al 2005). Field experiments have shown that African elephants distinguish between different call types (for example, contact calls – rumbles that travel long distances to maintain associations between elephants that could be several kilometres apart, or oestrus rumbles – that occur after a female has copulated) and these different call types elicit different responses in the listeners. Elephant vocalisations are not simply reflexive, they have distinct meanings to listeners and they are truly communicative, similar to the volitional use of language in humans (Leighty et al 2008; Poole 1999; Poole 2011).

45. Furthermore, elephants have been shown to vocally imitate the sounds they hear around them, from the engines of passing trucks to the commands of human zookeepers (Poole et al 2005, Stoeger et al 2012). Imitating another's behaviour is demonstrative of a sense of self, as it is necessary to understand how one's own behaviour relates to the behaviour of others.

46. Elephants display a wide variety of gestures, signals and postures, used to communicate information to the audience (Poole and Granli gestures chapter 2011). Such signals are adopted in many different contexts, such as aggressive, sexual or socially integrative situations, and each signal is well defined and results in predictable responses from the audience. That is, each signal or gesture has a specific meaning both to the actor and recipient. Elephants' use of gestures demonstrates that they communicate intentionally and purposefully to share information with others and/or alter the others' behaviour to fit their own desires.

47. Experimental evidence demonstrates that African elephants recognize the importance of visual attentiveness of the intended recipient (in this case, human experimenters) of gestural communication (Smet & Byrne 2014), further supporting

the suggestion that elephants' gestural communication is intentional and purposeful. Furthermore, the ability to understand the visual attentiveness and perspective of others is crucial for empathy and mental-state understanding.

Memory And Categorisation

48. Elephants have both extensive and long-lasting memories, just as the folk stories and adages encourage us to believe. McComb et al. (2000), using experimental playback of long-distance contact calls in Amboseli National Park, Kenya, showed that African elephants remember and differentiate the voices of at least 100 other elephants. Each adult female elephant tested was familiar with the contact-call vocalizations of individuals from an average of 14 families in the population. When the calls were from the test elephants' own family, they contact-called in response and approached the location of the loudspeaker and when they were from another non-related but familiar family — that is, one that had previously been shown to have a high association index with the test group — they listened but remained relaxed. However, when a test group heard unfamiliar contact calls (from groups with a low association index with the test group), they bunched together and retreated from the area.

49. McComb et al. (2001) went on to show that this social knowledge accumulates with age, with older females having the best knowledge of the contact calls of other family groups. McComb et al. (2011) also showed that older females are better leaders, with more appropriate decision-making in response to potential threats (in this case, in the form of hearing lion roars). Younger matriarchs were less skilled at pinpointing roars from male lions, the most dangerous predators because they can subdue a young elephant even when hunting alone. Sensitivity to picking out the roars of male lions increased with increasing matriarch age, with the oldest, most experienced females showing the strongest response to this danger. These experimental studies show that elephants continue to learn and remember information about their environments throughout their lives, and this accrual of knowledge allows them to make better decisions and better lead their families as they grow older.

50. Further demonstration of elephants' long-term memory comes from data on their movement patterns. African elephants are known to move over very large distances in their search for food and water. Leggett (2006) used GPS collars to track the movements of elephants living in the Namib Desert. He recorded one group traveling

over 600 km in five months, and Viljoen (1989) showed that elephants in the same region visited water holes approximately every four days, even though some of them were more than 60km apart. Elephants inhabiting the deserts of both Namibia and Mali have been described traveling hundreds of kilometers to arrive at remote water sources shortly after the onset of a period of rainfall (Blake et al. 2003; Viljoen 1989), sometimes along routes that researchers believe have not been used for many years. These remarkable feats suggest exceptional cognitive mapping skills, reliant on the long-term memories of older individuals who traveled that path sometimes decades earlier. Indeed it has been confirmed that family groups with older matriarchs are better able to survive periods of drought. The older matriarchs lead their families over larger areas during droughts than those with younger matriarchs, again apparently drawing on their accrued knowledge (this time about the locations of permanent, drought-resistant sources of food and water) to better lead and protect their families (Foley, Pettorelli, and Foley 2008).

51. Very importantly, it has recently been shown that long-term memories, and the decision-making mechanisms that rely on this knowledge, are severely disrupted in elephants who have experienced trauma or extreme disruption due to ‘management’ practices initiated by humans. Shannon et al (2013) demonstrated that elephants in South Africa who had experienced trauma decades earlier showed significantly reduced social knowledge. During archaic culling practices, these elephants were forcibly separated from family members and subsequently translocation to new locations (practices which have also accompanied taking elephants into captivity). Two decades later, they still showed impoverished social knowledge and skills and impaired decision-making abilities, compared with an undisturbed population in Kenya. Disrupting elephants’ natural way of life can very negatively impact their knowledge and decision-making abilities.

52. Elephants demonstrate advanced “working memory” skills. Working memory is the ability to temporarily store, recall, manipulate and coordinate items from memory. Working memory directs attention to relevant information, and results in reasoning, planning, and coordination and execution of cognitive processes through use of a “central executive” (Baddeley 2000). Adult human working memory is generally thought to have a capacity of around seven items. In other words, we can keep about seven different items or pieces of information in mind at the same time (Miller 1956).

Bates and colleagues conducted experiments with wild elephants in Amboseli National Park, Kenya, manipulating the location of fresh urine samples from related or unrelated elephants. The elephants' responses to detecting urine from known individuals in surprising locations showed that they are able to continually track the locations of at least 17 family members in relation to themselves, as either absent, present in front of self, or present behind self (Bates et al. 2008a). This remarkable ability to hold in mind and regularly update information about the locations and movements of a large number of family members is best explained by predicting that elephants possess an unusually large working memory capacity, apparently much larger than that of humans.

53. Elephants show sophisticated categorisation of their environment, with skills on a par with those of humans. Bates and co-authors experimentally presented the elephants of Amboseli National Park, Kenya, with garments that gave olfactory or visual information about their human wearers — either Maasai moran (male warriors who traditionally attack and spear elephants on occasion as part of their rite of passage), or Kamba men (who are agriculturalists and traditionally pose little threat to elephants). In the first experiment, the only thing that differed between the cloths was the smell, derived from the ethnicity and/or lifestyle of the wearers. The elephants were significantly more likely to run away when they sniffed cloths worn by Maasai than those worn by Kamba men or no one at all (See video here). In a second experiment, the researchers presented the elephants with two cloths that had not been worn by anyone, but here one was white (a neutral stimulus) and the other was red — the color that is ritually worn by Maasai moran. With access only to these visual cues, the elephants showed significantly greater reaction to red garments than white, often including signs of aggression. Bates et al. concluded that elephants are able to categorize a single species (humans) into sub-classes (i.e. "dangerous" or "low risk") based on either olfactory or visual cues alone (Bates et al. 2007). McComb et al. went on to show that the same elephants can also distinguish between human groups based on just their voices. The elephants reacted differently (and appropriately) depending on whether they heard Maasai or Kamba men speaking, and also whether they heard male or female Maasai (where female Maasai pose no threat as they are not involved in spearing events), and adult Maasai men or young Maasai boys (McComb et al. 2014). Scent, sounds, and visual signs associated specifically with Maasai men are categorized as "dangerous," while neutral signals are attended to but categorized as "low risk."

These sophisticated, multi-modal categorization skills may be exceptional among non-human animals. The above experiments also demonstrate the acute sensitivity that elephants have to the human world, monitoring our behavior and learning to recognize situations where humans might cause them harm.

Summary

54. As will be evident from this Declaration, both African and Asian elephants have been shown to demonstrate highly advanced cognitive abilities and levels of emotional awareness, sharing many key traits with humans. Based on the evidence presented, it seems clear that they should be treated as autonomous beings who direct their behaviour based on complex internal cognitive processes, rather than simply responding reflexively.

55. Scientific knowledge about elephant intelligence has been increasing rapidly in recent decades: what we currently know is only a tiny fraction of what elephant brains are likely to be capable of, with recent advances underlining just how sophisticated elephant behavior and cognition is likely to be.

I declare under penalty of perjury under the law of Colorado that the foregoing is true and correct.

Executed on the 29th (date) of MAR (month), 2023 (year)
at POLEGATE, EAST SUSSEX, U.K.
(city or other location, and state or country)

Karen McComb, Ph.D.

(signature)

Exhibit A

Prof. Karen McComb: Curriculum Vitae

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Falmer, Brighton BN1 9QH

karenm@sussex.ac.uk
+ 44 (0)1273 678610

Job title: Professor of Animal Behaviour & Cognition

SCIENTIFIC CAREER & QUALIFICATIONS

B.Sc., University of Edinburgh (1980-1984)
- 1st Class Honours in Zoology

Ph.D., University of Cambridge (1984-1988)
- Thesis title: Roaring and reproduction in red deer (Cervus elaphus). Supervised by Prof. T.H. Clutton-Brock

Research Fellow, University of Minnesota (1989 – 90)

Research Fellow, Newnham College, University of Cambridge (1990 – 93)

Lecturer / Senior Lecturer, University of Sussex (1993 – 2004)

Reader, University of Sussex (2004 – 2013)

Professor, University of Sussex (2013 – present)

PRIZES & AWARDS

University & early career
- University of Edinburgh Class Medal & Ashworth Prize in Zoology (1984), Class Medal & William Turner Award in Zoology (1983), Moira Lyndsay Stewart Award in Zoology & Jack Roberts Memorial Prize in Botany (1982).
- Prize for best talk by a research student at the Association for the Study of Animal Behaviour Spring Conference (1987) during PhD at Cambridge.

Recent career
- *PNAS* Cozzarelli Prize (2008) for outstanding originality and scientific excellence for article "Cross-modal individual recognition in domestic horses (*Equus caballus*)" with L. Proops and D. Reby. I led this study, taking a major role in conceiving and designing the experiment and writing the paper. http://www.pnas.org/site/misc/cozzarelliprize.shtml

CURRENT RESEARCH FOCUS

My current research is focused on investigating emotional awareness as a basis for social success in a non-human – the domestic horse. Despite the key role that emotional intelligence is believed to play in human social behaviour – we still know little of how individual differences in abilities to identify and respond appropriately to the emotional signals of others determine social integration and success in animal groups. With the strong research team that I have built in this area, I am developing a novel battery of naturalistic tests to quantitatively assess individual differences in emotional abilities and directly relating performance to measures of social success. As well as its scientific importance, our work has considerable significance for animal welfare and will allow us to better understand the emotional capacities and requirements of individual horses within the domestic environment.

SUMMARY OF RESEARCH CAREER

My research career has focused on using naturalistic experiments to provide important new insights into vocal communication and cognitive abilities in a wide range of mammals including African elephants, horses, lions, red deer and domestic cats and dogs. By devising novel experimental designs that tap into abilities animals use in decision-making in their natural environments, I have made significant breakthroughs in a number of key areas including:

Advances in our understanding of social cognition and conceptual knowledge
I previously led major new work on social cognition in domestic horses, including developing novel paradigms to examine cross-modal individual recognition in this species. Our study in *PNAS* (Proops et al., 2009), which was awarded the Cozzarelli Prize, provided the first systematic demonstration of cross-modal individual recognition of conspecifics in a nonhuman. This constituted a major advance, suggesting that rich multi-sensory representations could underlie animals' knowledge of each other. I am now initiating experimental studies on horses that will extend our understanding of animal social cognition to encompass decision-making about one of the most pertinent available indices of another's response - their emotional state (see current research above).

Advances in our understanding of social intelligence in wild mammals
My original work on social cognition in African lions (McComb et al., 2004) was important in showing that the costs of fighting with larger groups could have selected for numerical assessment skills in social species – suggesting a possible biological basis for the evolution of mathematical abilities and stimulating new research on other species based on my experimental paradigm. In a highly cited cover article in *Science* (McComb et al., 2001), I subsequently used playback experiments on African elephants to demonstrate that the possession of enhanced discriminatory abilities by the oldest individual in a group could influence the social knowledge of the group as a whole, providing the first insights into how cognitively advanced social mammals acquire and store information in the wild. I also provided the first empirical evidence that groups benefit from older leaders because of their enhanced ability to make crucial decisions about predatory threat, throwing new light on selection for longevity (McComb et al., 2011). Our most recent *PNAS* paper

(McComb et al., 2014) demonstrated that elephants' knowledge of human predators was extremely precise – revealing unusual abilities to determine ethnicity, gender and age from acoustic cues in human voices.

Advances in our understanding of sexual signals and the origins of language
My original papers on the functions of roaring in red deer provided the basis for a new systematic experimental approach to studying the role of vocal signals in sexual selection in mammals (e.g. McComb, 1987, which was a cover story in *Nature*). I realised early on the importance of applying source-filter theory to the study of mammal vocal communication and subsequently developed this approach with David Reby (originally my postdoc) and Ben Charlton (our PhD student) in a series of influential papers showing that formants, key parameters in human speech, also play a crucial role in the communication of non-human mammals (e.g. Reby & McComb, 2003; Reby et al., 2005). This work is given detailed coverage in the new edition of the flagship behavioural ecology text (Davies, Krebs & West, 2012 *An Introduction to Behavioural Ecology*). I have also used a comparative approach to show that evolutionary increases in the size of non-human primate vocal repertoires have been associated with increases in group size and extent of social bonding, results that have added new perspectives to ongoing debates about language evolution (McComb & Semple, 2005).

As well as its scientific significance, my work has also had important practical consequences for animal conservation and welfare. In particular, by revealing the key role that the oldest individuals play in elephant social groups, we demonstrated how whole populations of cognitively advanced social mammals could be dramatically affected by the removal of just a few key individuals (McComb et al. 2001 & 2011). In addition, our recent work illustrating that social disruption can have very significant long-term effects on elephant cognitive abilities had implications for the conservation and welfare of both wild and captive animals. As a result of the above findings, which are relevant to the conservation and welfare not just of elephants but also of other long lived, large-brained social mammals such as whales and dolphins, I was invited to contribute to the recommendations of the recent Convention on the Conservation of Migratory Species of Wild Animals (CMS).

SUMMARY OF TEACHING

I have always aimed to deliver excellence in Teaching and Learning at both undergraduate and postgraduate (MSc & PhD) levels. At undergraduate level, I currently organise and teach a successful final year module in Animal Vocal Communication and contribute to modules on Psychobiology and Contemporary Issues in Psychology. I also teach on post-graduate modules on Social Neuroscience and Voice Analysis and Re-synthesis.

Student feedback comments on Animal Vocal Communication illustrate the key elements that the students appreciate: "Most interesting course I have taken while at Sussex doing Psychology, very up to date research, great teaching, got to go into lab and discover how real research is conducted", "This was the best course of my degree", "The practical sessions reinforced what was learnt in the lectures, but in a fun way. Karen is very enthusiastic about this course and about the subject area which makes it a much more interesting and enjoyable class", "The workshops encourage critical thinking about experimental design and enable us to apply what we have learned in lectures", "Karen is clearly passionate about her subject and is very willing to discuss topic areas further when asked. It's also really nice to have someone lecturing who contributes so much to the scientific literature covered in the course".

Undergraduates and MSc students have benefitted from conducting their research projects as part of my lab, where they become integrated members of the research group. Several of these projects have contributed to significant publications on which students have been co-authors) and inspired students to go on to further MSc and PhD degrees themselves. My PhD students and postdocs have also performed outstandingly and many have gone on to very successful academic careers.

ADDITIONAL SCHOOL & UNIVERSITY CONTRIBUTION

I have held a number of significant administrative responsibilities within the university, notably:

- Chair of Postgraduate Exam Board 2014 – present
- Deputy Chair of Postgraduate Exam Board 2013
- Co-ordinator of undergraduate research projects for School of Psychology (2005 onwards) and previously for Experimental Psychology (1998/99 onwards)
- Exam Board secretary (2001-2003)
- Member of Academic Appeals Board (2002)
- Internal assessor for Periodic Review of Teaching in Biology (1997)

Mammal Vocal Communication and Cognition Research Group

In addition to fulfilling the specific internal roles above, I have served the university through developing, alongside my colleague David Reby, a highly successful research group in Mammal Vocal Communication and Cognition http://www.lifesci.sussex.ac.uk/cmvcr/Home.html
This has attracted and supported talented postgraduates and independent research fellows. At present, I have 3 PhD students, a postdoc and a full-time research assistant, working on projects ranging from social communication in African lions to emotional awareness in horses; an additional postdoc on culture in elephants is expected next year. Along with David Reby's students and collaborators, this makes for a vibrant research community.

I have also significantly enhanced the University's profile through the success of my external academic and public activities as documented below.

MEMBERSHIPS & NETWORKS

(i) Journals & academic affiliations

- UFAW link representative for University of Sussex 2014 onwards.

- Academic editor for *PLoS ONE* 2007 onwards.
- Editorial board of *Bioacoustics* 1997 onwards.
- Consulting editor for *Animal Behaviour* 1996-1998
- Council member for the Association for the Study of Animal Behaviour 1993-1996. ASAB liaison representative for the Institute of Biology 1995-1997
- Reviewer for *Science, Nature, Current Biology, Proceedings of the Royal Society B, Proceedings for the National Academy of Sciences, PLoS ONE, Animal Behaviour* and other journals
- Appointed reviewer for European Research Council grants 2012

(ii) Conference organisation

- Organised symposium on "Mammal vocal communication: insights into cognitive abilities and the origins of language" at the International Ethological Congress in Budapest, August 2005 (with David Reby)
- Organiser of the Association for the Study of Animal Behaviour Conference on "Evolution of Mind" held in London in December 1999 (with Stuart Semple), attended by more than 200 people

(iii) Recent invited academic lectures

- Invited speaker, Cetacean Culture Workshop, organised jointly by the Convention on the Conservation of Migratory Species of Wild Animals (CMS), and Whale and Dolphin Conservation (WDC) (April 2014)
- Plenary talk at the Association for the Study of Animal Behaviour meeting on "Cognition in the Wild" (December 2012)
- Invited speaker, International workshop on communication and social cognition, Institute of Evolutionary Biology and Environmental Studies, University of Zurich (March 2011)
- Invited speaker, International workshop on referential communication, Wissenschaftskolleg zu Berlin, Institute for Advanced Study, Berlin, (June 2010)
- Plenary speaker, International Society for Applied Ethology, Nordic meeting, Kuopia, Finland (January 2010)
- Invited speaker, International Ethological Congress, Rennes (August 2009)
- Invited speaker, Ecology and Evolutionary Biology, University of Princeton (April 2009)
- Invited speaker, Novartis day at the Royal Society Discussion meeting on Social Intelligence in London (May 2006)
- Invited speaker (and organiser), International Ethological Congress Symposium on "Mammal vocal communication: insights into cognitive abilities and the origins of language", Budapest (August, 2005)
- Keynote speaker, British Association for the Advancement of Science, Symposium on "Where do numbers come from", Salford (September 2003)
- Plenary speaker, Association for the Study of Animal Behaviour conference on Information Gathering (December 2002)
- Invited speaker, symposium on Alternative Approaches to Studying Social Cognition, International Ethological Congress, Tubingen (August 2001)

- Invited participant, International workshop on animal signalling, TalkBank, University of Philadelphia (May 2000)
- Plenary speaker, Association for the Study of Animal Behaviour Conference on Communication and Social Behaviour, Lisbon (July 1999)

BUSINESS, ENTERPRISE & THE COMMUNITY

(i) Lectures to the general public / industry

- Invited panel member/speaker Festival of Sound, organised by Magdalene College, University of Cambridge (December 2014)
- Invited panel member/speaker in Gulbenkian Foundation Supersonix Festival, organised on behalf of the Exhibition Road Cultural Group to focus on the art and science of sound & music-making (June 2012)
- Public lecture on 'Animal Communication' in Learning About Animals series in London (May 2007)
- Lecture to the Pet Care Trust Conference in Edinburgh (November 2006)
- Press conference at London Zoo in April 2001 for launch of my *Science* paper, organised by the American Academy for the Advancement of Science
- Lecture at the British Library National Sound Archive (December 2000)
- Royal Geographical Society lecture (jointly with Cynthia Moss) attended by more than 600 members of the public (November 1996)

(ii) Media involvement & TV documentaries

- There has been considerable media coverage of my work over the years, with appearances on British, American, Australian, Canadian and German TV and radio stations (including BBC TV news, Discovery Channel, Radio 4 Today programme and BBC Science in Action) and articles in major British, European and American newspapers (eg, The Guardian, Times, Liberation, National Geographic magazine, New Scientist). *Science* organised a press conference in London in April 2001 for the launch of my paper, which was their cover story – and later cover stories in *Biology Letters* (2006*), PNAS* (2009) *and Proceedings of the Royal Society B* (2011) also generated widespread media attention, as did my *Current Biology* paper in 2009 which featured as the most popular story on the BBC web site, as well as the top science and environment story. Two of my most recent papers – in *PNAS* (2014) and *Frontiers in Zoology* (2013) – received unusually extensive world-wide coverage, as did a recent *Current Biology* (2014) paper with my PhD student. This included interviews on the Radio 4 Today Programme, ITV News at Ten, BBC World TV News, Newsround, BBC World Service, and Science in Action, as well as being covered in BBC Breakfast, BBC Radio 2, 3 & 4 news reports, Time Magazine, The Economist, *Nature*, *Science*, National Geographic and by more than 200 other news outlets here and abroad.
- I have done regular consultancies for the BBC and other companies making wildlife documentaries on animal communication. Most recently, I was scientific consultant for the popular two-part BBC documentary "Talk to the Animals" (2014). I have also provided sound recordings for wildlife documentaries by the BBC and Windfall films and have a sound recording

credit (with Martyn Colbeck) on the BBC's "Echo of the elephants: the next generation" (1995).

- My elephant research was covered in BBC's "Inside the Animal Mind" in February 2014 and my horse research was filmed for the BBC series "Talk to the Animals" which aired in July 2014. Both programmes were given prime-time slots and were very well received by the public.

(iii) Educational Displays for Museums

- I provided photographic material to The Field Museum, Chicago for an exhibition on Mammoths and Mastodons, Titans of the Ice Age. This exhibition is currently on tour round the world.

(iv) Contribution to Primary Education

- I was invited to write an autobiographical outline for "STEM stories" an NSF project designed to encourage girls in the U.S.A. to pursue careers in Science by introducing them to the senior scientists in particular fields (http://www.stemstories.org/).

(v) Contribution to major textbooks and popular books

- My work has featured in John Alcock's and Lee Dugatkin's major textbooks on Animal Behaviour and currently receives detailed coverage in the new editions of the Krebs & Davies *An Introduction to Behavioural Ecology*, Bradbury & Vehrencamp's *Principles of Animal Communication* and Shettleworth's *Cognition, Evolution and Behavior*. It has also been reported in popular books including Brian Butterworth's *The Mathematical Brain* and there is a chapter on my research in the best-selling book: *Animal Wise* by Virginia Morell.

RESEARCH GRANTS

I have received consistent funding for my research over the years, most notably from The Leverhulme Trust and BBSRC:

Leverhulme Trust Research Grant (PI): £285,389 (Jan 2014) *Emotional awareness as a basis for social success in a non-human: the domestic horse*. This project is currently in progress and employs 2 full-time research staff – Dr Leanne Proops (PDRF) and Ms Kate Grounds (RA).

Leverhulme Trust Research Grant (PI): £174,892 (Mar 2009) *Age and experience as determinants of acquired knowledge in a non-human mammal.*

National Geographic grant (PI): $27,000 plus PDRA salaried by Durban (Jan 2006) *Elephant matriarchs and conservation.*

Waltham Foundation grant (PI): £9,632 (July 2002)
The Function of Purring in Cats: Seismic and Airborne Communication.

EU Marie Curie grant (Co-PI/Supervisor of PDRF): 114,072 Euro (Oct 2000)
Origin, Structure & Function of Sender-related Acoustical Features in Sexually Selected Mammal Vocalisations.

BBSRC research grant (PI): £166,092 (Mar 1996)
Communication Networks, Social Organisation and Reproductive Success.

Tusk Trust grants (PI): 3 x £1,500 (awarded 1994, 1995 & 1998)
Acoustic Communications in Elephants.

Nuffield Foundation grant (PI): £3,960 (Nov 1994)
Acoustic Communication in Social Mammals.

Royal Society Research grant (PI): £9,253 (Mar 1994)
Infrasonic Signalling in Elephants.

NERC small project grant (PI): £14, 832 (Oct 1993)
Acoustic Communication & the Evolution of Mammal Social Systems.

In addition I have had a number of Royal Society Conference grants, most recently in 2005 & 2009.

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Exhibit B

Exhibit B

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EXHIBIT 4

Declaration of Cynthia J. Moss

I, Cynthia J. Moss, declare as follows:

Introduction and Qualifications

1. My name is Cynthia J. Moss.

2. I am over the age of 18 and understand the obligations of an oath.

3. I graduated with a Bachelor of Arts in Philosophy from Smith College in 1962, and received an honorary Doctorate of Science from Smith College in 2002 and an honorary Doctorate of Social Science from Yale University in 2019. I reside and work in Amboseli National Park, Kenya.

4. I submit this Declaration in support of the Nonhuman Rights Project, Inc.'s petition for a writ of habeas corpus regarding the captive elephants at the Cheyenne Mountain Zoo. I am a nonparty to this proceeding.

5. I have studied and worked with elephants in Africa for the past 50 years. I am currently the Director of the Amboseli Elephant Research Project and have been since 1972, and I am currently the Director of the Amboseli Trust for Elephants and have been since 2001. Prior to founding the Amboseli Elephant Research Project, I worked: (1) as the editor for the African Wildlife Foundation's Wildlife News from 1971 to 1985; (2) part-time as a freelance journalist, mainly for Time and Life magazines, from 1970 to 1971; (3) as a research assistant on various projects with Drs. A.M. and S. Harthoorn, Dr. V. Finch, and Dr. J.B. Sale, consecutively from 1969-1970; (4) a research assistant to Dr. I. Douglas-Hamilton full time in 1968 and part-time in 1969, 1970, and 1971; (5) a reporter/researcher for Newsweek Magazine in New York from 1964 to 1968.

6. As Director of the Amboseli Elephant Research Project, and also as the director of the Amboseli Trust for Elephants, I have set up the world's longest-running research project on wild elephants in the Amboseli National Park, Kenya. My research focus incorporates the distribution, demography, population dynamics, social organization and behavior of the Amboseli elephants. My current work includes directing and supervising research and monitoring in the Amboseli National Park; training elephant researchers from African elephant

range states; outreach to the local Maasai community; carrying out surveys and training courses at other elephant study sites in Africa; disseminating scientific results; advocating for elephant welfare; promoting public awareness by writing popular articles and books and by making films about elephants; and fund raising for and administering the Amboseli Elephant Research Project.

7. Over the course of my career, I have received awards from international nongovernmental, media, academic, research, zoological, and professional organizations, including: (1) the Outstanding Achievement Award from the Jackson Hole Wildlife Film Festival in 2015; (2) the John D. & Catherine T. MacArthur Foundation Fellowship (2002-2007); (3) the Conservation Award from the Cincinnati Zoo in 2005; (4) the Guardian Award from In Defense of Animals in 2004; (5) the Distinguished Conservation Fellow Award from the Los Angeles Zoo in 2002; (6) my Honorary Doctorate Degree from Smith College in 2002; (7) an Award from Performing Animal Welfare Society in 2002; (8) elected Fellow of the Society of Women Geographers in 2001; (9) Advisor to the International Fund for Animal Welfare, ongoing since 2001; (10) sabbatical Fellowships at the National Center for Ecological Analysis & Synthesis, University of California, Santa Barbara (1999, 2000, 2001); (11) the Centennial Conservation Award from the Woodland Park Zoo in 1999; (12) the Conservation Excellence Award from the Oakland Zoo in 1999; (13) my book Little Big Ears received an award from the John Burroughs Foundation and the American Museum of Natural History in 1998; (14) elected Fellow of the Royal Geographical Society in 1997; (15) my film "Echo of the Elephants" received awards at Jackson Hole Wildlife Film Festival and the Italian Film Festival in 1993; (16) the Smith College Medal for alumnae achievement in 1985; (and 17) nomination of my book "Portraits in the Wild: Behavior Studies of East African Mammals" (1975, Houghton Mifflin, Boston) for the American Book Award for best science paperback of the year in 1982.

8. I am affiliated with a number of professional organizations, including: (1) the Author's Guild; (2) the Royal Geographic Society (elected Fellow); (3) the Society of Women Geographers (elected Fellow); (4) the Explorer's Club (Fellow); (5) the East African Natural History Society; (6) the East African Wild Life Society; (7) the Kenya Society for the

Protection & Care of Animals; and (8) PEN America. I was a member of the IUCN/SSC African Specialist Group from 1988-1996. Throughout my career, I have continued to lecture on elephant social organization and behavior to university students, wildlife club members, and specialist groups in Kenya, India, the US, and the United Kingdom. I have also served as a Consultant to conservation groups, animal welfare organizations, zoos, and others on elephant-related issues throughout my career.

9. During the course of my research career, I have been awarded extramural research grants from a number of institutions and groups including: (1) the African Wildlife Foundation in 1975; (2) the Midgard Foundation from 1978-1979; (3) the New York Zoological Society as a Research Fellow from 1979-1984; (4) the Disney Conservation Foundation from 1996-2006; (5) the Delano Foundation from 1996-1999; (6) the International Fund for Animal Welfare (IFAW), ongoing; (7) Born Free Foundation, ongoing; (8) Detroit Zoological Society, ongoing; (9) East Bay Zoological Society, ongoing; (10) Detroit Zoological Society, ongoing; (11) Rettet die Elefanen, ongoing; (12) Fairplay Foundation, ongoing; (13) Rogers Family Foundation, ongoing; (14) Charles Engelhard Foundation, ongoing; and (15) Maue Kay Foundation, ongoing.

10. I have written six books concerning my work with elephants, including: (1) Portraits in the Wild: Behavior Studies of East African Mammals. (1975, Houghton Mifflin, Boston); (2) Portraits in the Wild: Behavior Studies of East African Mammals (Second Edition – Revised, 1982, University of Chicago Press, Chicago); (3) Elephant Memories: Thirteen Years in the Life of an Elephant Family. (1988, William Morrow, New York, also in Swedish, Finnish, Dutch, Italian, French & Spanish editions); (4) Die Elefanten Vom Kilmandscharo. (1990, Rasch und Rohring, Hamburg, German edition of Elephant Memories, with an additional chapter covering 1987-90); (5) Echo of the Elephants. (1992, BBC Books, London, also in U.S., German and Japanese editions); (6) Little Big Ears: The Story of Ely. (1997, Simon & Schuster, New York).

11. I have served as co-editor for two books regarding my work with elephants: (1) Elephant Woman (with Laurence Pringle, 1997, Atheneum, New York), and (2) The Amboseli

Elephants: A Long-Term Perspective on a Long-Lived Mammal (co-edited with H.J. Croze & P.C. Lee), 2011, University of Chicago Press, Chicago.)

12. Over the course of my career, I have also contributed chapters concerning elephant cognition and welfare to five additional books: (1) The World Book Encyclopedia (1991, Chicago: World Book); (2) Elephants: Majestic creatures of the wild (1992, editor - J. Shoshani, Weldon Owen, Sydney); (3) The Smile of a Dolphin: Remarkable Accounts of Animal Emotions (2000, editor - M. Bekoff, Discovery Books, New York); (4) Never Forgetting: Elephants and Ethics (2008, editors - C. Wemmer and K. Christen, Johns Hopkins University Press); and (5) An Elephant in the Room: the Science and Well-being of Elephants in Captivity (2009, editor - D. Forthman, Tufts University Press).

13. I have published 65 peer-reviewed scientific articles on the social structure, vocalization and communication (both short and long-range), cognition, mating behavior, maternal behavior, techniques for aging, determining diet and habitat use, mourning behavior, and elephant identification via sight and odor of human tribal groups. These articles have been published in many of the world's premier scientific journals and books, including: Nature, Science, PLoS One, Animal Behaviour, Behaviour, Journal of Wildlife Management, Behavioral Ecology and Sociobiology, Pachyderm, Journal of Zoology, Mammalian Social Learning, Molecular Ecology Notes, Biology Letters, Molecular Ecology, Current Biology, Journal of Consciousness Studies, Animal Welfare, and the Journal of Wildlife Diseases. My scientific work has also been published in: Symposium of the Zoological Society of London, Proceedings 2nd International NCRR Conference, A Research Update on Elephants and Rhinos: Proceedings of the International Elephant and Rhino Research Symposium, and Proceedings of the Royal Society B. Specific topics of these publications include: musth in the African elephant, oestrus behavior and female choice in the African elephant, age estimation and population age structure of elephants from footprint dimensions, early maternal investment in male and female African elephant calves, social context of some very low frequency calls of African elephants, isotopic tracking of change in diet and habitat use in African elephants, statural growth in known-age African elephants, social context for learning and behavioural development among wild African elephants, matriarchs as repositories of social knowledge in

African elephants, characterization of tetranucleotide microsatellite loci in the African Savannah Elephant, long-distance communication of cues to social identity in African elephants, locus size predicts the rate of allelic dropout in two large-scale noninvasive genotyping projects, early disruption of attachment can affect the physiology, behavior, and culture of animals and humans over generations, genetic relatedness predicts fission and fusion of social groups in wild African elephants, elephants show high levels of interest in the skulls and ivory of their own species, elephants classify human ethnic groups by odour and garment colour, can elephants show empathy, and fecundity and population viability in female zoo elephants.

14. In addition to my scientific publications, I have also published 30 articles in more general audience publications, including: Smithsonian, New York Times Book Review, BBC Wildlife, New Scientist, the Sunday Times Magazine, Australian Women's Weekly, Wildlife News, Ms., Swara, International Wildlife, Wildlife, Animal Kingdom, Nature's Best, ASPCA's Animal Watch, Disney's Animal Kingdom, and Geospatial Solutions.

15. In addition to my academic and general audience articles, I have also written film scripts and provided scientific consulting for several films, including: (1) "Echo of the Elephants" (1990-1992, BBC Natural History Unit, received awards at Jackson Hole Wildlife Film Festival and Italian Film Festival); (2) "Echo of the Elephants: The Next Generation" (1992-1995, BBC Natural History Unit); (3) "Africa's Forgotten Elephants" (1996-1997, Scorer Associates for BBC); (4) "Echo of the Elephants: The Last Chapter?" (2002-2005, BBC Natural History Unit); (5) "Echo and the Elephants of Amboseli (2007-2008, Animal Planet, 13-part series); (6) "Echo: An Elephant to Remember" (2009-2010, BBC Natural History Unit); and (7) "An Apology to Elephants" (2013, HBO).

16. My Curriculum Vitae fully sets forth my educational background and experience and is attached as **Exhibit A**.

Basis for opinions

17. The opinions I state in this Declaration are based on my professional knowledge, education, training, and years of experience observing and studying elephants, as well as my

knowledge of peer-reviewed literature about elephant behaviour and intelligence published in the world's most respected journals, periodicals and books that are generally accepted as authoritative in the field, and many of which were written by myself or colleagues whom I have known for several years and with whose research and field work I am personally familiar. A full reference list of peer-reviewed literature cited herein is attached as **Exhibit B**.

Opinions

Premise

18. Autonomy in humans is defined as self-determined behaviour that is based on freedom of choice. As a psychological concept it implies that the individual is directing their behaviour based on some non-observable, internal cognitive process, rather than simply responding reflexively. Although we cannot directly observe these internal processes in other people, we can explore and investigate them by observing, recording and analysing behaviour. For non-human animals, observing similar behaviour and recording evidence of shared cognitive capacities should, parsimoniously, lead to similar conclusions about autonomy.

19. I shall indicate which species, African (*Loxodonta Africana*) or Asian (*Elephus maximus*), specific observations relate to. If the general term 'elephants' is used with no specific delineation, it can be assumed the comment relates to both species.

Brain And Development

20. Elephants are large-brained, with the biggest absolute brain size of any land animal (Cozzi et al 2001; Shoshani et al 2006). Even relative to their body sizes, elephant brains are large. Encephalization quotients (EQ) are a standardised measure of brain size relative to body size, and illustrate by how much a species' brain size deviates from that expected for its body size. An EQ of one means the brain is exactly the size expected for that body, and values greater than one indicate a larger brain than expected (Jerison 1973). Elephants have an EQ of between 1.3 and 2.3 (varying between sex and African and Asian species). This means an elephant's brain can be up to two and a half times larger than is expected for an animal of its size; this EQ is similar to that of the great apes, with whom elephants have not shared a common ancestor

for almost 100 million years (Eisenberg 1981, Jerison 1973). Given how metabolically costly brain tissue is, the large brains of elephants must confer significant advantages; otherwise their size would be reduced. Presumably this advantage is allowing greater intelligence and behavioural flexibility (Bates et al 2008a).

21. Generally, mammals are born with brains weighing up to 90% of the adult weight. This figure drops to about 50% for chimpanzees. Human baby brains weigh only about 27% of the adult brain weight (Dekaban & Sadowsky 1978). This long period of brain development over many years (termed 'developmental delay') is a key feature of human brain evolution and is thought to play a role in the emergence of our complex cognitive abilities, such as self-awareness, creativity, forward planning, decision making and social interaction (Bjorkland 1997). Delayed development provides a longer period in which the brain may be shaped by experience and learning (Fuster 2002). Elephant brains at birth weigh only about 35% of their adult weight (Eltringham 1982), and elephants show a similarly protracted period of growth, development and learning (Lee 1986). This similar developmental delay in the elephant brain is therefore likely associated with the emergence of similarly complex cognitive abilities.

22. Despite nearly 100 million years of separate evolution (Hedges 2001), elephants share certain characteristics of our large brains, namely deep and complex folding of the cerebral cortex, large parietal and temporal lobes, and a large cerebellum (Cozzi et al 2001). The temporal and parietal lobes of the cerebral cortex manage communication, perception, and recognition and comprehension of physical actions (Kolb and Whishaw 2008), while the cerebellum is involved in planning, empathy, and predicting and understanding the actions of others (Barton 2012). Thus, the physical similarities between human and elephant brains occur in areas that are relevant to capacities necessary for autonomy and self-awareness.

23. Elephant brains hold nearly as many cortical neurons as do human brains, and a much greater number than chimpanzees or bottlenose dolphins (humans: 1.15×10^{10}; elephants: 1.1×10^{10}, chimpanzees: 6.2×10^{9}; dolphins: 5.8×10^{9}, Roth & Dicke 2005). Elephants' pyramidal neurons (a class of neuron that is found in the cerebral cortex, particularly the pre-frontal cortex - the brain area that controls executive functions) are larger than in humans and most other species (Cozzi et al 2001). The degree of complexity of pyramidal neurons is linked

to cognitive ability, with more (and more complex) connections between pyramidal neurons being associated with increased cognitive capabilities (Elston 2003). Elephant pyramidal neurons have a large dendritic tree, i.e. a large number of connections with other neurons for receiving and sending signals (Cozzi et al 2001).

24. Elephants, like humans, great apes and some cetaceans, possess *von Economo neurons*, or spindle cells – the so-called 'air-traffic controllers for emotions' – in the anterior cingulate, fronto-insular, and dorsolateral prefrontal cortex areas of the brain (Hakeem et al 2009). In humans, these cortical areas are involved - among other things - in the processing of complex social information, emotional learning and empathy, planning and decision-making, and self-awareness and self-control (Allman et al 2001; Allman et al 2002; Allman et al 2011). The shared presence of spindle cells in the same brain locations in elephants and humans strongly implies these higher-order brain functions – the building blocks of autonomous, self-determined behaviour – are common between these species (Butti et al 2009; Hakeem et al 2009).

25. As described below, evidence demonstrates that along with these common brain and life-history characteristics, elephants share many behavioural and intellectual capacities with humans, including: self-awareness, empathy, awareness of death, intentional communication, learning, memory, and categorisation abilities. Many of these capacities have previously been considered – erroneously – to be uniquely human, and each is fundamental to and characteristic of autonomy and self-determination.

Awareness Of Self And Others

26. Asian elephants have been shown to exhibit Mirror Self Recognition (MSR) using Gallup's classic 'mark test' (Gallup 1970; Plotnik et al 2006). MSR is the ability to recognise a reflection in the mirror as oneself, and the mark test involves surreptitiously placing a coloured mark on an individual's forehead that it could not see or be aware of without the aid of a mirror. If the individual uses the mirror to investigate the mark, it is logical to assume that the individual recognises the reflection as itself. Almost all animals tested on this task fail: they do not recognise the image in the mirror as being a reflection of themselves. Indeed, the only

other mammals beyond humans who have successfully passed the mark test and exhibit MSR are the great apes (chimpanzees, bonobos, gorillas and orangutans) and bottlenose dolphins (Parker and Mitchell 1994, Reiss and Marino 2001). MSR is significant because it is considered to be the key identifier of self-awareness. Self-awareness is intimately related to autobiographical memory in humans (Prebble et al 2013), and is central to autonomy and being able to direct one's own behaviour to achieve personal goals and desires. By demonstrating that they can recognize themselves in a mirror, elephants must be holding a mental representation of themselves from another perspective, and thus be aware that they are a separate entity from others (Bates and Byrne 2014).

27. Related to possessing a sense of self is an understanding of death. Observing reactions to dead family or group members suggests an awareness of death in only two animal genera beyond humans; chimpanzees and elephants (Anderson et al 2010, Douglas-Hamilton et al 2006). Having a mental representation of the self – a pre-requisite for mirror-self recognition – probably also confers an ability to comprehend death. Wild African elephants have been shown experimentally to be more interested in the bones of dead elephants than the bones of other animals (McComb et al 2006), and they have frequently been observed using their tusks, trunk or feet to attempt to lift sick, dying or dead individuals (Poole & Granli 2011). Although they do not give up trying to lift or elicit movement from the body immediately, elephants appear to realise that once dead, the carcass cannot be helped anymore, and instead they engage in more 'mournful' behaviour, such as standing guard over the bodies, and apparently protecting it from the approaches of predators (Poole & Granli 2011They also have been observed to cover the bodies of dead elephants with dirt and vegetation (Moss 1992; Poole 1996). In the particular case of mothers who lose a calf, although they may remain with the calf's body for an extended period, they do not behave towards the body as they would a live calf. Indeed, the general demeanour of elephants who are attending to a dead elephant is one of grief and compassion, with slow movements and few vocalisations (Poole, pers. comm.). These behaviours are akin to human responses to the death of a close relative or friend, and illustrate that elephants possess some understanding of life and the permanence of death.

28. The capacity for mentally representing the self as an individual entity has been linked to general empathic abilities (Gallup 1982), where empathy can be defined as identifying with and understanding another's experiences or feelings by imagining what it would be like to be in their situation. Empathy is an important component of human consciousness and autonomy, and is a cornerstone of normal social interaction. It goes beyond merely reading the emotional expressions of others. It requires modelling of the emotional states and desired goals that influence others' behaviour both in the past and future, and using this information to plan one's own actions; empathy is only possible if one can adopt or imagine another's perspective, and attribute emotions to that other individual (Bates et al 2008b). Empathy is, therefore, a component of and reliant on 'Theory of Mind' – the ability to mentally represent and think about the knowledge, beliefs and emotional states of others, whilst recognising that these can be distinct from your own knowledge, beliefs and emotions (Premack and Woodruff (1978)/ Frith and Frith 2005).

29. Elephants clearly and frequently display empathy in the form of protection, comfort and consolation, as well as by actively helping those who are in difficulty, such as assisting injured individuals to stand and walk, or helping calves out of rivers or ditches with steep banks (Bates et al 2008b, Lee 1987). Elephants have even been observed feeding those who are not able to use their own trunks to eat (Poole and Granli 2011).

30. In an analysis of behavioural data collected from wild African elephants over a 43-year continuous field study, we concluded that as well as possessing their own intentions, elephants can diagnose animacy and goal directedness in others, understand the physical competence and emotional state of others, and attribute goals and mental states (intentions) to others (Bates et al 2008b), as evidenced in the examples below:

> *'IB family is crossing river. Infant struggles to climb out of bank after its mother. An adult female [not the mother] is standing next to calf and moves closer as the infant struggles. Female does not push calf out with its trunk, but digs her tusks into the mud behind the calf's front right leg which acts to provide some anchorage for the calf, who then scrambles up and out and rejoins mother.'*

'At 11.10ish Ella gives a 'lets go' rumble as she moves further down the swamp . . . At 11.19 Ella goes into the swamp. The entire group is in the swamp except Elspeth and her calf [<1 year] and Eudora [Elspeth's mother]. At 11.25 Eudora appears to 'lead' Elspeth and the calf to a good place to enter the swamp — the only place where there is no mud.'

Examples such as these demonstrate that the acting elephant (the adult female in the first example, and Eudora in the second) was able to understand the intentions of the other (the calf in the first case, and Elspeth in the second) – i.e. to either climb out of or into the water – and they could adjust their own behaviour in order to counteract the problem being faced by the other. Whilst humans may act in this helpful manner on a daily basis, such interactions have been recorded for very few non-human animals (Bates et al 2008b).

31. Experimental evidence from captive African elephants further demonstrates that elephants attribute intentions to others, as they follow and understand human pointing gestures - the only animal so far shown to do so spontaneously. The elephants understood that the human experimenter was pointing in order to communicate information to them about the location of a hidden object (Smet and Byrne 2013). Attributing intentions and understanding another's reference point is central to empathy and theory of mind.

32. Evidence of 'natural pedagogy' is rare among non-human animals, with only a few potential examples of true teaching (whereby the teacher takes into account the knowledge states of the learner as they pass on relevant information) recorded anecdotally in chimpanzees (Boesch 1991) and killer whales (Guinet and Bouvier 1995)[1]. Teaching is therefore still widely considered to be unique to humans (Csibra and Gergely 2009). Our analysis of simulated oestrus behaviours in African elephants – whereby a non-cycling, sexually experienced older female will simulate the visual signals of being sexually receptive, even though she is not ready to mate or breed again – shows that these knowledgeable females adopt false oestrus behaviours in order to demonstrate to naïve young females how to attract and respond

[1] Functional teaching has been experimentally demonstrated in various animal species including ants, babblers, meerkats, cheetahs and some primates, but this is not the same as deliberate pedagogy, as it does not rely on representing the knowledge states of the learners.

appropriately to suitable males. The experienced females may be taking the youngsters lack of knowledge into account and actively showing them what to do; a possible example of true teaching as it is defined in humans. Whilst this possibility requires further investigation, this evidence, coupled with the data showing that they understand the ostensive cues in human pointing, suggests that elephants do share some executive skills with humans, namely understanding the intentions and knowledge states (minds) of others.

33. Further related to empathy, coalitions and cooperation have been documented in wild African elephants, particularly to defend family members or close allies from (potential) attacks by outsiders, such as when a family group tries to 'kidnap' a calf from an unrelated family (Lee 1987, Moss and Poole 1983). These behaviours are based on one elephant understanding the emotions and goals of the coalition partner (Bates et al 2008b).

34. Cooperation is also evident in experimental tests with captive Asian elephants, whereby elephants demonstrated they can work together in pairs to obtain a reward, and understood that it was pointless to attempt the task if their partner was not present or could not access the equipment (Plotnik et al 2011). Problem-solving and working together to achieve a collectively desired outcome involve mentally representing both a goal and the sequence of behaviours that is required to achieve that goal; it is based on (at the very least) short-term action planning.

35. Wild elephants have frequently been observed engaging in cooperative problem solving, for example when retrieving calves that have been kidnapped by other groups, or when helping calves out of steep, muddy river banks (Bates et al 2008b, Moss 1992) These behaviours demonstrate the purposeful and well-coordinated social system of elephants, and show that elephants can hold particular aims in mind and work together to achieve those goals. Such intentional, goal-directed action forms the foundation of independent agency, self-determination, and autonomy.

36. Elephants also show innovative problem solving in experimental tests of insight (Foerder et al 2011), where insight can be defined as the 'a-ha' moment when a solution to a problem 'suddenly' becomes clear. (In cognitive psychology terms, insight is the ability to inspect and manipulate a mental representation of something, even when you can't physically

perceive or touch the something at the time. Or more simply, insight is thinking and using only thoughts to solve problems (Byrne 2016). A juvenile male Asian elephant demonstrated just such a spontaneous action by moving a plastic cube and standing on it to obtain previously out-of-reach food. After solving this problem once, he showed flexibility and generalization of the technique to other, similar problems by using the same cube in different situations, or different objects in place of the cube when it was not available. This experiment again demonstrates that elephants can choose the appropriate action and incorporate it into a sequence of behaviour in order to achieve a goal, which they kept in mind throughout the process.

37. Further experiments also demonstrate Asian elephants ability to understand goal-directed behaviour. When presented with food that was out of reach, but with some bits resting on a tray that could be pulled within reach, the elephants learned to pull only those trays that were baited with food (Irie-Sugimoto et al 2008). Success in this kind of 'means-end' task is a demonstration of causal knowledge, which requires understanding not just that two events are associated with each other but also that there is some mediating force that connects and affects the two which may be used to predict and control events. Moreover, understanding causation and inferring object relations may be related to understanding psychological causation, i.e., the appreciation that others are animate beings that generate their own behaviour and have mental states (e.g., intentions).

Communication and social learning

38. Speech is a voluntary behaviour in humans, whereby a person can choose whether to utter words and thus communicate with another. Therefore speech and language are reflections of autonomous thinking and intentional behaviour. Elephants also use their vocalisations to share knowledge and information with others, apparently intentionally (Poole 2011). Male elephants primarily communicate about their sexual status, rank and identity, whereas females and dependents call to emphasise and reinforce their social units. Call types can generally be separated into laryngeal calls (such as rumbles) or trunk calls (such as trumpets), with different calls in each category being used in different contexts (Poole 2011; Poole and Granli 2004; Soltis et al 2005; Wood et al 2005). Field experiments have shown that

African elephants distinguish between different call types (for example, contact calls – rumbles that travel long distances to maintain associations between elephants that could be several kilometres apart, or oestrus rumbles – that occur after a female has copulated) and these different call types elicit different responses in the listeners. Elephant vocalisations are not simply reflexive, they have distinct meanings to listeners and they are truly communicative, similar to the volitional use of language in humans (Leighty et al 2008; Poole 1999; Poole 2011).

39. Furthermore, elephants have been shown to vocally imitate the sounds they hear around them, from the engines of passing trucks to the commands of human zookeepers (Poole et al 2005, Stoeger et al 2012). Imitating another's behaviour is demonstrative of a sense of self, as it is necessary to understand how one's own behaviour relates to the behaviour of others.

40. Elephants display a wide variety of gestures, signals and postures, used to communicate information to the audience (Poole and Granli gestures chapter 2011). Such signals are adopted in many different contexts, such as aggressive, sexual or socially integrative situations, and each signal is well defined and results in predictable responses from the audience. That is, each signal or gesture has a specific meaning both to the actor and recipient. Elephants' use of gestures demonstrates that they communicate intentionally and purposefully to share information with others and/or alter the others' behaviour to fit their own will.

41. Experimental evidence demonstrates that African elephants recognize the importance of visual attentiveness of the intended recipient (in this case, human experimenters) of gestural communication (Smet & Byrne 2014), further supporting the suggestion that elephants' gestural communication is intentional and purposeful. Furthermore, the ability to understand the visual attentiveness and perspective of others is crucial for empathy and mental-state understanding.

Memory And Categorisation

42. Elephants have both extensive and long-lasting memories, just as the folk stories and adages encourage us to believe. McComb et al. (2000), using experimental playback of long-distance contact calls in Amboseli National Park, Kenya, showed that African elephants

remember and recognize the voices of at least 100 other elephants. Each adult female elephant tested was familiar with the contact-call vocalizations of individuals from an average of 14 families in the population. When the calls were from a familiar family— that is, one that had previously been shown to have a high association index with the test group—the test elephants contact-called in response and approached the location of the loudspeaker. When a test group heard unfamiliar contact calls (from groups with a low association index with the test group), they bunched together and retreated from the area.

43. McComb et al (2001) went on to show that this social knowledge accrues with age, with older females having the best knowledge of the contact calls of other family groups. McComb et al (2011) also showed that older females are better leaders, with more appropriate decision-making in response to potential threats (in this case, in the form of hearing lion roars). Younger matriarchs under-reacted to hearing roars from male lions, potential predators of elephant calves. Sensitivity to hearing this sound increased with increasing matriarch age, with the oldest, most experienced females showing the strongest response to this danger. These experimental studies show that elephants continue to learn and remember information about their environments throughout their lives, and this accrual of knowledge allows them to make better decisions and better lead their families as they grow older.

44. Further demonstration of elephants' long-term memory comes from data on their movement patterns. African elephants are known to move over very large distances in their search for food and water. Leggett (2006) used GPS collars to track the movements of elephants living in the Namib Desert. He recorded one group traveling over 600 km in five months, and Viljoen (1989) showed that elephants in the same region visited water holes approximately every four days, even though some of them were more than 60km apart. Elephants inhabiting the deserts of both Namibia and Mali have been described traveling hundreds of kilometers to arrive at remote water sources shortly after the onset of a period of rainfall (Blake et al. 2003; Viljoen 1989), sometimes along routes that researchers believe have not been used for many years. These remarkable feats suggest exceptional cognitive mapping skills, reliant on the long-term memories of older individuals who traveled that path sometimes decades earlier. Indeed it has been confirmed that family groups with older matriarchs are better able to survive periods

of drought. The older matriarchs lead their families over larger areas during droughts than those with younger matriarchs, again apparently drawing on their accrued knowledge (this time about the locations of permanent, drought-resistant sources of food and water) to better lead and protect their families (Foley, Pettorelli, and Foley 2008).

45. It has recently been shown that long-term memories, and the decision-making mechanisms that rely on this knowledge, are severely disrupted in elephants who have experienced trauma or extreme disruption due to 'management' practices initiated by humans. Shannon et al (2013) demonstrated that elephants in South Africa who had experienced trauma decades earlier showed significantly reduced social knowledge. During archaic culling practices, these elephants were forcibly separated from family members and subsequently translocation to new locations. Two decades later, they still showed impoverished social knowledge and skills and impaired decision-making abilities, compared with an undisturbed population in Kenya. Disrupting elephants' natural way of life can negatively impact their knowledge and decision-making abilities.

46. Elephants demonstrate advanced 'working memory' skills. Working memory is the ability to temporarily store, recall, manipulate and coordinate items from memory. Working memory directs attention to relevant information, and results in reasoning, planning, and coordination and execution of cognitive processes through use of a 'central executive' (Baddeley 2000). Adult human working memory is generally thought to have a capacity of around seven items. In other words, we can keep about seven different items or pieces of information in mind at the same time (Miller 1956). We conducted experiments with wild elephants in Amboseli National Park, Kenya, manipulating the location of fresh urine samples from related or unrelated elephants. The elephants' responses to detecting urine from known individuals in surprising locations showed that they are able to continually track the locations of at least 17 family members in relation to themselves, as either absent, present in front of self, or present behind self (Bates et al. 2008a). This remarkable ability to hold in mind and regularly update information about the locations and movements of a large number of family members is best explained by predicting that elephants possess an unusually large working memory capacity, apparently much larger than that of humans.

47. Elephants show sophisticated categorisation of their environment, with skills on a par with those of humans. We experimentally presented the elephants of Amboseli National Park, Kenya, with garments that gave olfactory or visual information about their human wearers – either Maasai moran (male warriors who traditionally attack and spear elephants on occasion as part of their rite of passage), or Kamba men (who are agriculturalists and traditionally pose little threat to elephants). In the first experiment, the only thing that differed between the cloths was the smell, derived from the ethnicity and/or lifestyle of the wearers. The elephants were significantly more likely to run away when they sniffed cloths worn by Maasai than those worn by Kamba men or no one at all. In a second experiment, we presented the elephants with two cloths that had not been worn by anyone, but here one was white (a neutral stimulus) and the other was red—the color that is ritually worn by Maasai moran. With access only to these visual cues, the elephants showed significantly greater reaction to red garments than white, often including signs of aggression. We concluded that elephants are able to categorize a single species (humans) into sub-classes (i.e. 'dangerous' or 'low risk') based on either olfactory or visual cues alone (Bates et al. 2007). McComb et al went on to show that the same elephants can also distinguish between human groups based on our voices. The elephants reacted differently (and appropriately) depending on whether they heard Maasai or Kamba men speaking, and also when they heard male or female Maasai (where female Maasai pose no threat as they are not involved in spearing events), and adult Maasai men or young Maasai boys (McComb et al 2014). Scent, sounds and visual signs associated specifically with Maasai men are categorized as 'dangerous', while neutral signals are attended to but categorized as 'low risk'. These sophisticated, multi-modal categorization skills may be exceptional among non-human animals.

Summary

48. Both African and Asian elephants evidently share many key traits of autonomy with humans, and so parsimoniously it must be concluded that elephants are also autonomous beings.

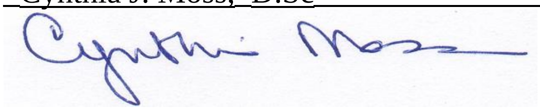
49. Scientific knowledge about elephant intelligence has been increasing rapidly in the past decade: what we currently know is only a tiny fraction of what elephant brains are likely capable of, and yet more amazing abilities are still likely to be discovered.

I declare under penalty of perjury under the law of Colorado that the foregoing is true and correct.

Executed on the ___14___ (date) of __4____ (month), _2023____ (year)

at __Orlando, FL____
(city or other location, and state or country)

_Cynthia J. Moss, _D.Sc____________________________________



____
(signature)

Exhibit A

CURRICULUM VITAE

NAME: Cynthia J. Moss

ADDRESS: P.O. Box 15135
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Nairobi, Kenya
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E-mail: cmoss@elephanttrust.org

DATE OF BIRTH: July 24, 1940

PLACE OF BIRTH: Ossining, New York

NATIONALITY: U.S.A. (resident of Kenya)

EDUCATION: BA, Smith College, 1962; D.Sc., Smith College, 2002

PRESENT POSITION: Director, Amboseli Elephant Research Project
Amboseli Trust for Elephants

PROFESSIONAL HISTORY:

1972-present: Director Amboseli Elephant Research Project and since 2001 Director of the Amboseli Trust for Elephants. Set up long-term research project on the elephant population in the Amboseli ecosystem in southern Kenya. Conducted research on the distribution, demography, population dynamics, social organization and behavior of the Amboseli elephants. Present activities include: directing and supervising research and monitoring; training elephant researchers from African elephant range states; outreach to Maasai community; carrying out surveys and training courses at other elephant study sites in Africa; disseminating scientific results; advocating for elephant welfare; promoting public awareness by writing popular articles and books and by making films about elephants; fund raising for and administering Project.

1971-1985: Editor of African Wildlife Foundation's *Wildlife News.*

1970-1971: Part-time work as freelance journalist, mainly for *Time* and *Life* magazines.

1969-1970: Research assistant to Drs. A.M. and S. Harthoorn, veterinary research, Nairobi, 6 months; compiled and wrote a 75-page report on elephants for Cinema Center Films' "The African Elephant", 6 months; research assistant to Dr. V. Finch, environmental physiology project on eland, hartebeest, zebra, wildebeest, ostrich, and Boran cattle, Athi Plains, Kenya, 2 months; research assistant to Dr. J.B. Sale, U. of Nairobi, feeding ecology of elephants in Tsavo National Park, Kenya, 2 months.

1968: Research Assistant to Dr. I. Douglas-Hamilton, elephant behaviour and ecology, Lake Manyara National Park, Tanzania, 8 months. (Subsequently worked on the project for shorter periods in 1969, 1970, and 1971.)

1964-1968: Reporter/Researcher, *Newsweek* Magazine, New York.

GRANTS, FELLOWSHIPS, AWARDS:

1975	African Wildlife Foundation grant
1978 - 1979	Midgard Foundation grant
1979 - 1984	Research Fellow, grants, New York Zoological Society
1982	*Portraits in the Wild* nominated for American Book Award for best science paperback of the year
1985	Smith College Medal for alumnae achievement
1993	"Echo of the Elephants" received awards at Jackson Hole Wildlife Film Festival and Italian Film Festival.
1996-2006	Disney Conservation Foundation grants
1996-1999	Delano Foundation grants
1997	Elected Fellow of the Royal Geographic Society
1998	*Little Big Ears* received an award from the John Burroughs Foundation and the American Museum of Natural History
1999	Conservation Excellence Award from the Oakland Zoo
1999	Centennial Conservation Award from Woodland Park Zoo
1999, 2000, 2001	Sabbatical fellowships at National Center for Ecological Analysis & Synthesis, University of California, Santa Barbara
2000	Howard Gilman Foundation grant
2001-ongoing	Advisor to the International Fund for Animal Welfare
2001	Elected Fellow of the Society of Women Geographers
2002-2007	John D. & Catherine T. MacArthur Foundation Fellowship
2002	Award from Performing Animal Welfare Society (PAWS)
2002	Smith College Honorary Doctorate Degree
2002	Distinguished Conservation Fellow Award, LA Zoo
2004	Guardian Award from In Defense of Animals
2005	Conservation Award, Cincinnati Zoo

PROFESSIONAL ACTIVITIES:

1988-1996	IUCN/SSC African Elephant Specialist Group member
Ongoing:	Lectures on elephant social organization and behaviour to university students, wildlife club members, and specialist groups in Kenya, India, U.S., and U.K.
Ongoing:	Consultant to conservation groups, animal welfare organizations, zoos and others on elephant-related issues

MEMBERSHIPS:

American Museum of Natural History
Authors Guild
East African Natural History Society
East African Wild Life Society
Flying Doctors Society of Kenya
Kenya Society for the Protection & Care of Animals
PEN America
Royal Geographic Society (Fellow)
Society of Women Geographers (Fellow)
Explorers Club (Fellow)

PUBLICATIONS

BOOKS:

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(1982) *Portraits in the Wild: Behavior Studies of East African Mammals* (Second Edition - Revised). University of Chicago Press, Chicago.
(1988) *Elephant Memories: Thirteen Years in the Life of an Elephant Family.* William Morrow, New York. (Also in Swedish, Finnish, Dutch, Italian, French & Spanish editions.)
(1990) *Die Elefanten Vom Kilmandscharo.* Rasch und Rohring, Hamburg (German edition of *Elephant Memories,* with an additional chapter covering 1987-90).
(1992) *Echo of the Elephants.* BBC Books, London. (Also in U.S., German and Japanese editions.)
(1997) *Little Big Ears: The Story of Ely*. Simon & Schuster, New York.
Pringle, Laurence & **Moss, Cynthia** (1997) *Elephant Woman.* Atheneum, New York.
Moss, C.J. & Croze, H.J. (eds) (2011) *The Amboseli Elephants: A Long-Term Perspective on a Long-Lived Mammal.* University of Chicago Press, Chicago.

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Lee, P.C. & **Moss, C.J.** (2009). Welfare and well-being of captive elephants: perspectives from wild elephant life histories. In: Forthman, D. (Ed) *An Elephant in the Room: the Science and Well Being of Elephants in Captivity*. Tufts University Press, MA.

SCIENTIFIC PUBLICATIONS IN JOURNALS AND BOOKS:

1. Poole, J.H. & **Moss, C.J.** (1981) Musth in the African elephant, Loxodonta africana. *Nature*, 292, 830-831.
2. Douglas-Hamilton, I., Hillman, A.K.K. & **Moss, C.J.** (1981) Notes on vertical photography of elephants for age determination. *ILCA Monographs*, 4, 131-142.
3. **Moss, C.J.** & Poole, J.H. (1983) Relationships and social structure of African elephants. In *Primate Social Relationships: An Integrated Approach* (ed R.A. Hinde), pp. 315-325. Blackwell Scientific Publications, Oxford
4. Poole, J.H. & **Moss, C.J.** (1983) Musth discovered in the African elephant. *African Elephant and Rhino Newsletter,* 1:8.
5. **Moss, C.J.** (1983) Oestrous behaviour and female choice in the African elephant. *Behaviour*, 86, 167-196.
6. Western, D., **Moss, C.J.** & Georgiadis, N. (1983) Age estimation and population age structure of elephants from footprint dimensions. *JWildlManage*, 47, 1192-1197.

7. Lee, P.C. & **Moss, C.J**. (1986) Early maternal investment in male and female African elephant calves. *BehavEcolSociobiol*, 18, 353-361.
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14. Koch, P.L., Heisinger, J., **Moss, C.**, Carlson, R.W., Fogel, M.L., & Behrensmeyer, A.K. (1995) Isotopic tracking of change in diet and habitat use in African elephants. *Science*, 267:1340-1343.
15. Lee, P.C. & **Moss, C.J.** (1995) Statural growth in known-age African elephants (*Loxodonta africana*). *J.Zool., Lond.* 236: 29-41.
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17. Lee, P.C. & **Moss, C.J.** (1999) The social context for learning and behavioural development among wild African elephants. In: Box, H.O. & Gibson, K.R. (eds) *Mammalian Social Learning*. Cambridge University Press, Cambridge, 102-125.
18. McComb, K., **Moss, C.J.**, Sayialel, S. & Baker, L. (2000) Unusually extensive networks of vocal recognition in African Elephants. *Animal Behaviour, 59: 1103-1109.*
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22. **Moss, C.J.** (2002) Elephant research in Amboseli: a perspective from 28 years. In: Schwammer, H.M, Foose, T.J., Fouraker, M, & Olson, D. (eds) *A Research Update on Elephants and Rhinos: Proceedings of the International Elephant and Rhino Research Symposium, Vienna, June 7-11, 2001,* Schuling, Munster, 96-102.
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45. Wild female African elephants (Loxodonta africana) exhibit personality traits of leadership and social integration. Lee PC, **Moss CJ**. J Comp Psychol. 2012 Aug;126(3):224-32. doi: 10.1037/a0026566. PMID: 22905995 [PubMed - indexed for MEDLINE]
46. Enduring consequences of early experiences: 40 year effects on survival and success among African elephants (Loxodonta africana). Lee PC, Bussière LF, Webber CE, Poole JH, **Moss CJ**. Biol Lett. 2013 Feb 13;9(2):20130011. doi: 10.1098/rsbl.2013.0011. Print 2013 Apr 23. PMID: 23407501 [PubMed - indexed for MEDLINE]
47. The influence of social structure, habitat, and host traits on the transmission of Escherichia coli in wild elephants. Chiyo PI, Grieneisen LE, Wittemyer G, **Moss CJ**, Lee PC, Douglas-Hamilton I, Archie EA. PLoS One. 2014 Apr 4;9(4):e93408. doi: 0.1371/journal.pone.0093408. eCollection 2014. PMID: 24705319 [PubMed - in process] Free PMC Article

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(1976) Serengeti perhaps will die (Review of The Last Place on Earth by Harold T.P. Hayes). *The New York Times Book Review*, April 17, pp. 11, 29.
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FILM SCRIPTS AND SCIENTIFIC CONSULTING FOR FILMS:

1990-1992	"Echo of the Elephants", BBC Natural History Unit
1992-1995	"Echo of the Elephants: The Next Generation", BBC Natural History Unit
1996-1997	"Africa's Forgotten Elephants", Scorer Associates for BBC
2002-2005	"Echo of the Elephants: The Last Chapter?", BBC Natural History Unit
2007-2008	"Echo and the Elephants of Amboseli, Animal Planet 13-part series
2009-2010	"Echo: An Elephant to Remember", BBC Natural History Unit
2013	"An Apology to Elephants", HBO.

Exhibit B

Exhibit B

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EXHIBIT 5

Declaration of Bob Jacobs

I, Bob Jacobs, declare as follows:

Introduction and Qualifications

1. My name is Bob Jacobs. I graduated with a Bachelor of Arts, *Magna Cum Laude,* in German from Whitman College in 1980. I received an M.A. in Germanics, with a minor in Teaching English as a Second Language, from the University of Washington in 1982. I received my Ph.D. from the University of California, Los Angeles (UCLA) in Applied Linguistics in 1991, completing a neuroanatomy dissertation under the supervision of Drs. Arnold B. Scheibel and John Schumann. The dissertation was entitled: "A Quantitative Dendritic Analysis of Wernicke's Area". During this time, I also worked with Dr. Marian Diamond of the University of California, Berkeley. Post-doctoral research in neuroimaging was also completed from 1991-1993 under the supervision of Dr. Harry Chugani at UCLA. I began my tenure track professorship in the Department of Psychology at Colorado College in 1993, started the school's Neuroscience major in 1996, and have been at Colorado College since that time, becoming a full professor in 2006. I reside in Colorado Springs, CO.
2. I submit this Declaration in support of the Nonhuman Rights Project, Inc.'s petition for a writ of habeas corpus regarding the captive elephants at the Cheyenne Mountain Zoo. I have professional knowledge of the facts to which I attest and am not a party to this proceeding.
3. I have been conducting research on the mammalian brain since 1984 when I began my dissertation research in the Laboratory of Dr. Arnold B. Scheibel at the UCLA Brain Research Institute. I have 44 peer-reviewed publications to my name, all in well-respected scientific journals. I also have two chapters in edited volumes, and 63 professional talks/posters presented at academic conferences, and over 60 invited lectures about the brain. From 1984 to 2010, my main research focus on the human cerebral cortex, specifically on the quantitative neuromorphology in the cerebral cortex, that is, the shape and size of nerve cells (neurons) in

the outmost layers of the brain involved in higher cognitive functions—18 publications have focused on human tissue.

4. From 2010 onward, I focused on comparative neuroanatomy, examining the brains of a variety of species—for many of these species, our studies constitute the first time anyone had explored the neurons in the brains of these animals. Species examined included: African elephant, giraffe, minke whale, humpback whale, bottlenose dolphin, Siberian tiger, clouded leopard, Florida manatee, cheetah, African leopard, chimpanzee, African wild dog, domestic dog, banded mongoose, caracal, zebra, wildebeest, pygmy hippopotamus, greater kudu, ring-tailed lemur, golden lion tamarin, chacma baboon, macaque monkey, Flemish giant rabbit, Bennett's wallaby, and Long-Even's rat. A total of 18 publications have focused on these non-human animals.
5. With regards to the African elephant, we documented the types of neurons in both the cerebral cortex and in the cerebellum, a part of the brain involved in balance, body control, and coordination. This research was conducted on adult and newborn elephants—resulting in a total of 4 publications focused exclusively on the elephant brain, which had not been explored previously. In addition to academic publications, I have presented these results at several scientific conferences (e.g., Society for Neuroscience, Performing Animal Welfare Society), and have written summaries of this research for the online publication known as "The Conversation" (see here and here).
6. My Curriculum Vitae fully sets forth my educational background and experience and is attached as "Exhibit A."

Basis for opinions

7. My early interest in brain research involved using the research techniques of Dr. Scheibel to extend both his and Dr. Diamond's interest into the effects of the environment on the brain. Dr. Diamond was a pioneer in documenting the effects of an impoverished and enriched environment on neuroanatomy in non-human animals; my dissertation extended that to the human brain, where we found education related differences in the neurons of the cerebral cortex. Specifically, individuals with a university education had more complex neurons than individuals with a high school or less than high school education.
8. I have followed this area of research my entire career, including when we examined the brains of both free and captive animals. As such, several decades of neuroscientific research has led me to several conclusions about the state of the brain in captive non-human animals, particularly with regard to long-lived, large-brained mammals such as elephants.
9. One of the main findings of our elephant cortex paper (Jacobs et al., 2011) was that pyramidal neurons in the elephant are just as complex as similar neurons in the human cortex. As is the case in humans, these neurons are also more complex in the frontal lobe, involved with higher cognitive function, than in the occipital lobe, involved in the early processing of incoming visual information. There are remarkable parallels in terms of overall complexity of neurons and the functional involvement of these neurons. One difference was noted between the cortical neurons in the African elephant and in humans—those in the African elephant appear to extend their branches more broadly than neurons in the human, which tend to be more compact. As such, elephant neurons sample a very wide array of information because of the length of their dendrites. This broad synthesis of information in the African elephant may contribute to their contemplative nature—elephants often appear to be examining their surroundings and thinking very deeply about what is going on around them. They have the leisure of their great size and few natural predators, which allows them to consider their decisions very carefully. Primate cortical neurons, by contrast, seem more designed for quick

responses to the environment. This contemplative aspect of the elephant further supports the findings expressed below with regards to how their brain responds to captivity.

10. Although my own research has focused on the African elephant, all of conclusions here apply equally to Asian elephants as well—in fact, the conclusion applies across all mammals studied to date. In terms of general neuroanatomy, the Asian elephant brain is very similar to the African elephant brain (Shoshani et al, 2006). There is no reason to suspect that the brain of an Asian elephant be different in terms of physiology, neurochemistry, and basic cellular makeup (Barasa & Schochatovitz, 1961) than any other mammal. All evidence suggests it is remarkably similar to the brain of an African elephant, both in terms of structure (Maseko et al., 2012) and function (Plotnick et al., 2006; Hart et al., 2008).
11. I recently published a co-authored comprehensive review article on the neural consequences of impoverished environments for elephants and cetaceans (Jacobs et al., 2021; see here). This review article forms the basis of the opinions expressed in this declaration.

Opinions

12. In addition to a rather large list of well-documented physical ailments (Riddle & Stremme, 2011) and behavioral abnormalities (Greco et al., 2017) that afflict elephants in captivity, extensive neural consequences to an impoverished environment have been demonstrated in many species to date: mice, rats, rabbits, cats, and primates, including humans (Jacobs et al., 1993, 2021). No research of this nature has been completed on elephants as these are post-mortem studies and would therefore require killing of the animal; as such, we extrapolated from controlled scientific studies with all evidence suggesting that the brains of animals such as elephants would not "behave" any differently than the brain of any other mammal, including humans. There is a great deal of evolutionary continuity across the brains of the species that have been examined, which makes this a very logical extension of the existing research. Indeed, much of what we know about the neuropsychiatric consequences of chronic stress in humans derives from nonhuman animal models (Lecorps et al., 2021).

13. Over 60 years of neuroscience research indicates that an impoverished environment negatively affects the cerebral cortex (Diamond et al., 1964; Diamond, 2001). These effects include a thinner cerebral cortex, decreased blood supply, smaller neuronal cells bodies with few glial ("helper") cells for metabolic support, decreased dendritic branching for synthesizing information, fewer dendritic spines (indicating fewer connections with other neurons), and smaller, less efficient synapses. Additional studies reveal similar epigenetic-related deficiencies at the molecular (van Praag et al., 2000) and neurochemical (Kozorovitskiy et al., 2005) level throughout the brain. These changes at the cortical level are associated with deficits in an animal's emotional and cognitive functioning (Neidl et al., 2016).

14. A crucial component to an enriched environment is exercise (Basso & Suzuki, 2017), which not only increases the supply of oxygenated blood to a metabolically expensive brain, but also contributes to potential neurogenesis and enhanced cognitive abilities through a series of complex biochemical cascades (Horowitz et al., 2020). Large, captive mammals are severely deprived of the exercise component of enrichment, particularly when one realizes that elephants naturally travel tens of kilometers a day (sometimes more than 100 kilometers) across diverse terrain with numerous plants and various substrates, something they cannot do in the small, monotonous enclosures that typify zoo exhibits (Holdgate et al., 2016). Not only do elephants in larger enclosures exhibit lower glucocorticoid metabolite concentrations than their cohorts in smaller enclosures, but they also exhibit lower cortisol (stress hormones) levels when they can access diverse enrichment options and are allowed to be in compatible social groups (Brown et al., 2019). In Asian elephants, cortisol levels negatively correlate with locomotion and positively correlate with stereotypies (Schmid et al., 2001). Overall, these findings imply that cortical neurons in impoverished/captive animals are less complex, receive less metabolic support, and process information less efficiently than cortical neurons from animals in an enriched, more natural environment (Rosenzweig & Bennett, 1969).

15. Two other brain areas are affected negatively by a captive/impoverished environment because such an environment severely constrains or even prevents the natural behavior of animals,

resulting in chronic frustration, boredom, and stress. Two subcortical (beneath the cortex) brain structures negatively affected by such stress are the hippocampus, involved primarily in declarative (i.e., facts and events) and spatial memory formation, and the amygdala, involved in emotional processing. Decades of neuroscientific research in the laboratory and in the field (Sapolsky, 2005) have demonstrated that prolonged stress results in chronically elevated levels of glucocorticoids (stress hormones) (Sapolsky, 1996). Chronic exposure to these stress hormones contributes to wide-ranging neurodegeneration (Vyas et al., 2016), including neuronal damage/death in the hippocampus (Sapolsky et al., 1990), resulting in memory deficits, and in the amygdala (McEwen et al., 2015), resulting in emotional processing deficits. In natural environments, the body's stress-response system is designed for quick activation to escape from danger; in captivity, there is no escape. In captivity, animals have an almost complete lack of control (Sapolsky, 2012) over their environment. The resulting chronic stress tends to inhibit the immune system (Schedlowski & Schmidt, 1996), with negative health and neural consequences (McEwen et al., 2015). Under chronic psychological or physical stress, pro-inflammatory cytokines are released by activated immune cells and can interact with multiple corticolimbic brain structures, dysregulating different growth factors and neurogenesis, several neurotransmitter systems, and neuroendocrine communication (Capuron & Miller, 2011). Moreover, animals kept in social isolation exhibit increased aggression and depression like symptoms (Miura et al., 2002).

16. Stress from captivity often fosters learned helplessness and conditioned defeat (Maier & Seligman, 2016), which involves the amygdala (Hammack et al., 2012) and broad dysregulation of the neurotransmitter serotonin (Maier & Watkins, 2005). Under similar conditions (Chugani et al., 2001), stress is associated with a variety of neuropsychiatric diseases in humans, such as anxiety/mood disorders (Zhang et al., 2018), including major depression, and post-traumatic stress disorder (PTSD) (Koenigs & Grafman, 2009). Current human research, in fact, suggests that childhood trauma may subsequently make the adult brain more vulnerable to maladaptive stress responses (Banihashemi et al., 2020), an issue

particularly relevant for long-lived, highly social animals such as elephants and cetaceans born into captivity. One neural consequence under such conditions is microglia activation and a sustained release of inflammatory mediators (Leszek et al., 2016). Subsequent neuroinflammation contributes to physiological, behavioral, affective, and cognitive disorders (de Pablos et al., 2014; McLeod et al., 2001). To the extent that captivity induces stress-related immuno-suppression, captive animals are thus more susceptible not only to neuroinflammation but also to opportunistic infections and possible disruptions of fertility (Edwards et al., 2019). Given the highly conserved (Nikolova et al., 2018) nature of neural structures (i.e., brains have a lot in common across species), there is no logical reason to believe that the large, complex brains of animals such as elephants (Jacobs et al., 2011) would react any differently to a severely stressful environment than does the human brain.

17. Captivity and the psychosocial stress it engenders, has negative effects on complex circuitry between a subcortical collection of nuclei (groups of neurons) known as the basal ganglia and the cerebral cortex. Through a series of reciprocal connections, the basal ganglia select and orchestrate appropriate cortical activity for a given situation, including the two pathways involved in movement: the direct pathway and the indirect pathway. The direct pathway tends to be involved in generating movement/behavior whereas the indirect pathway is more crucial for inhibition of movement/behavior. Normal movement depends on a delicate balance between these two pathways. Stereotypic behavior resulting from stress has been documented in a large number of species (e.g., poultry, rodents, pigs, voles, cows, sheep, dogs, horses, and primates, including humans), and is invariably associated with an imbalance in the direct/indirect pathways (McBride & Parker, 2015). More specifically, the indirect pathway is suppressed as a result of dysregulation of two neurotransmitter systems, dopamine and serotonin (Langen et al., 2011). Such behavioral stereotypies may represent a coping strategy as the animal attempts to mitigate the overwhelming effects of psychosocial stress (Poirier & Bateson, 2017). It is worth noting that elephants, in their natural habitat, have never been

noted to have exhibit such stereotypies, which reflect underlying (abnormal) disruption of neural mechanisms.

18. Stereotypies are common human and non-human responses to chronic stress. Children with a history of early institutional care are more likely to exhibit stereotypies, underscoring the influential role of the environment during early development (Bos et al., 2010). In nonhuman animals, such behavioral stereotypies are seldom if ever observed in nature (Boorer, 1972), but have been consistently documented in many captive animals beyond murid rodents. Chronic stress also creates heightened dopamine sensitivity in the nucleus accumbens, which is part of the mesolimbic pathway associated with motivation (Cabib, 2006). Environmental deprivation and social isolation have repeatedly been shown to dysregulate these motor control pathways in several species, resulting in stereotypies (Martin et al., 1991; McBride & Hemmings, 2005). By extension, comprehensive environmental enrichment appears to rebalance activity in these pathways, thus at least partially ameliorating or even preventing the emergence of stereotypies. Comprehensive environmental enrichment appears to prevent stereotyped behaviors by increasing metabolic activity in the motor cortex, the striatum, and the nucleus accumbens (Turner et al., 2002).

Summary

19. Long-lived individuals with large, complex brains integral to their intricate sociobehavioral existence cannot function normally in captivity. The neural point of view underscores the sociobehavioral assessment of elephant needs. Physical and behavioral abnormalities are easy to observe, but one must look deeper to see the neural consequences. Evolution has constructed the brain—of all organisms—to be extremely and exquisitely responsive to the environment (for better and worse). This responsivity extends to the level of gene expression, meaning that the environment can turn on or turn off different genes (Sapolsky, 2017). As such, the captive environment we place animals in significantly and sometimes permanently alters their brains in a negative manner. From a neural perspective, imprisoning large mammals and putting them on display is undeniably cruel.

20. Elephants exhibit behavioral patterns and physical abnormalities similar to other mammals in impoverished environments. Moreover, they possess very similar, highly conserved, neurobiological systems as do other mammals for responding to impoverishment and chronic stress. Therefore, elephants sustain neurobiological insults from living in confined, artificial environments. Insofar as most captive elephants cannot be "rewilded" for scientific and ethical reasons, the case can be made for transferring them to authentic sanctuaries, where they may live in a more natural environment. Authentic sanctuaries report improved physical and psychological health in elephants after their arrival, including decreased frequency or extinction of stereotypies, reduced aggression toward keepers, muscle tone gain, and formation of social bonds between elephants with different social histories, including elephants who were abused, traumatized, or solitary for decades (Buckley, 2009; Derby, 2009). Thus, elephants should either remain free (and protected) or, if already in captivity, they should be released into well-designed sanctuaries—several already exist for elephants; for example in Tennessee (see here), in Georgia (see here), and in Northern California (see here).

Observations of elephants at the Cheyenne Mountain Zoo

21. On June 6, 2022, I visited the Cheyenne Mountain Zoo and observed 4 of the 6 elephants in the Wilgruen Elephant Center (2 were not within view of the public) for approximately 2 hours. It is important if not essential when evaluating elephant well-being to see first-hand the conditions in which they live—it is worse in person than on paper (see this Word document summarizing information about the elephants' living environment, with hyperlinks to publicly available sources, and this Google Drive folder of images and videos showing aspects of the elephant compound). Two elephants were in Exhibit 1, and two elephants were Exhibit 2. This experience leads me to the following observations/conclusions:

    a) **Quantity of space.** Although the overall size of the 3 Cheyenne Mountain Zoo elephant exhibits (~0.77 acres, or 3,116 m^2; see here) meets the minimum AZA requirement for six elephants (500 m^2 each, with a minimum shared space of 3,000 m^2), it is immediately obvious that the allotted space at the zoo is woefully inadequate. Insofar as elephants in their natural habitat have expansive home ranges, extending from 10s to 10,000 km^2 (Fernando et al., 2008; Bahar et al., 2018), the enclosure space provided by any zoo is simply insufficient—especially year after year, decade after decade. The barn is barely large enough to hold the elephants, but not for any length of time. It is unclear if the elephants are held there overnight—if so, this would be very problematic and could contribute to foot damage despite the presences of a pile of sand in the middle.

b) **Quality of space:** Within 10 minutes of entering the largest exhibit (Exhibit 1), the two elephants had explored all locations containing food (feeders in artificial trees, vegetables and fruit that had been scattered on the ground, etc.). In fact, they had explored almost every aspect of the exhibit within the first 10 minutes. Exhibit 1 does have two water features (a pond, and a waterfall), and does provide some limited options for shade (but only if the elephants stand under one of the three canopies—the elephants ignored these features during my visit. Shade is extremely important given the altitude of the zoo, as is access to mud baths, which is how the elephants protect their skin from the sun. The mud bath pool was in the Demo area; as such, they only had access to it part of the time. It would be better if they always had access to it. Exhibit 2, which is ~5 times smaller than Exhibit 1, is essentially barren—here, the elephants briefly interacted with "enrichment devices" for delivering food—thereafter, there was nothing else for them to do.

c) **Time in Exhibit 1:** One of the keepers informed me that only two elephants are allowed in Exhibit 1 at any given time. So, the zoo has 3 groups of 2 elephants who, independently of each other, have access to the largest exhibit. In a 12-hour day (assuming they are in the barn at night), this means each elephant only gets approximately 4 hours in Exhibit 1— for the other 8 hours of daylight, the elephants are in the much smaller, barren Exhibits/enclosures.

d) **Vegetation:** There was no live vegetation available to the elephants in either Exhibit 1 or Exhibit 2. There were a couple of spaces with live vegetation, but these were behind electrified wires, prohibited the elephants from access. The elephants were clearly drawn to this vegetation and made attempts to reach some branches (being careful not to touch the wires), but they could not access what they could see (and smell)—one can only imagine how frustrating this might be for them. As such, none of the exhibits had natural vegetation. The zoo does have a vacation yard (see here and here), which is ~2 acres in size and off limits for visitors. The elephants supposedly get to visit this area a couple of times a month during the spring/summer. This is very different from what they would experience in a sanctuary.

e) **Substrate:** Although the zoo does make mounds of sand available to the elephants, both in the barn and in Exhibit 1, the terrain on which the elephants walk is mostly, densely packed, sandy soil—which is not a lot different from walking on concrete. Limited space, which restricts movements, coupled with hard surfaces (e.g., concrete, packed soil; Miller et al., 2016), leads to osteoarthritis, which regularly occurs prematurely in captive elephants. Such ailments are associated with pain and joint stiffness, inability to stand, and sometimes leads to euthanasia (Issa and Griffin, 2012; Buckwalter et al., 2013).

f) **Hillside:** The Cheyenne Mountain Zoo is on the side of the mountain. As such, there is very little flat space for the elephants. They must climb up and down the hillside to reach the water feature at the top of Exhibit 1—this was clearly an issue for one of the elephants in Exhibit 1, who came down the incline very gingerly, presumably because of leg issues such as osteoarthritis. This will become an even greater issue as the elephants in the zoo age.

g) **Food:** The food available to the elephants was hay, scattered fruits and vegetables, and some browse (broken tree branches)—a monotonous diet that requires little manipulation and is quickly consumed. In their natural habitat, elephants are highly diverse feeders, consuming more than 100 seasonally and geographically varying food species (e.g., grasses, trees, bark, roots, fruits, and aquatic plants; Dierenfeld, 2006), and spending 60-80% of their waking hours foraging over long distances (Poole & Granli, 2009). In zoos, feeding schedules tend to be predictable—as appeared to be the case at the Cheyenne Mountain Zoo (the elephants clearly knew where the food was, and followed keepers who threw food on the ground to motivate them to move from area to area). A more varied feeding regime would certainly enhance the well-being the elephants (Holdgate et al., 2016).

h) **Exercise:** The elephants receive very little exercise in such a small enclosure. As a result, presumably, the zoo constructed a walking path (~0.23 miles, or 0.37 km long; see here). In videos (see here and here), elephants walked along this path as trainers threw fruit and vegetables on the ground. During my visit, the elephant path had plants growing in it, suggesting it had not been used in a relatively long period of time. As such, it remains unclear how often the path is actually used. Nevertheless, even the walking path is inadequate given that elephants in their native habitat normally travel ~8-12 km/day, with much greater distances (up to ~50 km/day) being common (Wall et al., 2013; Miller et al., 2016). As such, to cover 10 km, elephants at the Cheyenne Mountain Zoo would need to do 27 laps of the walking path each day; 50 km would require 135 laps a day. This clearly isn't happening.

i) **Obesity:** Several, if not all, of the elephants in the zoo were obese. Obesity, coupled with limited space and hard substrate, is associated with high rates arthritis and foot disease in captive elephants (Morfeld et al., 2014).

j) **Social interaction:** There was virtually no social interaction among the two elephants in Exhibit 1; those in Exhibit 2 were separated by a gate and could not interact with each other. One of them, after extracting food from the feeding device, leaned her head against the door to the barn, and didn't move at all for nearly 20 minutes. Many elephant management problems are linked to inappropriate social groupings (Veasey, 2006).

Free elephants tend to live in matriarcal, multi-generational family groups of two to 10 adult females and juveniles (Vance et al., 2009). Elephant family groups share a fission-fusion structure, separating and merging with larger groups of up to several hundred elephants (Poole & Moss, 2008; de Silva et al., 2011). As noted earlier, there are three dyads of elephants in the Cheyenne Mountain Zoo; as such, each elephant interacts with only one other elephant.

k) **Human interaction**: After paying a fee, people (mostly children) were allowed to feed the elephants some vegetables by hand. The elephant involved patiently waited behind the enclosure, stretching out her trunk to receive the food—clearly, part of her daily routine. This activity provides no real benefit for the elephants—it is merely a method of collecting money from the public.

l) **Stereotypies:** In the two hours I observed the elephants, 3 of 4 exhibited marked stereotypies in the form of body rocking, swaying, and head bobbing (see videos here). Between ~47% and ~ 85% of elephants in zoos exhibit stereotypies, which can consume up to ~20% of the animal's daily activity (Mason & Latham, 2004; Mason & Veasey, 2010). The elephants only stopped if they were being fed, interacting with other elephants, or in a training session. It is clear that large portions of time involve such stereotypies, which can further aggravate foot issues. Moreover, as noted above, the existence of stereotypies is a direct reflection of dysregulation of motor control circuitry in the brain, that is, a form of brain damage.

m) **Anthropogenic noise:** The elephant exhibit is situated between the main road to the zoo below it, and a parking lot further up the hill above it. Elephants depend a great deal on sound for communication, both vocally and seismically. Their feet have a very high number of Pacinian corpuscles (skin receptors sensitive to vibration), which makes them very sensitive to low frequency (subsonic to human hearing) sounds/vibrations (Bouley et al., 2007). In a recent video (see here), one of the elephants in the Cheyenne Mountain Zoo is extremely agitated by the noise of a nearby truck. This is, presumably not an isolated event. Moreover, on the day I visited, there was a very large number of people (with many screaming children). The elephants' exhibits are filled with a disturbing abundance of anthropogenic noise, which elephants may easily perceive to be potential risks/threats (Mortimer et al., 2021).

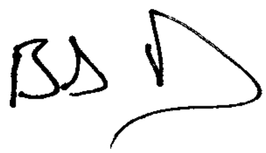
n) **Enrichment:** The zoo claims to use enrichment in the form of feeding devices, objects (e.g., tires, barrows), the walking path and so on. However, these represent only a very limited type of directed enrichment (Markowitz, 1982) and are employed in an attempt to alleviate the specific psychological/behavioral/neural problems arising from the captive, inarguably impoverished environment. They are band-aids, not cures. Current evidence suggests that targeted, ad hoc zoo/aquarium enrichment remains insufficient for the overall neural health of mammals such as elephants as long as they remain constrained by traditional captive conditions. Here it is worth noting a couple of additional points: natural environments appear to be better for the emotional health of rats than artificially enriched environments (Lambert et al., 2016), with similar findings in humans (Lambert et al., 2015). A sanctuary would provide these elephants with a much more natural, and thus enriching, environment. In conclusion, the transient, inconsistent enrichment (as is the case with zoo "enrichment") can create more stress and frustration for the elephants than no enrichment at all (Latham & Mason, 2010).

I declare under penalty of perjury under the law of Colorado that the foregoing is true and correct.

Executed on the __26____ (date) of __April____ (month), __2023____ (year)

at _____Colorado Springs, Colorado_________________________
(city or other location, and state or country)

Bob Jacobs, Ph.D.____



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(signature)

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Exhibit A

CURRICULUM VITAE

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Birth date: Feb. 14, 1958
Birthplace: Mojave, CA.

Educational Background

1991-1993	UCLA	Post-doc	UCLA DANA Scholar, Pharmacology
1984-1991	UCLA	Ph.D.	Applied Linguistics Specialization: Cognitive Neuroscience
1980-1982	University of Washington	M.A.	Germanics TESL (minor)
1976-1980	Whitman College	B.A.	German

Grant Support

2001: Consultant on Center for the Study of Culture, Brain, and Development program grant; funded by Foundation for Psychocultural Research ($1,000,000)
2000: Hughes Foundation grant for laboratory equipment ($9,155)
1996: Hughes Foundation grant for laboratory equipment ($10,999.95)
1995: National Science Foundation: Instrumentation and Laboratory Improvement Grant ($24,430)

Selected Honors/Credentials

2016-17; 2020-22: Herman-Winkler Professorship
2005: Mentor Recognition Award—University of California, San Diego
1999: Faculty Spirit Award--Colorado College Center for Community Service
1996-98: John D. and Catherine T. MacArthur Assistant Professor in Psychology
1995: Nominated for National Science Foundation Presidential Faculty Fellows Award
1988-91: Ursula Mandal Scholarship (annual $10,000 award; University of California, Los Angeles)
1988: California State Teaching Credential
1982: Delta Phi Alpha (University of Washington)
1980: Phi Beta Kappa (Whitman College)

Language Experience

German	M.A. degree, relative fluency (two years abroad inclusive)
Japanese	Spoken and written: two years in Japan and formal study at UCLA
French	Two years, university level
Chinese (Mandarin)	One quarter, university level
Korean	One quarter, university level
Latin	Two quarters, university level

Teaching Experience

2006-present	Professor, Psychology	Colorado College
1999-2006	Associate Professor, Psychology	Colorado College
1993-1999	Assistant Professor, Psychology	Colorado College
1990-91	Guest Lecturer	University of California, Los Angeles
1984-91	Teaching Associate/Fellow	University of California, Los Angeles
1986-90	Instructor	UCLA American Language Center
1988	Instructor	Santa Monica College, CA.
1982-84	Chief language instructor, coordinator	Asahikawa Cultural Center, Japan
1980-82	German teaching assistant	University of Washington

Refereed publications

Jacobs, B., Rally, H., Doyle, C., O'Brien, L., Tennison, M., & Marino, L. (2021). Putative neural consequences of captivity for elephants and cetaceans: *Reviews in the Neurosciences*. https://doi.org/10.1515/revneuro-2021-0100

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Creswell, J., Hrubes, M., & **Jacobs, B.** (2001). Putative dendritic changes following corpus callosotomy in human cortex: A quantitative and qualitative case study. [Abstract/Poster] Society for Neuroscience, San Diego, California, November, #251.15.

Sann, S.B, Hrubes, M., & **Jacobs, B.** (2000). Regional dendritic variation in spine-free nonpyramidal neurons: A quantitative Golgi study in humans. [Abstract/Poster] Society for Neuroscience, New Orleans, LA, November, 461.16.

Kapler, E., Scheibel, A.B., & **Jacobs, B.** (2000). Cell packing density in Brodmann's areas 10 and 18 of the human cerebral cortex. [Abstract/Poster] Society for Neuroscience, New Orleans, LA, November, #461.17.

Shen, T., Davenport, P., E. Kapler, E., Jacobs, J., Sann, S., Ford, K., Prather, M., Tyson, W., & **Jacobs, B.** (1999). A quantitative Golgi analysis of infant human Betz cells: Preliminary findings. [Abstract/Poster] Society for Neuroscience, Miami, Florida, October, #905.8.

Prather, M., Treml, M., Driscoll, L., Schall, M., & **Jacobs, B.** (1997). Regional variation in dendritic and spine complexity: A quantitative Golgi analysis of human cerebral cortex. [Abstract/Poster] Society for Neuroscience, New Orleans, LA, October, #87.13.

Kamm, G., Hovey, S., Treml, M., Prather, M., & **Jacobs, B.** (1997). The Colorado College elementary school outreach program for neuroscience education: What the children say. [Abstract/Poster] Society for Neuroscience, New Orleans, LA, October, #111.9.

Jacobs, B., & Larsen, L. (1997). Pluripotentiality, epigenesis, and language acquisition. Commentary on R-A. Müller, Innateness, autonomy, universality? Neurobiological approaches to language. *Behavioral and Brain Sciences*, 19:4, 639.

Courns, K., Ferguson, J., Larsen, L., Schall, M. & **Jacobs, B.** (1996). Age-related dendritic and spine changes in human occipital and prefrontal cortices: A quantitative Golgi study. [Abstract/Poster] Society for Neuroscience, Washington, D.C., November, #307.2.

Ferguson, J., Driscoll, J., Courns, K., Rattenbury, K., Baca, S., Larsen, L. & **Jacobs, B.** (1995). An overview of the Colorado College elementary school outreach program for neuroscience education. [Abstract/Poster] Society for Neuroscience, San Diego, California, November, #101.21

Baca, S., Larsen, L., Fisher, B., Kernan, R., Schall, M., & **Jacobs, B.** (1995). Dendritic and spine analyses across hierarchically arranged areas of human neocortex: A quantitative Golgi study. [Abstract/Poster] Society for Neuroscience, San Diego, California, November, #182.9.

Jacobs, B., & Horner, J. (1995). Language as a multimodal sensory enhancement system. Commentary on W. K. Wilkins & J. Wakefield, Brain evolution and neurolinguistic preconditions. *Behavioral and Brain Sciences.* 18:1, 194-95.

Larsen, L., Swanson, R.L., Wainwright, M.L., & **Jacobs, B**. (1994). Quantitative dendritic and spine analyses of human prefrontal and occipital cortices. [Abstract/Poster] Society for Neuroscience, Miami, Florida, November, #584.13.

Sato, E., & **Jacobs, B.** (1994). Selective attention and education: A neurobiological perspective. American Educational Research Association, New Orleans, LA, April 5.

Sato, E., & **Jacobs, B.** (1994). Neural mechanisms of selective attention essential to language development. American Association of Applied Linguists, Baltimore, Maryland, March 5.

Jacobs, B., & Raleigh, M. J. (1993). Sizing up social groups. Commentary on Dunbar, Coevolution of neocortical size, group size and language in humans. *Behavioral and Brain Sciences.* 16:4, 710-11.

Jacobs, B., Chugani, H. T., Allada, V., Chen, S., Colgan, M., Phelps, M. E., Pollack, D. B. & Raleigh, M. J. (1993). Metabolic brain development in rhesus macaques and vervet monkeys: A PET study. [Abstract] Sixteenth Meeting of the American Society of Primatologists, Sturbridge, Massachusetts, August 18-22.

Sato, E., & **Jacobs, B.** (1993). From input to intake: Towards a brain-based perspective of selective attention. American Association for Applied Linguistics, Atlanta, Georgia, April 19.

Allada, V., Schelbert, H. R., **Jacobs, B**., Chugani, H. T., Raleigh, M. J., Brunken, R. C., Williams, R. G., & Phelps, M. E. (1993). Cardiac metabolism in developing non-human primates with positron emission tomography. [Abstract #2354] 66th Scientific Session of the American Heart Association. Atlanta, Georgia. November 8-11.

Jacobs, B., Chugani, H. T., Allada, V., Chen, S., Phelps, M. E., Pollack, D. B. & Raleigh, M. J. (1993). Metabolic brain development in non-human primates: A quantitative PET study. [Abstract/Poster] XVIth International Symposium on Cerebral Blood Flow and Metabolism, Sendai, Japan, May 22-28.

Jacobs, B., & Schall, M. (1992). Exploring the changing human brain: The relationship between gender, hemisphere, education and dendritic measures. *Perspective,* 16:3, 37-45.

Jacobs, B., Chugani, H. T., Allada, V., Harris, G. C., Chen, S., Phelps, M. E., Pollack, D. B. & Raleigh, M. J. (1992). Brain development in vervet monkeys: A preliminary PET study. [Abstract/Poster] Society for Neuroscience, Anaheim, California, October 25-30.

Jacobs, B., Chugani, H.T., Allada, V., Chen, S., Colgan, M., Harris, G.C., Phelps, M.E., Pollack, D.B., & Raleigh, M.J. (1992). Brain development in rheses monkeys: A preliminary quantitative PET study. [Abstract/Poster] Fifth Conference on the Neurobiology of Learning and Memory Univeristy of California, Irvine, October 22-24.

Jacobs, B., & Raleigh, M. J. (1992). Attachment: How early, how far? Commentary on G. W. Kraemer, A psychobiological theory of attachment. *Behavioral and Brain Sciences,* 15:3, 517. https://doi.org/10.1017/S0140525X0006982X

Jacobs, B. (1991). Neurobiology and language acquisition: Continuity and identity. Commentary on P. Greenfield, Language, tools, and brain: The ontogeny and phylogeny of hierarchically organized sequential behavior. *Behavioral and Brain Sciences.* 14:4, 565.

__________ (1991). Contribution to "Defining our field: Unity in diversity." *Issues in Applied Linguistics.* 1, 156.

Jacobs, B., & Scheibel, A. B. (1991). Education related changes and individual variability in Wernicke's area: A quantitative dendritic analysis. [Abstract/Poster] Society for Neuroscience, New Orleans, LA, November 10-15.

Scheibel, A. B., & **Jacobs, B.** (1991). Age-related changes in Wernicke's area: A quantitative dendritic analysis. [Abstract/Poster] Society for Neuroscience, New Orleans, LA, November 10-15.

Jacobs, B., (1989). A neurobiological perspective of individual differences in language acquisition. Workshop paper presented at the Stanford Child Language Research Forum. April 8.

__________ (1989). Environmental diversity and the brain: Implications for language acquisition. Paper presented at the Ninth Second Language Research Forum at the University of California, Los Angeles, February 24.

__________ (1988). The developing brain and SLA. Paper presented at the Eighth Second Language Research Forum at the University of Hawaii, Manoa, March 3-6.

Jacobs, B., & Hilles, S. (1987). Establishing a neurobiological perspective of primary and secondary language acquisition. Paper presented at the Seventh Second Language Research Forum at the University of Southern California, Los Angeles, February 22.

Invited lectures

Jacobs, B. (2019). Parent, children, brains…challenges and responsibilities. Colorado College, Gifted and Talented program, Colorado Springs, CO, June 10.

__________ (2018). Big cats, big neurons: What makes the felid brain special. International Captive Wildlife Conference. Los Angeles, CA, November 11.

__________ (2018). The neuroscience of captivity. International Captive Wildlife Conference. Los Angeles, CA, November 10.

__________ (2016). Insights from the elephant brain. International Captive Wildlife Conference. San Andreas, CA, November 12.

__________ (2016). Cortical neuromorphology: Beyond primates and rodents. International Conference on Brain Informatics and Health. Featured Speaker. Nebraska, Omaha, October 15.

__________ (2015). The ever-changing brain: Education and enrichment. Colorado College, Gifted and Talented program, Colorado Springs, CO, June 8.

__________ (2015). The ever-changing brain: education and enrichment. Colorado Springs School District 11, Colorado Springs, CO, April 22.

__________ (2003). Your brain, your life. Reach for Tomorrow. Colorado Springs, CO, August 7.

__________ (2002). A brain's view of language: Looking back and from within. Colloquium: Cognitive neuroscience and second language acquisition research: Defining the interface. American Association of Applied Linguistics. Salt Lake City, Utah, April 6-9.

__________ (2000). Educating the brain: Development, plasticity, and responsibility. Colorado Science Convention Beyond 2000: Sound Science & Sustainability. Denver, CO. Sept. 29.

__________ (1997). What teachers should know about the brain. National Science Teachers Association Western Area Convention. Denver, CO. Nov. 21.

Jacobs, B., Prather, M., & Kamm, G. (1997). The Colorado College Neuroscience Outreach Program. National Science Teachers Association Western Area Convention. Denver, CO. Nov. 20.

Jacobs, B. (1997). Four talks: (1) Positron emission tomography and the developing primate brain; (2) Lifespan changes in the human brain; (3) Education and the brain; and (4) Regional dendritic variation in the human cerebral cortex. Capital University of Medical Sciences, Anding Hospital, and Xuan Wu Hospital. Beijing, China, June 4-June 25.

Jacobs, B., & Chugani, H. T. (1994). Glucose metabolism in the developing brain: Correlations with synaptogenesis, plasticity and epilepsy. XIXth CINP Congress, Washington, D.C., July 1.

Jacobs, B. (1994). Metabolic brain development in rhesus macaques and vervet monkeys: A PET study. Social cognition affinity group. University of California, Los Angeles. March 14.

__________ (1994). Quantitative dendritic analysis of Wernicke's area. Neuroscience colloquium. Colorado State University, Fort Collins. Feb. 1.

__________ (1993). Dendritic and PET studies of the developing brain: Implications for language acquisition. English colloquium. University of Washington, Seattle, May 12.

__________ (1993). A PET study of metabolic brain maturation in vervet and rhesus monkeys. Psychology colloquium. The Colorado College, Feb. 5.

__________ (1993). Lifespan development and epigenetic influences on the dendritic systems in Wernicke's area. Psychology colloquium. The Colorado College, Feb. 5.

__________ (1993). Lifespan development and epigenetic influences on the dendritic systems in Wernicke's area. Psychology colloquium. Southern Connecticut State University, Feb. 1.

__________ (1993). Lifespan development and epigenetic influences on the dendritic systems in Wernicke's area. Center colloquium. Center for Molecular and Behavioral Neuroscience, Rutgers University, Jan. 29.

__________ (1992). Lifespan development and epigenetic influences on the dendritic systems in Wernicke's area. Psychology colloquium. Macalaster College, Dec. 8.

__________ (1991). Wernicke's area and the environment. Colloquium presentation at California State University. Fullerton, California, April 30.

__________ (1991). A quantitative dendritic analysis of Wernicke's area. Colloquium presentation at the University of North Carolina. Greensboro, North Carolina, February 8.

_________ (1991). A quantitative dendritic analysis of Wernicke's area. Colloquium presentation at Boys Town National Research Hospital. Omaha, Nebraska, January 10.

_________ (1990). Toward a neurobiological understanding of interaction in language acquisition. Paper presented to graduate second language acquisition course at the University of Washington, Seattle, May 16.

_________ (1989). The brain-environment interface: Implications for language acquisition. Colloquium paper presented at the University of Washington, Seattle, April 28.

_________ (1987). What the brain can tell us about language acquisition. Colloquium paper presented at the University of Washington, Seattle, March 11.

Community Presentations

Jacobs, B. (2019). Exploring the elephant brain: What their unique brain structure suggests about their mental abilities. Cheyenne Mountain Zoo, Colorado Springs, CO. May, 5.

Jacobs, B. & Lee, Laura (2014). Exploring the elephant brain and beyond. Talk to CC trustees. Colorado Springs, CO. Feb. 21.

Jacobs, B. (2013). Elephant and beyond: Brain research with exotic animals. BSCS: Peak Area Leadership in Science. Colorado Springs, CO. Feb. 12.

_________ (2013). What parents and teachers should know about the brain. BSCS: Peak Area Leadership in Science. Colorado Springs, CO. Feb. 12.

_________ (2011). What parents and teachers should know about the brain. Colorado College Summer Education Program. Colorado Springs, CO. June 11.

_________ (2010**).** The changing brain: Development, aging, and environmental influences. Dana Alliance Brain Awareness Week Lecture. Colorado Springs, CO. March 18.

_________ (2009). What teachers should know about the brain. Colorado College Education Seminar Series, CO, Nov. 3.

_________ (2008). Brain development, education, plasticity and enrichment. Colorado College Children's Center Seminar. Colorado Springs, CO. June 11.

_________ (2007). What parents and teachers should know about the brain. Colorado College Summer Education Program. Colorado Springs, CO. March 13.

Jacobs, B. & Erdal, K. (2006). The brain: A work in progress. Colorado College Student Life Staff Meeting. Colorado Springs, CO. Nov. 14.

Jacobs, B. (2005). The making of a liberal arts brain. Board of Trustees Meeting. Colorado Springs, CO. July 28.

_________ (2004). Neuroscience at Colorado College. Board of Trustees Meeting. Colorado Springs, CO. Feb. 20.

_________ & Travis, K. (2003). Neuroscience at Colorado College. The Colorado Forum. Colorado Springs, CO. Oct. 2.

_________ (2002). What teachers should know about the brain. Jenkins Middle School. Colorado Springs, CO. Dec. 4.

_________ (2002) The ever-changing brain. Widows or widowers group. Colorado Springs, CO. Aug. 5.

_________ (2001). What teachers should know about the brain. HUB presentation. Colorado Springs, CO. Oct. 17.

_________ (2001). What parents should know about the brain. Address at Colorado College Summer Education Program. Colorado Springs, CO. June 18.

Erdal, K., & **Jacobs, B.** (1996). Careers in Psychology. Palmer High School. Dec. 17.

Jacobs, B. (1996). Age-related changes in the human brain. Sigma Xi of Colorado Springs Seminar. Dec. 12.

_________ (1996). The aging brain. Mira Mesa Retirement Community. Colorado Springs, CO. June 10.

_________ (1996). Introduction to the brain. Palmer High School. Colorado Springs, CO. May 1.

_________ (1995). This is your brain at Colorado College. Homecoming Alumni Reunion. Colorado Springs, CO. Oct. 14.

_________ (1995). The human brain: The heart of humanity. Colorado College Business and Community Alliance. Colorado Springs, CO. Feb. 8.

_________ (1994). Introduction to the brain. Palmer High School. Colorado Springs, CO. Nov. 7.

_________ (1993). Educating the brain. Fountain Valley School of Colorado. Colorado Springs, Colorado. October 7.

_________ (1992). Brain development and education. Inter-sorority mother's club. University of California, Los Angeles. April 14.

Current professional organizations/activities

2006-present	*Cerebral Cortex*, Reviewer
2005-present	*Advances in Complex Systems*, Reviewer
2004-present	*Brain, Behavior and Evolution*, Reviewer
2003-present	*Neurobiology of Aging*, Reviewer
2000-present	*Language Learning*, Reviewer
1998-present	*Psi Chi* (undergraduate journal), Reviewer
1996-present	*Brain Research*, Reviewer
1993-present	Faculty for Undergraduate Neuroscience, Member
1993-present	Rocky Mountain Region Neuroscience Group, Member
1991-present	*Behavioral and Brain Sciences,* Associate member
1991-present	*Issues in Applied Linguistics*, Reviewer
1991-present	*American Journal of Primatology,* Reviewer
1989-present	Society for Neuroscience, Member
1987-present	*Studies in Second Language Acquisition,* Reviewer

Colorado College Support obtained for Faculty Research

<u>Research funds from the Natural Science Executive Committee</u>

1993-1994	Quantitative dendritic analysis of human frontal and occipital cortices [$2,079]
1994-1995	Quantitative dendritic analysis of human frontal and occipital cortices [$2,280]
1995--sup.	Quantitative dendritic analysis of human frontal and occipital cortices [$1,000]
1995-1996	Quantitative dendritic analysis of human frontal and occipital cortices [$2,979]
1996-1997	Quantitative dendritic analysis of human cerebral cortices [$2,500]
1997-1998	Quantitative neuromorphology [$2,900]
1998-1999	Quantitative neuromorphology [$2,900]
1999-2000	Quantitative neuromorphology [$2,900]
2000-2001	Quantitative neuromorphology [$3,000]
2001-2002	Quantitative neuromorphology [$3,500]
2002.2003	Quantitative neuromorphology [$2,500]
2003-2004	Quantitative neuromorphology [$3,875]
2004-2005	Quantitative neuromorphology [$2,930]
2005-2006	Quantitative neuromorphology [$3,487.50]
2006-2007	Quantitative neuromorphology [$3,745]
2007-2008	Quantitative neuromorphology [$3,600]
2008-2009	Quantitative neuromorphology—comparative: elephant [$4,400]
2009-2010	Quantitative neuromorphology—comparative: cetacea [$4,820]
2010-2011	Quantitative neuromorphology—comparative: giraffe, manatee [$4,320]
2011-2012	Quantitative neuromorphology—comparative: tiger [$4,049]
2012-2013	Quantitative neuromorphology [$4,510]
2013-2014	Quantitative neuromorphology [$5,000]
2014-2015	Quantitative neuromorphology [$5,000]
2015-2016	Quantitative neuromorphology [$5,000]
2016-2017	Quantitative neuromorphology [$5,000]
2017-2018	Quantitative neuromorphology [$5,000]
2018-2019	Quantitative neuromorphology [$5,000]

Colorado College Elementary School Outreach Program for Neuroscience Education

Summary: I developed the Colorado College Elementary School Outreach Program for Neuroscience Education in 1993. The program is designed to introduce local elementary school children to basic neuroscience by providing them with hands-on experience with brain tissue at the gross and microscopic level. To date, my Neuroscience students have accomplished the following:

Number of classrooms visited: 1,075

Grades visited: generally, 1st through 6th; and some middle school children

Number of elementary school students involved: approximately 24,623

We have also visited several local high schools and talked to over 1,000 students, and had students from several local schools of all levels visit the Laboratory of Quantitative Neuromorphology.

Undergraduate publications with students

Travis, K. & **Jacobs, B.** (2003). Regional dendritic variation in human neonatal cortex: A quantitative Golgi analysis. *Journal of Behavioral and Neuroscience Research*, *1*, 8-16. [Online, peer-reviewed Journal]

Creswell, J., Britt, J., Hrubes, M., **Jacobs, B**. (2001). Putative dendritic changes following corpus callosotomy in human cortex: A quantitative and qualitative case study. *Journal of Psychology and the Behavioral Sciences, 15,* 1-21.

Gaddis, B. (1999). Behavioral dysfunctions resulting from frontal lobe damage: A case study. *Journal of Psychology and the Behavioral Sciences, 13,* 72-83.

Prather, M., Schall, M., & **Jacobs, B.** (1998). Regional differences in dendritic and spine complexity: A quantitative Golgi analysis of human cerebral cortex. *Psi Chi Journal, 3:1*, 151-162.

Fisher, B. M., & **Jacobs, B.** (1998). A quantitative dendritic analysis of a bulimic brain: A case study. *Psi Chi Journal, 3:1,* 3-17.

Courns, K., & **Jacobs, B.** (1996). Age-related dendritic changes in human occipital and prefrontal cortices: A quantitative Golgi study. *Modern Psychological Studies, 4:1,* 10-20.

Baca, S. M., & **Jacobs, B.** (1995). A quantitative dendritic analysis of four functionally distinct areas of human cerebral cortex. *Modern Psychological Studies, 3:2,* 52-63.

Walter, L. (1995). Recovery from stroke involving the left middle cerebral artery. *Modern Psychological Studies, 3:2, 21-28.*

Larsen, L. L. & **Jacobs, B.** (1995). Quantitative dendritic and spine analyses of human prefrontal and occipital cortices. *The Drexel University Journal of Undergraduate Research. 1,* 14-20.

Undergraduate research grants/awards received by students (total awards = $100,775)

Vivian Nguyen	2019	Colorado College Conference Grant ($910)
Lili Uchida	2019	Colorado College Conference Grant ($1,000)
Vivian Nguyen	2019	Tabor Award in the Natural Sciences ($500)
Coby Dodelson	2019	Colorado College Faculty-Student Collaborative Research Grant ($4,500)
Vivian Nguyen	2018	Colorado College Conference Grant ($950)
Allysa Warling	2018	Colorado College Conference Grant ($920)
Lili Uchida	2018	Colorado College Conference Grant ($900)
Vivian Nguyen	2018	Tashjian Crecelius Family Prize for Women in Science ($500)
Allysa Warling	2018	Tabor Award in the Natural Sciences ($500)
Vivian Nguyen	2018	Colorado College Faculty-Student Collaborative Research Grant ($4,500)
Allysa Warling	2017	Colorado College Faculty-Student Collaborative Research Grant ($4,500)
Beck Shea-Shumsky	2017	Colorado College Venture Grant for 2017 Society for Neuroscience conference ($1,000)

Allysa Warling	2017	Colorado College Venture Grant for 2017 Society for Neuroscience conference ($1,000)
Lucy Sloan	2017	Colorado College Venture Grant for 2017 Society for Neuroscience conference ($1,000)
Beck Shea-Shumsky	2016	Colorado College Venture Grant for 2016 Society for Neuroscience conference ($924)
Madeleine Garcia	2015	Colorado College Faculty-Student Collaborative Research Grant ($4,500)
Madeleine Garcia	2015	Tashjian Crecelius Family Prize for Women in Science ($500)
Karen Chui	2015	Colorado College Faculty-Student Collaborative Research Grant ($4,500)
Brian Kopec	2014	Colorado College Venture Grant for 2014 Society for Neuroscience conference ($761)
Cameron Johnson	2014	Colorado College Venture Grant for 2014 Society for Neuroscience conference ($1,000)
Cameron Johnson	2014	Colorado College Faculty-Student Collaborative Research Grant ($3,500)
Laura Lee	2013	Colorado College Venture Grant for 2013 Society for Neuroscience conference ($1,000)
Tessa Harland	2012	Colorado College Venture Grant for 2012 Society for Neuroscience conference ($865)
Deb Kennedy	2012	Colorado College Venture Grant for 2012 Society for Neuroscience conference ($865)
Nicholas Johnson	2012	Colorado College Venture Grant for 2012 Society for Neuroscience conference ($850)
Leona Waller	2011	Colorado College Faculty-Student Collaborative Research Grant ($3000)
Tessa Harland	2011	Colorado College Faculty-Student Collaborative Research Grant ($3000)
Caroline Janeway	2010	Colorado College Venture Grant for 2010 Society for Neuroscience conference ($850)
Courtney Townshend	2010	Colorado College Venture Grant for 2010 Society for Neuroscience conference h ($850)
Jessica Borst	2009	Colorado College Venture Grant for summer research ($1000)
Kaeley Anderson	2008	Colorado College Venture Grant for 2008 Society for Neuroscience conference ($1000)

Ryan Casserly	2008	Colorado College Venture Grant for 2008 Society for Neuroscience conference ($1000)
Brooks Robinson	2007	Colorado College Venture Grant for 2007 Society for Neuroscience conference ($850)
Brian Bones	2007	Colorado College Venture Grant for 2007 Society for Neuroscience conference ($850)
Brian Bones	2007	Colorado College Faculty-Student Collaborative Research Grant ($3000)
Charles Hass	2004	Colorado College Venture Grant for 2004 Society for Neuroscience conference ($700)
Caitlin Dufault	2004	Colorado College Venture Grant for 2004 Society for Neuroscience conference ($700)
Hyo Lee	2004	Faculty for Undergraduate Neuroscience travel grant for 2004 Society for Neuroscience conference ($250)
Emilie Steffen	2004	Colorado College Venture Grant for senior thesis ($801)
Caitlin Dufault	2003	Colorado College Venture Grant for 2003 Society for Neuroscience conference ($850)
Hyo Lee	2003	Colorado College Venture Grant for 2003 Society for Neuroscience conference ($850)
Katie Travis	2003	Faculty for Undergraduate Neuroscience travel grant for 2003 Society for Neuroscience conference ($300)
Hyo Lee	2003-summer	Howard Hughes Undergraduate Research Program ($3,000)
Katie Travis	2003	Best paper/presentation at Colorado-Wyoming Academy of Science, April 26.
Jon Britt	2001	Colorado College Venture Grant for 2001 Society for Neuroscience conference ($591.50)
Johanna Creswell	2001	Colorado College Venture Grant for 2001 Society for Neuroscience conference ($591.50)
Jon Britt	2001-summer	Howard Hughes Undergraduate Research Program ($3,000)
Johanna Creswell Melody Hrubes	2001	Outstanding poster presentation at the 26th Annual West Coast Biological Sciences Undergraduate Research Conference, April 28, Santa Clara University. [$50]
Sharon Sann	2000	Colorado College Venture Grant for 2000 Society for Neuroscience conference ($850)
Melody Hrubes	2000	Colorado College Venture Grant for 2000 Society for Neuroscience conference ($850)

Jesse Jacobs	1999	Colorado College Venture Grant for 1999 Society for Neuroscience conference ($550)
Elisa Kapler	1999	Colorado College Venture Grant for 1999 Society for Neuroscience conference ($550)
Ting Shen	1999	Colorado College Venture Grant for 1999 Society for Neuroscience conference ($550)
Jesse Jacobs	1999-summer	Howard Hughes Undergraduate Research Program ($3,000)
Elisa Kapler	1999-summer	Howard Hughes Undergraduate Research Program ($3,000)
Clarissa Parker	1999-summer	Colorado College Faculty-Student Collaborative Research Grant ($2,500)
Melissa Prather	1998	Psi-Chi/Allyn & Bacon Publishers Psychology National Award for outstanding undergraduate psychology paper (1st place; $500)
Ting Shen	1998-summer	Associated Colleges of the Midwest Program for Minority Students and Academic Careers ($3,000)
Bethany Gaddis	1998-summer	Colorado College Faculty-Student Collaborative Research Grant ($2,500)
Melissa Prather	1997	Colorado College Venture Grant for 1997 Society for Neuroscience conference ($700)
Melinda Treml	1997	Colorado College Venture Grant for 1997 Society for Neuroscience conference ($700)
Melissa Prather	1997-summer	Colorado College Faculty-Student Collaborative Research Grant ($2,500)
Melinda Treml	1997-summer	Howard Hughes Undergraduate Research Program ($2,500)
Sonja Hovey	1997	Colorado College Venture Grant for 1997 conference on Multiple Intelligences ($450)
Dan Haas	1996-summer	Howard Hughes Undergraduate Research Program ($2,500)
Birgit Fisher	1996	National Honor Society in Psychology (Psi Chi): Award for research excellence ($150)
Jennifer Ferguson	1995	Colorado College Venture Grant for 1995 Society for Neuroscience conference ($771)
Renee Moorehouse	1995	Howard Hughes Undergraduate Research Program ($1,250)
Jennifer Ferguson	1995	Howard Hughes Undergraduate Research Program ($1,250)
Lori Larsen	1995	Psi-Chi/Allyn & Bacon Publishers Psychology National Award for outstanding undergraduate psychology paper (1st place; $500)
Kelly Courns	1995-summer	Associated Colleges of the Midwest Program for Minority Students and Academic Careers ($3,000)

Sherry Bekhit	1995	National Conference on Undergraduate Research travel grant ($446)
Lori Larsen	1994	Faculty for Undergraduate Neuroscience travel grant for 1994 Society for Neuroscience conference ($500)
Serapio Baca	1994	Colorado College Venture Grant for 1994 Society for Neuroscience conference ($681)
Serapio Baca	1994-summer	Associated Colleges of the Midwest Program for Minority Students and Academic Careers ($3,000)
Sherry Bekhit	1994-summer	Howard Hughes Undergraduate Research Program ($2,500)
Serapio Baca	1994-95	Howard Hughes Undergraduate Research Program ($2,500)
Rebecca Kernan	1994	Howard Hughes Undergraduate Research Program ($1,250)

Selected student presentations

Garcia, M., & Shea-Shumsky, B. (2016). Comparative neuronal morphology of gigantopyramidal neurons in mammals. Colorado Springs Undergraduate Research Forum, United States Air Force Academy, Colorado Springs. April 15.

Garcia, M., Shea-Shumsky, B., Tennison, M., Chui, K., & **Jacobs, B.** (2016). Neuromorphology of gigantopyramidal cells across artiodactyls, perissodactyls, feliformia, caniformia, primates, a rodent, a lagomorph, and a diprotodont. Front Range Neuroscience Meeting, Colorado State University, Fort Collins, December 7.

Lee, L., Raghanti, M. A., Lewandowski, A., Roberts, J. F., Sherwood, C. C., & **Jacobs, B.** (2013). Neocortical neuronal morphology in the infant giraffe (*Giraffa camelopardalis tippelskirchi*) and infant elephant (*Loxodonta Africana*). Colorado Springs Undergraduate Research Forum, University of Colorado, Colorado Springs. April 13.

Johnson, N., Sherwood, C.C., Manger, P.R., & **Jacobs, B.** (2013). Comparative morphology of cerebellar cortex neurons in clouded leopard, Siberian tiger, humpback whale, and chimpanzee. Colorado Springs Undergraduate Research Forum, University of Colorado at Colorado Springs, Colorado Springs. April 13.

Wahl, D., Hof, P.R., Sherwood, C.C., Maseko, B.C. Manger, P.R., & **Jacobs, B.** (2012). Comparative neuromorphology of Florida manatee, giraffe, human, and African Elephant cerebellar cortex. Rocky Mountain Regional Neuroscience Group, Aurora Colorado. May 10.

Kennedy, D. & Harland, T. (2012). Neuronal morphology in the giraffe (*Giraffa camelopardalis*) neocortex. Colorado Springs Undergraduate Research Forum, Colorado College, Colorado Springs. April 28.

Wahl, D. (2012). Comparative neuromorphology of Florida manatee, giraffe, human, and African Elephant cerebellar cortex. Colorado Springs Undergraduate Research Forum, Colorado College, Colorado Springs. April 28.

Janeway, C. & Townshend, C. (2011). Quantitative neuromorphology in cetacea: Bottlenose dolphin (*Turisops truncatus*), north Atlantic minke whale (*Balaenoptera acutostrata acutostrata*), and humpback whale (*Megaptera novaeangliae*). Colorado Springs Undergraduate Research Forum, United States Air Force Academy, Colorado Springs. April 30.

Anderson, K. (2009). The morphology of supragranular pyramidal neurons in the human insular cortex: A quantitative Golgi study. Colorado Springs Undergraduate Research Forum, Colorado College, Colorado Springs. April 11.

Anderson, K. (2008). The morphology of supragranular pyramidal neurons in the human insular cortex: A quantitative Golgi study. Undergraduate Research Symposia in the Biological Sciences and Psychology. University of Chicago, Oct. 31-Nov. 2.

Bones, B. & **Jacobs, B.** (2008). Regional variation of basilar dendrites from supragranular pyramidal neurons of the insula cortex: A quantitative Golgi study. Colorado Springs Undergraduate Research Forum, University of Colorado, Colorado Springs. April 12.

Mendoza, J. (2008). Does musical training enhance language abilities? Colorado Springs Undergraduate Research Forum, University of Colorado, Colorado Springs. April 12.

Hass, C. & **Jacobs, B.** (2005). Dendritic morphometrics of human insular pyramidal neurons. Colorado Springs Undergraduate Research Forum. April 30.

Lee, H.W. & **Jacobs, B.** (2004) Regional dendritic variation in human insular cortex: A quantitative Golgi analysis. [Oral Presentation] Annual West Coast Biological Sciences Undergraduate Research Conference, April 24.

Lee, H.W., Travis, K., Dufault, C. & **Jacobs, B.** (2004). Regional dendritic variation in human insular cortex: A quantitative Golgi Analysis. Southwestern and Rocky Mountain Division of the American Association for the Advancement of Science, April 10.

Travis, K., & **Jacobs, B.** (2003). Regional dendritic variation in neonatal cortex: A quantitative Golgi Analysis. Colorado-Wyoming Academy of Science, April 26.

Watt, H., & **Jacobs, B.** (2003). Quantitative dendritic properties of human insular cortex. Colorado-Wyoming Academy of Science, April 26.

Travis, K., & **Jacobs, B.** (2003). Regional dendritic variation in neonatal human cortex: A quantitative Golgi Analysis. Preparing Future Faculty Conference. Boulder, CO, Feb. 1.

Creswell, J., Britt, J., Hrubes, M., & **Jacobs, B.** (2002). Putative dendritic changes following corpus callosotomy in human cortex: A quantitative and qualitative case study. Loyola Marymount College, CA, April 27. [note: more comprehensive than the 2001 presentation]

Creswell, J., Hrubes, M., & **Jacobs, B.** (2001). Putative dendritic changes following corpus callosotomy in human cortex: A quantitative and qualitative case study. West Coast Biological Sciences Undergraduate Research Conference. Santa Clara, CA, April 28.

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Sann, S. (2000). Regional dendritic variation in spine-free nonpyramidal cells: A quantitative Golgi study in humans. Colorado College Third Annual Psychology/Neuroscience Poster Day. Colorado Springs, Colorado, May 5.

Kapler, E. (2000). Cell packing density in Brodmann's areas 10 and 18 in the human cerebral cortex. Colorado College Twelfth Annual Biology Day. Colorado Springs, Colorado, April 15.

Jacobs, J. (2000). A quantitative Golgi analysis of laminae III and V neurons in four regions of human cerebral cortex: A case study. Colorado College Twelfth Annual Biology Day. Colorado Springs, Colorado, April 15.

Davenport, P. (1999). Quantitative Golgi analysis of dendritic and spine systems in the prefrontal and occipital cortices over the life-span of the vervet monkey. Colorado College Second Annual Psychology/Neuroscience Poster Day. Colorado Springs, Colorado, May 7.

Shen, T., & **Jacobs, B.** (1999). A quantitative Golgi analysis of developing dendritic systems in four regions of human cerebral cortex. 24th West Coast Biological Sciences Undergraduate Research Conference. University of California, Irvine, May 1.

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Shen, T., & **Jacobs, B.** (1998). A quantitative Golgi analysis of developing dendritic systems in four regions of human cerebral cortex. Associated Colleges of the Midwest Minority Students and Academic Careers Workshop. Ripon College, Oct. 2-3.

Prather, M., Schall, M., & **Jacobs, B.** (1998). Regional differences in dendritic and spine complexity: A quantitative Golgi analysis of human cerebral cortex. Colorado College Tenth Annual Biology Day. Colorado Springs, Colorado, April 25.

Prather, M., Schall, M., & **Jacobs, B.** (1998). Regional differences in dendritic and spine complexity: A quantitative Golgi analysis of human cerebral cortex. Colorado College First Annual Psychology/Neuroscience Poster Day. Colorado Springs, Colorado, May 1.

Jacobson, A., & **Jacobs, B.** (1998). Quantitative Golgi analysis of dendritic and spine systems in the prefrontal and visual cortices of the neonatal vervet monkey. Colorado College Tenth Annual Biology Day. Colorado Springs, Colorado, April 25.

Hovey, S., & **Jacobs, B.** (1998). Educators' perspectives on teaching with the multiple intelligences. Colorado College First Annual Psychology/Neuroscience Poster Day. Colorado Springs, Colorado, May 1.

Treml, M., & **Jacobs, B.** (1998). Quantitative dendritic and spine analyses of primary and heteromodal areas of human cerebral cortex. Colorado College First Annual Psychology/Neuroscience Poster Day. Colorado Springs, Colorado, May 1.

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Rattenbury, K., & **Jacobs, B.** (1997). The rehabilitation and acute recovery of aphasic traumatic brain injury and brainstem infarct: Two case studies. Annual Rocky Mountain Region Neurosceince Group Symposium. University of Colorado, Boulder, May 20.

Rattenbury, K., & **Jacobs, B.** (1997). The rehabilitation and recovery of aphasic traumatic brain injury and brainstem infarct: Two case studies. Southern Colorado Undergraduate Research and Creative Work Conference. University of Colorado, Colorado Springs, April 26.

Haas, S.D, & **Jacobs, B.** (1996). Quantitative dendritic and spine analyses of fifteen distinct cortical areas: A case study. Colorado College Tenth Annual Biology Day. Colorado Springs, Colorado, April 5.

Courns, K., & **Jacobs, B**. (1996). Age-related dendritic changes in human occipital and prefrontal cortices: A quantitative Golgi study. [Abstract/Poster] 21st Annual West Coast Biological Sciences Undergraduate Research Conference, San Diego, April 27.

Ferguson, J., & **Jacobs, B.** (1996). Quantitative dendritic and spine analyses of eight functionally distinct areas of human cerebral cortex. Colorado College Ninth Annual Biology Day. Colorado Springs, Colorado, April 12.

Ginardi, R., & **Jacobs, B.** (1996). Quantitative dendritic analysis of area 18 of human cerebral cortex: Age-related changes. Colorado College Ninth Annual Biology Day. Colorado Springs, Colorado, April 12.

Fisher, B., & **Jacobs, B.** (1996). Quantitative analysis of a bulimic brain: A case study. Rocky Mountain Psychological Association. Park City, Utah, April 11-14.

Courns, K., & **Jacobs, B.** (1995). Age-related dendritic changes in human occipital and prefrontal cortices: A quantitative Golgi study. [Abstract/Poster] PEW Midstates Science and Mathematics Consortium: Undergraduate Research Symposium in the Biological Sciences and Psychology. Washington University, Nov. 10-12.

Courns, K., & **Jacobs, B.** (1995). Age-related dendritic changes in human occipital and prefrontal cortices: A quantitative Golgi study. [Abstract/Poster] Associated Colleges of the Midwest Minority Students and Academic Careers Workshop. Beloit College, Oct. 7.

Baca, S. M., & **Jacobs, B.** (1995). A quantitative dendritic analysis of four functionally distinct areas of human cerebral cortex. [Abstract/Talk] Rocky Mountain Region Neuroscience Group. Denver, Colorado, May 23.

Bekhit, S., & **Jacobs, B.** (1995). Quantitative dendritic and spine analysis of speech cortices. [Abstract/Poster] National Conference on Undergraduate Research. Union College, New York. April, 20-22, 1995.

Baca, S. M., & **Jacobs, B.** (1995). A quantitative dendritic analysis of four functionally distinct areas of human cerebral cortex. [Abstract/Talk] Colorado-Wyoming Academy of Science. Colorado Springs, Colorado, April 21.

Larsen, L., Swanson, R. L., Wainwright, M. L, & **Jacobs, B.** (1995). Quantitative dendritic and spine analyses of human prefrontal and occipital cortices. [Abstract/Talk] Colorado-Wyoming Academy of Science. Colorado Springs, Colorado, April 21.

Walter, L. & **Jacobs, B.** (1995). Recovery from stroke involving the left middle cerebral artery. [Abstract/Talk] Colorado-Wyoming Academy of Science. Colorado Springs, Colorado, April 21.

Baca, S. M., & **Jacobs, B.** (1995). A quantitative dendritic analysis of four functionally distinct areas of human cerebral cortex. [Abstract/Poster] Colorado College Eighth Annual Biology Day. Colorado Springs, Colorado, April 15.

Bekhit, S., & **Jacobs, B.** (1995). Quantitative dendritic and spine analysis of speech cortices. [Abstract/Poster] Colorado College Eighth Annual Biology Day. Colorado Springs, Colorado, April 15.

Kernan, R., & **Jacobs, B.** (1995). Hierarchical cognitive function and neuronal complexity: A quantitative dendritic and spine analysis. [Abstract/Poster] Colorado College Eighth Annual Biology Day. Colorado Springs, Colorado, April 15.

Baca, S. M. (1995). A quantitative dendritic analysis of four functionally distinct areas of human cerebral cortex. [Abstract/Talk] Fourth Annual Undergraduate Psychology Seminar. Colorado Springs, Colorado, Feb. 25.

Walter, L. (1995). Recovery from stroke involving the left middle cerebral artery. [Abstract/Talk] Fourth Annual Undergraduate Psychology Seminar. Colorado Springs, Colorado, Feb. 25.

Baca, S. M., & **Jacobs, B.** (1994). A quantitative dendritic analysis of four functionally distinct areas of human cerebral cortex. [Abstract/Poster] Associated Colleges of the Midwest Minority Students and Academic Careers Workshop. Mount Vernon, Iowa, Oct. 1.

Selected senior theses

Beck Shea-Shumsky	2017	Comparative neuronal morphology of gigantopyramidal neurons in mammals
Madeleine Garcia	2017	Comparative neuronal morphology of gigantopyramidal neurons in mammals
Korbyn Ukasick	1017	The potential for flow within the structure of closed-skill individual sports and open-skill team sports
Mackenzie Tennison	2016	Comparative neuronal morphology of gigantopyramidal neurons in felines, primates, ungulates, the wallaby, and the rat
Molly Winston	2016	Pupillometry in healthy controls: Age as a predictor of the pupillary light response
Dylan Mohr	2015	Apical dendrites across species
Brian Kopex	2015	Apical dendrites across species
Cameron Johnson	2015	Quantitative neuromorphology in the neocortex of the Siberian tiger and clouded leopard
Laura Lee	2014	Neocortical neuronal morphology in the infant giraffe (*Giraffa camelopardalis tippelskirchi*) and infant African elephant (*Loxodonta africana*)
Nicholas Johnson	2013	Comparative morphology of cerebellar cortex neurons in Ccouded leopard, Siberian tiger, humpback whale, and chimpanzee
Deb Kennedy	2012	Neuronal morphology in the giraffe (*Giraffa camelopardalis*) neocortex
Tessa Harland	2012	Neuronal morphology in the giraffe (*Giraffa camelopardalis*) neocortex

Devin Wahl	2012	Comparative neuromorphology of Florida manatee, giraffe, human, and African elephant cerebellar cortex
Sam McCune	2012	The Localization, morphology, and function of Betz cells
Jennifer Morishita	2012	Obsessive-compulsive disorder and the female reproductive cycle
Caroline Janeway	2011	Investigation of cortical neuromorphology in three cetacean species: Bottlenose dolphin (*Tursiops truncates*), north Atlantic minke whale (*Balaenoptera acutorostrata acutorostrata*), and humback whale (*Megaptera novaeangliae*)
Courtney Townshend	2011	Neuromorphology of cetacean neocortex: Bottlenose dolphin (*Tursiops truncates*), north Atlantic minke whale (*Balaenoptera acutorostrata acutorostrata*), and humback whale (*Megaptera novaeangliae*)
Erika Pirotte	2011	Effects of multiple concussions in the National Football League: Chronic traumatic encephalopathy
Jessica Borst	2010	Quantitative morphology of supragranular pyramidal neurons in elephant cerebral cortex
Markus Hannan	2010	Quantitative morphology of elephant neurons
Brittney Moore	2010	Recovery and rehabilitation: The effects of stroke on language
Samara Haver	2010	The neuronal basis of theory of mind in the autistic brain
Kaeley Anderson	2009	The Morphology of Supragranular Pyramidal Neurons in the Human Insular Cortex: A Quantitative Golgi Study
Ryan Casserly	2009	Like a Rock: Contributions of Proprioceptive and Motor Systems in Embodied Grounding [with Tomi-Ann Roberts]
Hanna Gleason	2009	Neurophysiology of Meditation and Well-Being
Jessica Rice	2009	Comparison of Three-Dimension Neuronal Reconstructions: Neurolucida Lucivid vs Neurolucida Camera
Jaime Webster	2008	The effects of neglect on children's brain growth, attachment patterns, and emotional development
Matthew Shepherd	2008	Mirror neurons
Brooks Robinson	2008	Variation in dendritic morphology in human insular cortex
Brian Bones	2008	Quantitative study of dendritic extent in human insula
Jenny Mendoza	2007	Does musical training enhance language abilities?
Rosemary Tracy	2007	Positive psychology as a treatment for mental illness
Molly Long	2007	The neurobiology of meditation

Brittany Bishop	2007	Qi and Its Mechanisms in the Body and Brain: Scientific Support
Yi, Crystal	2006	The native language neural commitment hypothesis and language acquisition
Neophytou, Andreas	2006	Allelic frequencies of seven STR loci in the Greek-Cypriot Population [with Ralph Bertrand, Distinction—Neuroscience]
Michel, Courtney	2006	Morphological gender differences in human insula: A quantitative Golgi study
Tearse, Phill	2006	Gender differences in the left human insula: A quantitative Golgi study
Hass, Charlie	2005	Dendritic morphometrics of human insular pyramidal neurons [Distinction—Neuroscience]
Dionne, Kalen	2005	The morphological effects of polybrominated diphenyl ether (PBDE) exposure on cortical pyramidal neurons in the postnatal rat: A quantitative dendritic analysis [with Lori Driscoll, Distinction—Neuroscience]
Steffen, Emilie	2004	"Oh! Thanks goodness! You you have:" An examination of aphasia diagnosis and classification [with Kristi Erdal]
Lee, Hyo Won	2004	Regional dendritic variation in human insular cortex: A quantitative Golgi study [Distinction—Neuroscience]
Travis, Katie	2003	Regional dendritic variation in neonatal human cortex: A quantitative Golgi analysis. [Distinction—Neuroscience]
Watt, Hilary	2003	Quantitative dendritic properties of the human insular cortex.
Jennifer Godfrey	2002	Relationships between clicks, whistles and accuracy of task performance in bottlenose dolphins (*Tursiops truncates*) [with Kristi Erdal]
John Rino	2002	Neuromorphological analysis of apical and basilar dendrites in BA10: A quantitative Golgi analysis
David Heister	2002	Apical and basilar dendrites of layer III pyramidal cells of Brodmann's area 10 in the human cortex: A quantitative Golgi analysis
Jon Britt	2001	Elongated basilar dendrites on cortical pyramidal cells in adult callosotomy patients: A quantitative Golgi study [Distinction—Neuroscience]
Johanna Creswell	2001	Quantitative and qualitative analysis of dendritic systems following callosotomy in humans: A Golgi-Kopsch study
Melody Hrubes	2001	Effect of corpus callosotomy in BA4, BA10, and BA44 dendrites in human cortex

Jon Faust	2001	The effects of formalin fixation on the Golgi-Kopsch and rapid Golgi methods [Distinction—Neuroscience]
Sharon Sann	2001	Regional dendritic variation in spine-free nonpyramidal cells: A quantitative Golgi study in humans [Distinction—Neuroscience]
Elisa Kapler	2000	Cell packing density in Brodmann's areas 10 and 18 in the human cerebral cortex [Distinction—Neuroscience]
Jesse Jacobs	2000	A quantitative Golgi analysis of laminae III and V neurons in four regions of human cerebral cortex: A case study [Distinction—Neuroscience]
Clarissa Parker	2000	The effect of environmental enrichment on a mandrill's (*Mandrillus sphinx*) psychological well-being.
Clara Vondrich	2000	Teaching a zoo-reared orangutan an imitative concept: A pilot study [Distinction—Neuroscience]
Ting Shen	2000	A quantitative Golgi analysis of developing dendritic systems in four regions of human cerebral cortex
Bethany Gaddis	1999	Behavioral dysfunctions resulting from frontal lobe damage: A case study
Peter Davenport	1999	Quantitative Golgi analysis of dendritic and spine systems in the prefrontal and occipital cortices over the life-span of the vervet monkey
Melissa Prather	1998	Regional differences in dendritic and spine complexity: A quantitative Golgi analysis of human cerebral cortex [Distinction—Psychology]
Annelise Jacobson	1998	Quantitative Golgi analysis of dendritic and spine systems in the prefrontal and visual cortices of the neonatal vervet monkey
Sonja Hovey	1998	Educators' perspectives on teaching with the multiple intelligences
Melinda Treml	1998	Quantitative dendritic and spine analyses of primary and heteromodal areas of human cerebral cortex [Poster only]
Kumi Rattenbury	1997	The rehabilitation and acute recovery of aphasic traumatic brain injury and brainstem infarct: Two case studies [Distinction—Neuroscience]
Kelly Courns	1997	Age-related dendritic changes in human occipital and prefrontal cortices: A quantitative Golgi study. [Distinction--Neuroscience]
Katharine Raker	1997	Dolphin consciousness: A social psychological perspective
S. Daniel Haas	1997	Quantitative dendritic and spine analysis of fifteen distinct cortical areas: A case study
Jennifer Ferguson	1996	Dendritic and spine analyses of eight functionally distinct areas of human cerebral cortex [Poster only]

Michael Allen	1996	Age-related dendritic changes in the human prefrontal cortex: A quantitative Golgi study [Distinction--Psychology]
Reneé Ginardi	1996	Quantitative dendritic analysis of area 18 of human cerebral cortex: Age-related changes
Haven Iverson	1996	The role of development in violent behavior
Rebecca Kernan	1996	Hierarchical cognitive function and neuronal complexity: A quantitative dendritic and spine analysis [Distinction--Psychology]
Eric Kuhn	1995	Isolation of epinephrine, norepinephrine and dopamine receptor sites in the medial medulla of the rat brain utilizing tyrosine hydroxylase immunocytochemistry. [with Carolyn Glaubensklee, Biology; Distinction--Biology]
Ashwin Budden	1995	The pineal hormone melatonin and circadian rhythms: Implications for neonatal care
Stacy Traylor	1995	"The best part of my body": Children's developing theories of brain
Lori Walter	1995	Recovery from stroke involving the left middle cerebral artery
Birgit Fisher	1995	A quantitative dendritic analysis of human primary motor and supplementary motor areas, the angular gyrus and prefrontal areas [Distinction--Psychology]
Serapio Baca	1995	A quantitative dendritic analysis of four functionally distinct areas of human cerebral cortex [Distinction--Psychology]
Becky Swanson	1994	Quantitative dendritic and spine analysis of human frontal and occipital cortices [Distinction--Psychology]
Lori Larsen	1994	Quantitative dendritic and spine analysis of human prefrontal and occipital cortices [Distinction--Psychology]

EXHIBIT 6

Declaration of William Keith Lindsay

I, William Keith Lindsay, declare as follows:

Introduction and Qualifications:

1. My full name is William Keith Lindsay. I am also known more generally, and in some published work, by the name Keith Lindsay. I was awarded Bachelor of Science with Honours in Zoology from the University of British Columbia, Vancouver, Canada, in 1974. I completed an MSc in Zoology at the University of British Columbia in 1982, under the supervision of Professor A.R.E. Sinclair, with a dissertation entitled "Habitat selection and social group dynamics of African elephants, in Amboseli Kenya." I received a PhD in Zoology at the University of Cambridge in 1994, under the supervision of Dr. S.K Eltringham, for my dissertation entitled "Feeding ecology and population demography of African elephants in Amboseli, Kenya." I have published over forty scholarly articles related to elephants. My CV, which lists these articles, is attached as **Exhibit A**.
2. I submit this Declaration in support of the Nonhuman Rights Project, Inc.'s petition for a writ of habeas corpus regarding the captive elephants at the Cheyenne Mountain Zoo. I have personal and professional knowledge of the facts to which I attest, and I am not a party to the proceedings.
3. I am a natural resources advisor/monitoring & evaluation expert with over 40 years of professional experience in Southeast Asia, Africa, Latin America, the Caribbean, North America and Europe, in planning, conducting and evaluating field projects and in senior administrative and leadership roles. I was a senior staff member at the Oxford-based consultancy, The Environment & Development Group (EDG), during 1994-2013. I undertook a variety of long- and short-term consultancy missions and project work, both independently and with EDG, in project/programme monitoring and evaluation, environmental assessment and land-use planning, community-based natural resource management, protected area monitoring and management, and biodiversity research and conservation. Since 2013, I have been an independent consultant on assignments for international donor agencies and nongovernmental organizations (NGO) in Africa and Asia.
4. My life-long involvement with elephants began in 1977 when I joined the Amboseli Elephant Research Project (AERP) in southern Kenya. I went on to undertake and complete my MSc and PhD research projects on feeding ecology and population processes, through observational study of free-ranging wild African elephants in their natural environment. I

have remained a Collaborating Researcher with AERP, focusing on ecosystem change, elephant ranging, and human-elephant co-existence. There has been cross-over into my professional work; since the late 1980s/early 1990s, I have had elephant-focused assignments in all parts of Africa, including southern Africa (elephant management policies in Botswana and South Africa), Central Africa (regional elephant conservation coordination for the Convention on Migratory Species), West Africa (research on the movements, population structure and habitat requirements of the Gourma elephants in Mali) and East Africa (Kenya's national elephant strategy, woodland habitat conservation in Tanzania). My work in Asia includes community-based natural resource management and conservation in elephant-populated regions of Cambodia and Thailand and promotion of human-elephant coexistence in Myanmar. My current concerns include stopping the international trade in ivory and live elephants through supporting African elephant range states in a coordinated action on CITES (the Convention on the International Trade in Endangered Species) and facilitating dialogue towards resolution of human-elephant land-use conflict, in partnership with practitioners within and between Africa and Asia. For the past 10 years, I have been active in promoting improved well-being for elephants held in captivity in North American, European, and Asian zoos and circuses.

5. My participation in academic groups include as Associate Fellow, 2003-2006, Environmental Change Institute, University of Oxford, and Member, 2009-present, Oxford Centre for Tropical Forests, University of Oxford. I have been a member of the IUCN/ Species Survival Commission's African Elephant Specialist Group (AfESG) during 1992-2001 and more recently from September 2020 to present.
6. Much of my experience with elephant biology derives from my work with African savanna elephants but the fundamental principles of elephant ecology and behavior are applicable to African forest elephants and to Asian elephants. There is extensive literature on all three species, and while there are certainly documented distinctions between them in terms of habitat and food choices, and social behavior and relationships, the similarities due to common phylogeny and physical attributes and needs far outweigh these differences of detail. Throughout this document, I will simply refer to 'elephants,' but the consequences apply equally to all elephant taxa. The observations herein apply generally to captive elephants as well as those living in the wild.

Autonomy and higher cognition demonstrated in elephants' foraging decisions and use of space

7. As the largest living land animals, elephants have proportionately enormous metabolic requirements and thus the greatest need to find sufficient nutrients for maintenance, growth and reproduction (Christiansen 2004). They are the ultimate generalist herbivores, and they satisfy this ongoing need for nutrition by selecting diets from the diverse vegetation on offer in complex and constantly variable natural ecosystems (Roever *et al.* 2012; Woolley *et al.* 2011; Lindsay 1994). These ecosystems present both foraging opportunities and existential risks from natural and human hazards.
8. To navigate their way through this landscape of potential rewards and threats, elephants have evolved sensory systems and cognitive capacities that allow them to develop and exhibit flexible and responsive decision strategies, appropriate to each individual animal as well as to members of their social groups, to cope and prosper in the face of these multi-layered challenges (Poole & Granli 2009).
9. It has now been recognized that elephants possess complex cognitive abilities comparable in many respects to higher primates and cetaceans. Byrne & Bates (2011) reviewed the findings of research on elephants in the wild and in captivity and confirmed their significant capacity in several areas of physical and social cognition:
    - Physical cognition:
        - Knowledge of environmental spaces and objects
        - Use of tools and understanding of causality
        - Learning to discriminate among features and categories
        - Quantity judgments
    - Social cognition
        - Knowing about others and their interactions
        - Communication and social manipulation
        - Social learning
        - Theory of mind
10. Elephants display a high degree of autonomy in the choices they make throughout their decades-long lives. Several of the aspects of elephants' physical cognition, particularly in the way they find their way around their natural environment, its rewards and hazards, will be discussed in the sections below.

Foraging strategies: selectivity, manipulation, memory, anatomy and cognitive ability

11. Elephants select items from all parts of plants and a vast range of species in plant communities (Poole & Granli 2009; Lindsay 1994). The major component of biomass in

most plants is structural materials, including fibrous stems, branches, and roots. Down the abundance scale, with less fibre and greater soluble cell contents, are leaves and finally the most nutritious plant parts: fruits, seeds and flowers. In order to satisfy their large absolute forage needs, elephants must include in their diets large quantities of coarse plant material and cell walls, with varying degrees of lignification, and relatively smaller amounts of easily digestible material. The relative amounts of digestible plant parts will vary greatly between plant communities, and between seasons in the same locations (Roever *et al.* 2012; Duffy *et al.* 2011).

12. An elephant's foraging strategy must be able to respond to these changes, making use of the best foraging opportunities at any given time and place. These opportunities present themselves in areas of land ranging from tens to many thousands of square miles, depending on the productivity of the plant communities and their spatial extent (Sukumar 2003). In zones that are more stable and well-watered within and between years, large amounts of digestible plants will be more-or-less continuously available and there may be little need to cross more than a few square miles in search of food. In the more arid savannas and semi-deserts of sub-Saharan Africa, the timing and localization of rainfall events is much less predictable between years and their range areas are necessarily much larger, and flexible (Young *et al.* 2009, Duffy *et al.* 2011). Paradoxically, the forests of much of Asia and the African Congo basin provide relatively little food at ground level, with biomass and leaf canopy locked up in treetops. Forest elephants rely on scattered and ephemeral openings in the forest cover and seasonally fruiting trees for their forage (Campos-Arceiz & Blake 2011). To achieve the optimal nutritional intake, elephants must have considerable capacity for spatial and categorical memory of the localities of the plants available in the best foraging sites and their timings within such ranges (Roever *et al.* 2012).
13. There are different components to the predictability of food supplies: some plant communities, such as wetlands, will be continuously productive although with possibly less nutritious/more fibrous food, while others may be temporarily productive only during times of abundant rainfall yet may have highly nutritious plant components. The pattern of food abundance can change between years, varying between times of drought and plenty (Birkett *et al.* 2012). In forests, the timing of fruiting varies between different tree species, which are widely distributed and often isolated. Elephants must learn and remember all these locations and timings, and are able to recall them when appropriate (Polansky *et al.* 2015). Older elephants retain knowledge of past events and locations of food and water that were appropriate at specific times of drought or plenty, and they teach this knowledge to younger

family members (McComb *et al.* 2001).

14. This memory spans years and even decades, and there is evidence that older female elephants in family groups have better survival in droughts than do younger animals, and they can lead their companions to the best spots that had been favorable in the past (McComb *et al.* 2001). Areas of the brain active in spatial memory are well-developed in elephants (Jacobs *et al.* 2011). But to make use of this memory, they must also be able to put memories together with current sensory information, as they make the correct, context-appropriate decisions on the direction and distance to move (Polansky *et al.* 2015, Jacobs *et al.* 2014).
15. With their highly developed sense of smell, and in combination with hearing thunder, elephants can detect the direction of distant rainstorms that will result in flushes of fresh vegetation (Birkett *et al.* 2012). Olfactory areas of the elephant brain are also highly developed (Jacobs *et al.* 2014).
16. The location of other necessary resources, and their spatial and temporal availability, are searched for, monitored, remembered, and recalled. An elephant must drink large amounts of water at least every few days. Thus they must find sources of clean water for drinking. Other resources include: water or mud for cooling/wallowing; minerals - if they cannot be found in vegetation, then areas of salty soil or rock ('salt-licks') must be located; and shelter, such as tree canopies, for relief from the sun during the heat of the day (Boult *et al.* 2019).
17. Elephants' bodies are adapted for covering large distances. The average distance of ground covered per day is a remarkably consistent at ±10km in 24 hours (as evident in a variety of studies reviewed in Miller *et al.* 2016). This figure has been documented across very different biomes, from arid deserts, through different semi-arid savanna types, to moist tropical forests (Douglas-Hamilton 1998, Leggett 2009, Wall *et al.* 2013, Wyatt & Eltringham 1974, Merz 1986, Galanti *et al.* 2000). Within this stable daily movement pattern there is, however, a wide range in distance traveled in any given day, from less than 1km when foraging locally to 30km or more of directed movement when moving to new foraging areas.
18. Striding over large areas is accomplished most efficiently with long legs, and as longer legs evolved, there was the parallel evolution of foraging anatomy to reach from ground to mouth. Modification of a prehensile upper lip has led to the development of the trunk seen today (Shoshani 1998), which is a highly specialized organ useful not only for different forms of feeding, but also for drinking, olfaction, grooming, visual and auditory social

signaling, and other motor functions.

19. Studies of foraging elephants (*e.g.* Guy 1976, Short 1981, Lindsay 1994) have documented that a wide range of food items is chosen from hundreds of species of plants, including fruits, buds, leaves, climbing shoots, flowers, growing stems, woody stems and branches, bark, and roots. Because it forms continuous ground cover and is easy to pluck/harvest, grass forms a significant portion of elephants' diets when it is available and abundant. All grass parts - flowers/ seeds, leaves, stems, and roots - are eaten, as and when each is most nutritious at the time of year and growth stage. Each item of food requires specific processing and handling, to select the most nutritious, digestible bits and discard the less digestible parts or those holding soil or other contaminants (Poole & Granli 2009).

Use of trunk, other body parts and tools

20. The musculature of the trunk requires millions of sensory and motor nerve connections, and the trunk is capable of both immense strength and fine control in selecting, picking up, and moving objects in the environment. Elephants use their trunks in extremely dexterous manipulation of food items, analogous to the human hand in its ability to handle objects with delicate control, with the added quality of olfaction (Rasmussen & Munger 1996). As in humans, the evolution of this manipulation organ required accompanying neural development (Onodera & Hicks 1999).
21. Other food preparation techniques include the lifting and moving of branches to reveal lush grass beneath. Such adjustment of the local environment implies a deeper understanding of the localization of plant productivity. Elephants also use other body parts to process food items. Tusks are used in different ways: to cut grass stems, break twigs and branches, carve bark from trees, dig for roots or water. Feet are used in kicking up roots, crushing, or flattening thorns (Poole & Granli 2009).
22. Tools may be fashioned from tree branches and used to pry into bark or dig salty soil from ground sources. Tools in the form of branches serving as 'back scratchers' are also used for grooming, and matts of vegetation may be used as sunshades (Hart *et al.*2001).

Acute awareness of and response to risk factors in the environment

23. Elephants have a keen awareness of risk factors in their environment and they make swift assessments and take appropriate responses. Predation is a key risk. Very young calves are vulnerable to attack by lions, and when these predators are detected, all family members are cooperatively protective; alerted by a specific alarm call, they will rush to protect the

calf and chase away the predator. Older females in particular show rapid and appropriate responses (McComb *et al.* 2011).

24. The primary risk to elephants, however, is human beings. There are two ways that this presents itself: through competition in the way they use land and through killing for the ivory trade (Thouless *et al.* 2016). In land use competition, elephants can themselves come into conflict with human groups who practice both agriculture and livestock husbandry.
25. Elephants are displaced when their previously available wild habitat is converted to agriculture or settlement (Mmbaga *et al.* 2017). When this happens, there is active competition for the use of those fields, particularly when the plants in fields are more attractive to elephants than the vegetation on offer in natural habitats. Elephants make the rational foraging choice of preferring these more nutritious food sources to many of their natural foods that are declining in quality (Osborn 2004). Elephants also come into direct conflict with livestock owners who may also be semi-mobile pastoralists. There is more scope for the sharing of livestock grazing lands, but the key points of conflict are at waterpoints. Again, there is injury and mortality on both sides of this conflict (Kuriyan 2002).
26. There is very rapid learning by elephants of the dangers posed by these potential conflicts. One way that they avoid the conflict is to change their movement and foraging patterns to times of day when people are less active. Typically, this is at night. Elephants' 'raids' into agricultural fields are most common at night, as are visits to livestock waterpoints. If there is a protected area (national park or other designated wildlife protection zone) in the vicinity, elephants will retreat into it during daylight hours and emerge at night into the surrounding lands (Douglas-Hamilton *et al.* 2005). Evidence from radiotracking of elephants shows that they move much more quickly through landscapes they share with humans, from one zone of perceived relative safety to another (Graham *et al.* 2009).
27. Killing of elephants by rural villagers or armed gangs for their ivory is a much greater threat to elephants in the immediate term. Elephants can detect alarm calls from some considerable distance and avoid the area where killings take place (O'Connell-Rodwell & Wood 2007). Again, they seek the refuge provided by protected areas when they are secured by wildlife agencies.
28. There is clear evidence that elephants' response to humans is based on an ability to distinguish the risk posed by different human groups. Playback experiments show that this is mediated by vocal cues – they can recognize and respond to the sounds of Maasai warriors as distinct from that of women and children, and other ethnic groups, and respond

with a flight response to the former but not the latter McComb *et al.* 2014). There is a similar ability to differentiate among types of humans through visual and olfactory cues (Bates *et al.* 2007).

Human-elephant conflict transformed to coexistence through negotiation

29. Many different attempts to mitigate or eliminate human-elephant conflict have been attempted over the past decades. Several of these have involved aggressive deterrence methods or hard barriers. But they have been met with mixed success, in large part because elephants are able to respond and find ways around them. The most effective responses to such conflicts treat elephants as autonomous and sentient beings and work with their biological nature to achieve solutions that promote coexistence rather than conflict (Shaffer *et al.* 2019).
30. One commonly used approach has been to try to scare elephants when they enter fields, with the use of firecrackers, 'thunderflashes', or shots from guns. While these measures may work in the short term, elephants soon discover that the noises are localized and generally nonlethal. Their use, however, does make the elephants more fearful and, thus, potentially more aggressive in their approach to humans (Davies *et al.* 2011).
31. Electric fences are erected by people to keep elephants out of crop fields (e.g. Kioko *et al.* 2008). Elephants, while initially deterred, respond to the hazard of electric shocks by handling the 'hot' wire with non-conducting tusks; they are then able to snap the wire and enter the field. They may also break fences by pushing other elephants into them; both these approaches demonstrate higher cognitive ability and autonomy. But it is the use of branches and logs as tools to break fences that is their most impressive feat. And these techniques, once discovered are rapidly copied and replicated by other elephants, a form of cultural transmission. The use of these fences, which deliver a powerful shock, also make elephants more aggressive and more likely to attack humans in retaliation.
32. More effective fences have been developed that recognize elephants' natural aversion to pungent plant products, such as chillies (Osborn 2002), and to the stinging attacks of honey bees (King *et al.* 2017). Fences using these more natural approaches have the additional advantage of providing a livelihood supplement to the farmers. A fence system that startles elephants with strobe lights, rather than alarming noises, has also proven effective; indeed, several of the described methods are more effective if used without noise-makers (Davies *et al.* 2011). Early warning systems, where observers share information about the presence of elephants in an area or near contested sites, have allowed more targeted, preventive

approaches for reducing damage to human life, property, and livelihoods (Sugumar *et al.* 2013, Graham *et al.* 2011).

33. As noted above, it is now increasingly recognized by conservation workers that elephants are autonomous and sentient beings, and that coexistence can be achieved by people entering into 'negotiation' with elephants (Shaffer *et al.* 2019). Such programmes have reduced the use of aggressive methods that serve only to escalate the tension between humans and elephants and increase the potential for mutual harm. Instead, they emphasize more positive approaches that work with elephants' perceptions and decision-making, allowing them some autonomy in their movements and feeding choices, while at the same time protecting human interests (e.g. Songhurst *et al.* 2016).

Summary of elephants' intrinsic cognitive qualities and needs based on their use of space

34. Elephants, in their detailed understanding of, and carefully tailored responses to, the challenges of their natural habitats, demonstrate a deep degree of autonomy, sentience, and judgment in their foraging and movement strategies. The strategies for flexible, reactive problem-solving and decision-making make use of elephants' highly developed anatomical, sensory, and cognitive adaptations and abilities, and are fine-tuned over decades of experience in navigation of environments with both predictable and unpredictable elements. The experiences gained over a lifetime are then shared between members of their strongly bonded social groups through example, teaching, and learning. When we recognize that these qualities of elephants are deeply ingrained through millennia of evolutionary selection and adaptation to their particular native ecosystems, we must inevitably move from a position of domination towards appreciation of them as creatures deserving of, and requiring, autonomy to the greatest extent possible in appropriate environmental conditions.

Observations on minimum standards for captive elephants

35. It is instructive to consider some of the so-called "standards" for the husbandry of elephants held in captivity that have been developed and modified over time by different zoo associations and other concerned groups. A discussion of these standards, in comparison to the actual needs of elephants, is presented below.

36. The Standards of the American Association of Zoos and Aquariums (AZA 2022) specify the following minimum acceptable spatial areas for indoor and outdoor enclosures for its member zoos:

- Indoor: Females – 37m^2 (400 square feet) per animal; females with calves – 56m^2 (600 sq.ft.); Males – 56m^2 (600 sq.ft.)
- Outdoor: Females and males – 500 m^2 (5,400 sq.ft. or 0.12 acre).

The AZA standards also specify minimum figures for size and composition of social groups:

- Females: 3 adult females; Males: 2 adult males; Mixed group: 3 adults of either sex.

37. For the purpose of comparison, it is worth considering the current standards of the British and Irish Association of Zoos and Aquariums (BIAZA 2019). They go some way beyond AZA standards, having increased steadily over recent years, and include:

- Indoor: Females – 300m^2 (3,229 square feet) for up to and including 4 females; additional females 80m^2 each (861 sq.ft.); Males – 160m^2 each (1,722 sq.ft.)
- Outdoor: Females and males – 3,000m^2 for any shared space (32,290 sq.ft. or 0.75 acre); this is a minimum and a much larger space for 5 or fewer females and males of 20,000m^2 (4.9 acres) is considered desirable.

The BIAZA Standards minimum figures for size and composition of social groups are:

- Females: 4 compatible adult females; Males: at least 2 adult males of different ages in bachelor groups and with the opportunity of mixing with females.
- All elephants must have the option to get away from other elephants if so desired, through use of space and visual or physical barriers in the enclosure.

38. The "Best Practice" guidelines developed by the Coalition for Captive Elephant Well-Being (Kane *et al.* 2005), which were the result of a meeting attended by elephant husbandry and welfare experts and zoo professionals at Tufts University in 2004, are intended to take greater cognizance of elephant biology. The CCEWB recommends the following minimum conditions for space:

- Indoor: Females – 60m^2 (645 sq.ft.) per animal, overnight; 185m^2 (1,990 sq.ft.) per animal in winter quarters (i.e. longer term); males – 110 m^2 (1,184 sq.ft.) overnight; 320m^2 (3,444 sq.ft.) winter quarters
- Outdoor: Females and males – Sufficient to allow walking of 10 km (6.2 miles) per day.

and for social groups and companions:

- African savanna elephants: 10 individuals; African forest elephants and Asian elephants: 5 individuals
- Females; related animals and socially bonded animals never separated; Males: separated from their maternal group only by or after sexual maturity (10 years or older); Sub-adult and adult males: separate facilities, including separate night quarters and yards for male elephants, as well as the option of common housing and yards for males and females.

39. The fundamental biological needs of elephants have been established by the extensive scientific research undertaken thus far on the living elephant species in their natural ranges, as described in part above. A comparison between the sets of space and housing standards with each other, and with the evidence from elephant biology, makes it clear that the minimum standards adopted by the AZA for zoos located in the United States are weaker than both those of the United Kingdom and of the CCEWB elephant welfare experts, which are themselves also inadequate when compared to elephants' natural lives.
40. The AZA standards for social conditions are equally inadequate. These guidelines appear to be a compromise between the actual needs of elephants and the financial and logistical difficulties faced by AZA member zoos in meeting such requirements, with the balance tilted firmly towards the latter criteria.
41. All of these standards fall far, far short of fulfilling elephants' requirements for space and sociality in both indoor and outdoor facilities (in fact, by several orders of magnitude).
42. A review by Atkinson & Lindsay (2022) has argued persuasively that "*Quality space means that elephants can forage in natural, diverse vegetation, walk for miles each day, and exert a high degree of control over their social interactions. They suffer in zoos psychologically and physically because of the limits of what can be provided within such restricted environments.*" They conclude that, for captive situation, only "*100ha or more of diverse, natural habitat in a warm climate would offer individual elephants the opportunity to live fulfilling lives.*"

Information sources and observations of Missy, Kimba, Lucky, Lou Lou, and Jambo at the Cheyenne Mountain Zoo

43. There are five African savanna elephants currently resident at Cheyenne Mountain Zoo. Their history of capture at early age and movement between numerous locations, along with observations of their present state indicates that they have led lives with very limited

ability to exercise their autonomy. In relation to the quality of their lives in captivity, I have studied the following information sources:

Satellite imagery

- A satellite image on Google Earth Pro (©2022; version 7.3.4.8642), image date October 6, 2019, showing the Cheyenne Mountain Zoo elephant exhibit. Zooming and moving around this image allowed visual inspection of the elephant enclosure and its features. The Ruler tool was used for measuring linear distances and areas of polygons to estimate the dimensions and size of the elephant enclosures and their features.

Documents

- A Word document, with publicly available hyperlinks, summarising the location and management of the Cheyenne Mountain Zoo and its elephant exhibit, along with the history of the five elephants and others that have been held at the Zoo. Available at: https://bit.ly/3EGlMTH.

Websites

- The CMZ official website, https://www.cmzoo.org/, including items in its Archive, https://www.cmzoo.org/news/archive/.
- Facebook posts: 6 posts, listed in the References.
- YouTube videos: 14 videos, listed in the References.
- The Elephant Database. A database that attempts to collate information on all elephants held in captivity worldwide. Its accuracy depends on the information supplied by informants and should be viewed with a healthy critical eye. Available at: https://www.elephant.se/.

Photographs and video clips

- 63 image files (in *.jpg format), showing aspects of the elephant compound, the barn and the elephants. Available at: https://bit.ly/3kr6onn
- 18 short video clips (*.MOV format) of varying length, showing aspects of the elephant compound, the barn, the elephants and zoo visitors. Available at: https://bit.ly/3Zo3E8R

Information on the elephants held at Cheyenne Mountain Zoo: present and past

44. All of elephants currently held at CMZ are female African savanna elephants with the following details:

- Missy: Age 53, taken from an unknown location in Africa at an early age, passing through three other zoos for close to 40 years before arriving at CMZ in 2015. She is currently blind in the left eye and, while reportedly energetic, receives injections for arthritis.
- Lou Lou: Age 40, taken from Kenya in 1984 at 2 years of age, spending 31 years at an animal trader and two other zoos – the same as Missy's last two zoos – before coming to CMZ in 2015 along with Missy.
- Kimba: Age 45, taken from South Africa's Kruger Park in 1977 at 3 years of age, spending one year at an animal trader in Michigan before coming directly to CMZ in 1981.
- Lucky: Age 42, taken from Kruger Park in 1980 at 1 year of age, coming to CMZ in 1981 together with Kimba via the same animal trader. She receives injections for arthritis.
- Jambo: Age 39, taken from an unknown location in Africa in 1985 at age 2 by an animal trader in Florida, then spending 26 years in a range of performance and elephant encounter venues in California, arriving at CMZ in 2011. She killed a keeper in 2010, before a scheduled performance in a circus act.

45. The history of other elephants held at CMZ, largely in the early half of the 20th century, is not particularly successful. They include three African savanna elephants and three Asian elephants, all of whom are now dead. There have been no births at CMZ. The African savanna elephants, two females, and a male were:

- Malaika: A female, recently died at age 37; taken from an unknown location in Africa in 1987 at age 1 to a "wildlife ranch" in Texas, then to a "wild animal park" in California where she spent 20 years before coming to CMZ in 2008. She has had a long history of problems with her legs, particularly her right rear foot and leg, and has been unable to stand up without intervention on two occasions.
- Penny: A female, died at age 47; taken from an unknown location in Africa in 1956 at age 2 by a German animal trade company and soon moved to CMZ, where she remained until moving at age 27 to Omaha's Henry Doorly Zoo. She died in 2001, with the cause described as "*disease: infection associated; mechanical abnormality*". This sounds like

a foot infection, which is a very common cause of death for elephants in captivity (Fowler & Mikota 2006).

- Timbo: A male, died at age 9; taken from an unknown location in Africa in 1959 at age 1, moved at age 3 to Denver Zoo and to CMZ one year later in 1962. He was euthanized in 1967, with the cause of death said to be "*musculoskeletal, bacterial*". Again, this does sound like an infection of one or more feet.

The female Asian elephants were:

- Shirley Temple: Died at an unrecorded age; taken from an unknown location in Asia at an unrecorded age or date, came to CMZ in 1937 via at least two zoos in California, moved after 5 years at CMZ to a succession of 7 different circuses and other performance venues including a New York drive-inn movie theatre, where the record ends in 1958.
- Penny: Died at age 10; taken from an unknown location in the wild in Asia in 1948 at age 2, coming via a private zoo in California to CMZ in that year, moving after 5 years at CMZ to Lee Richardson Zoo in Kansas where she died in 1956 from an unrecorded cause.
- Tessie: Died at an unrecorded age; taken an unknown location from the wild in Asia and arrived at CMZ from Lincoln Park Zoo in Chicago in 1900. She died of an unrecorded cause in 1913.

The elephant facilities and their management

46. It is clear to me in my professional opinion that the facilities and their management at the Cheyenne Mountain Zoo fall far short of fulfilling the physical and psychological needs of the five elephants, including the need to exercise their autonomy, in both indoor and outdoor facilities.
47. The elephant exhibit was redeveloped and reopened in 2013 as the Wilgruen Elephant Center in its Encounter Africa. The total area of Encounter Africa was reportedly 10 acres (Earls 2013); this included space for a group of seven meerkats and the five-member lion pride as well as the elephants and a male rhino. The Elephant Center was said to be designed specifically with the goal of providing support for aging female African elephants (CMZ 2020). The area is likely to include all the infrastructure and off-exhibit management facilities as well as the elephant barn and the different compounds/ yards and visitor

facilities, including a "skyway" that allows close proximity to the elephants by zoo customers and a training area where the public can observe and feed elephants directly.

48. The zoo is privately owned and located in the outskirts of Colorado Springs, CO. It is said to be 40 acres in a larger 150 acre property of mountain slopes, surrounded by conifer forest on all sides, but with housing developments – and a golf course – less than 0.2 miles to north and south. The main access road runs past the elephant exhibit at a distance of 100-150 yards.

49. The indoor and outdoor areas provided to the elephants have been examined with different information sources. Information on the structure of the indoor quarters has been gleaned from examination of the Google Earth images, a number of relevant YouTube videos and posts on the CMZ website.

50. The size of the elephant living space within the barn is estimated, from examination of the Google Earth image of the barn, to be a maximum of 2,000 yd^2. It appears to subdivided into a number of stalls separated by bars for holding individual elephants and a larger, apparently communal, area with deep piles of sand and various feeding apparatuses. The floor of the stalls spears to be covered with a rubberized concrete surface. The elephants are said to share the barn with a male eastern black rhinoceros. The walls and ceiling are metal, reflecting sounds and making the barn interior a noisy place.

51. This barn might be physically spacious enough to "hold" the current number of elephants, but only for a few hours of any given day. It is completely unsuitable for keeping them confined for any more than this brief amount of time; confinement for any longer periods is likely to lead to foot and joint damage from standing on the hard substrate, and psychological damage from the noise and the frustration of prevented choice and movement.

52. The size of the outdoor exhibit area, Elephant Encounter, is said to be several acres. It is divided into three yards, and has a pond and artificial waterfall. There is a walking route, called the Elephant Trek, running alongside the outdoor compounds, and a separate "Vacation Yard". Examination of the Google Earth satellite image indicates that the various sections available to the elephants have the following dimensions:

- Main yard, including the pond and waterfall: 0.52 acres. Long axis = 65 yards; width = 45-50 yards
- Middle yard: 0.11 acres. Long axis = 40 yards; width = 15 yards
- Back yard: 0.14 acres. L-shaped, with long axes = 40 and 50 yards; width = 10 yards.
- "Demo" area, for training/ public feeding: 0.06 acres (280 sq.yards).

The total area of the three yards, plus the training area, comes to 0.83 acres in the main elephant exhibit. There is an additional area, known as the "Vacation Yard", of conifer woodland on the opposite (north) side of the barn from the other outdoor compounds – see below.

As noted above, the natural ranges of elephants are much, much larger, by several orders of magnitude than these tiny exhibit areas.

53. There is a walking path or Elephant Trek, with an estimated distance is 0.23 miles (= 405 yards), or half a mile (810 yards) for a return trip. The elephants appear to be enticed along the path by Zoo staff throwing food rewards – fruit or vegetables – ahead of them along the path. It is not clear how often each individual elephant is taken for a walk in this way, but observations of grassy patches suggest that it is not as frequent as the daily walks that are suggested by zoo sources. It is said to be for exercise and enrichment, indicating that the Zoo management recognizes the confined nature of the main compounds and the need of such additional exercise for the elephants' health.
54. The so-called "Vacation Yard" is most commonly described in zoo information sources to be 2 acres in size. An estimate from an examination of the Google Earth image suggests that it is roughly triangular in shape, with a long axis of about 150 yards, and a width at the base of 90 yards. It is available to the elephants for only a few days per month during the season of maximum plant growth – the Zoo's demonstration videos were taken in the month of June of different years. This area is described as popular with the elephants, who enjoy the opportunity to forage on natural vegetation, including both grass and woody plants. However, the timing and frequency of use by the elephants appear to be dictated more by Zoo management concerns over the preservation of the vegetation than by where the elephants would prefer to spend their time.
55. The maximum linear distance available for directional walking within the largest exhibit yard is little more than 65 yards; in the Vacation Yard, it is 150 yards. While the Walking Path offers a greater distance to walk, it is not clear how often this is used and even it offers a tiny fraction of the miles that elephants cross on a daily basis in natural environments. All of the movements of elephants within the different yards and along the Walking Path are controlled directly and exclusively by Zoo staff.
56. The outdoor area and its management are described below:

- Much of the ground cover in the exhibit yards is bare, compact soil. The terrain is a mixture of steep slopes and smaller flat areas. The steep slopes, while providing exercise opportunities for muscle maintenance, could also be risky for the elephants with poor limb health. In all the exhibit yards, there is little stimulation or room to explore; a few boulders are stuck in the ground and there is a 20ft. waterfall in the large exhibit. While this landscaping may look appealing to the visiting public, the features provide no novelty or variety to the elephants themselves. They do nothing to alleviate the tedium of these sterile surroundings.

- There is some shade provided by three "umbrellas" that appear to be about 8 yards in diameter, with an area of some 50 sq.yd. each. The landscaping appears to be designed more to project a feeling to visitors of a quasi-natural environment, rather than providing anything meaningful to the elephants.
- There is a pond in the main exhibit area, which appears to be deep enough to support an elephant's body weight, to take weight off their feet; there is a video showing Kimba playing in it, but it is not clear how often this occurs and how many of the elephants use it. An artificial waterfall is generally a feature of more interest to visitors than to the elephants, as it will have quickly become a part of everyday life. The most that can be said is that it provides a source of drinking water and occasional amusement, but it is also a constant source of high frequency noise.

57. In combination with the bleak appearance and size limitation of the enclosures, there are several deficiencies in the management, including the feeding regime. It appears that a variety of food items, including hay and occasionally woody browse are scattered on the ground or suspended from hooks or baskets. Richer food, such as vegetables, fruit or alfalfa cubes may be fed during training sessions, interactions with the public or as enticements for carer-directed movements. There are also small niches in the mock termite hills and other sites where food can be hidden for the elephants to find. None of these "enrichment" efforts would provide much stimulation to the intellect of elephants when compared to natural foraging challenges; elephants would soon grow accustomed to the predictable routine of these food provision modalities. And none would be necessary, of course, in a natural habitat, or an appropriate sanctuary, with extensive areas of native vegetation.
58. It appears that the elephants are moved into their stalls when zoo staff go off duty, spending at least half their day and probably longer in the close confines of the barn. On cold days, they are kept in the barn all day. As elephants in the wild are actively moving for up to 18 hours every 24-hour period, this involuntary confinement is both physically and

psychologically harmful. It also removes agency from the elephants, depriving them of the basic need to make their own decisions on how and where they spend their time.

59. The handling modality of the elephants by keepers appears to be protected contact, but with considerable control over movements and placement in exhibit areas. This control is exerted by enticing the elephants to follow trails of food rewards in the form of fruit and vegetables offered ahead of them. According to the Zoo's website, the elephants are all moved between exhibit areas every two hours or so, with regular separation of socially bonded females from each other.

60. The zoo staff give public demonstration of training and health inspection in the Demo area, reportedly twice daily. Such performance in front of a noisy public is undoubtedly disturbing to the elephants. There is also a twice-daily scheduled session where paying members of the public can participate directly in feeding them food items by hand. Other hands-on sessions are offered in behind-the-scene "VIP" visits. Additional hands-on interactions include "painting" sessions, where an elephant may daub paint on a card that is held up by a keeper.

61. The behavioral repertoire of the five elephants in the Cheyenne Mountain Zoo is extremely limited, widely divergent from that of free-ranging elephants, and indicative of the pathology of zoo husbandry. Observations from the video clips and photographs have informed this conclusion. When the elephants are not simply standing and feeding, they can be seen to walk between the front and back yards on the same path every time. There is no variety in their lives, no challenge to employ their mental capacity for exploration, spatial memory, or problem-solving. There is no opportunity to employ their wide range of vocalisations, to communicate and interact with a range of other elephants over distance.

62. The best that could be said for the current elephants is that they do not appear to have personality conflicts that result in aggressive actions between them. This situation does not sound like a positive outcome. There are two pairs of females who have spent many years together; Lucky and Kimba have been together at CMZ for 39 years, while Missy and Lou Lou have been together at three different zoos for over 35 years. It is not clear how much social interaction there is between them and the others, or of what nature – affiliative, aggressive or ambivalent.

Summary of elephant management by the zoo

63. The elephants are managed very intensively, with much hands-on training, exercise activities, occasional exposure to natural foraging, and constant movement between

different yards and activity centres. There is much emphasis placed on "enrichment", which appears intended to provide novelty and stimulation to the elephants' minds, to accompany the apparent concern for maintaining their bodily health. The zoo management appear sincere in their wish to support their "elderly, geriatric" female elephants as much as possible. However, all of this intervention is imposed on the elephants, with all vestiges of autonomy having been removed. The delight experienced when they are allowed to forage naturally is the default situation in the wild, and in good sanctuaries. There is no need for "yoga" stretches, carer-led use of the walking path, or the various forms of "enrichment" provided when elephants are allowed to choose how to spend their daily cycle in different foraging, wallowing and resting sites.

64. In addition, elephants need the freedom to choose their own social companions, to avoid antagonism and bond in social groups with compatible others. In an area the size of the current zoo compounds, and under the intensive management regime, there is little opportunity to form and maintain such separate sub-groups.

65. It is now accepted that elephants experience permanent damage to their brains as a result of the trauma endured in impoverished environments (Jacobs *et al.* 2021). However, it is less clear whether this impact is more damaging when the animal has had a longer period of independent, nature-based living before the deprivation, whether the trauma occurs earlier or later in their lives. Most of the elephants currently held in zoos were either born in captivity or taken from the wild at a very early age. The female elephants at CMZ all appear to have been removed from the wild between the ages of 1 and 3 years and then kept in zoo or circus conditions for the remainder of their lives.

Conclusions

66. On the basis of my review of the sources of evidence I have studied and my analysis in relation to my own extensive professional knowledge and understanding of elephants' undeniable biological needs, I conclude that Missy, Kimba, Lucky, Lou Lou, and Jambo are not being kept in anything close to a satisfactory environment that is consistent with an acceptable life for an elephant.

67. The life of these five elephants at Cheyenne Mountain Zoo is nothing but a succession of boring and frustrating days, damaging to their bodies and minds, and punctuated only by interaction with their keepers. Their physical and psychological health has been severely compromised by the sustained deprivation of their autonomy and freedom of movement. They spend at least half, if not more, of each day in a barn with very little cushioning for

their feet and joints. When allowed outside, they are commonly unable to walk more than 100 yards in any direction, they have limited shade from the sun, and only one artificial water feature is just about deep enough to allow proper bathing. The elephants receive predictable enrichment activities while at the same time are subjected to constant controlled, directed movements between the zoo compounds, are unable to communicate over large distances, and their acute hearing is bombarded by constant auditory disturbances from the artificial waterfall, the nearby road and the visitors who can approach them closely.

68. My professional conclusions and recommendations are:

- The five elephants should be moved, as soon as possible, to a "rewilding" facility in their native Africa or to a suitable elephant sanctuary in the United States. If there is a possibility of rewilding the elephants, then that scenario should be considered. However, if rewilding is not viable, the elephants should be immediately relocated to a suitable elephant sanctuary according to practices that are well-established by sanctuary professionals. They were all taken from the wild at an early age and have spent all their remaining years in the barren confines of zoo compounds or, in some cases, the much worse conditions of performance venues. Their behavior has been completely controlled by his human handlers, and for this reason has been stressful to the point of psychological damage.
- There is no obstacle to their recovering some measure of successful and fulfilling lives in the favourable ecological and social surroundings of a large, appropriate habitat area such as a sanctuary.
- Cheyenne Mountain Zoo should never be used again to keep elephants captive, for public display or for any other purpose.

I declare under penalty of perjury under the law of Colorado that the foregoing is true and correct.

Executed on the 22nd of May, 2023

at Oxford, United Kingdom

William Keith Lindsay, Ph.D

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Waterfall fun! – 6 August 2017 https://www.facebook.com/watch/?v=10155767909781019

Missy enjoying a BIG mound of sand! - 6 July 2016 https://www.facebook.com/watch/?v=10154457084281019

Abnormally Normal: CMZooZen with LouLou – 27 April 2020 https://www.facebook.com/watch/?v=160782708637296

Cheyenne Mountain Zoo – 6 March 2019 https://www.facebook.com/CMZoo/videos/766677163717453/

YouTube videos

Elephants at the Cheyenne Mountain Zoo in Colorado Springs (Short) - 20 Sept 2022 https://www.youtube.com/watch?v=8-Fne6oUWw4

Elephant Feeding Experience at Cheyenne Mountain Zoo - 13 Apr 2021 https://www.youtube.com/watch?v=cz5NJhKQJ5Y

Abnormally Normal: Training with Lucky, African Elephant - 23 Mar 2020 https://www.youtube.com/watch?v=Cp-kZQ02wx4

New Elephant Barn: Checking Out the Barn - 6 Sept 2011 https://www.youtube.com/watch?v=cK9j8t3msS4

Jambo Walks the Elephant Trek With Keeper Ilana - 20 Apr 2012 https://www.youtube.com/watch?v=OBoDA00AsmI

Lucky The Elephant Takes A Walk @ Cheyenne Mountain Zoo (04-19-19) - 20 April 2019 https://www.youtube.com/watch?v=cX6ju70fKQY

Elephants socializing at the Cheyenne Mountain Zoo – 30 November 2014
https://www.youtube.com/watch?v=OZ-7zWgXuIY

Cheyenne Mountain Zoo! – 15 September 2018
https://www.youtube.com/watch?v=Ln3Z9B0K9UU

Lucky Painting (African Elephant) - 22 November 2011
https://www.youtube.com/watch?v=48_RtO1i1MM

Elephant gets upset during training at Cheyenne Mt – 19 March 2015
https://www.youtube.com/watch?v=mhC44WJfYI0

Jensen Kids Feeding Elephant at Cheyenne Mountain Zoo – 19 August 2015
https://www.youtube.com/watch?v=WyZY_WC64DU

Cheyenne Mountain Zoo celebrates Missy the elephant's 50th birthday - 1 July 2019
https://www.youtube.com/watch?v=UqrIzuCRIjo

A Tusk Update on Malaika, CMZoo African Elephant – 28 March 2019
https://www.youtube.com/watch?v=xw_tpqiQpiU

African elephant, Malaika, receives emergency assistance - 1 April 2019
https://www.youtube.com/watch?v=CDmLW04H1uU

Exhibit A

Curriculum Vitae

Name	William Keith LINDSAY
Profession	Natural Resources Advisor/ Monitoring & Evaluation Expert
Date of Birth	5 November 1952
Nationality	Canadian / British (dual citizenship)

Key experience

Keith Lindsay is a natural resources advisor/ monitoring & evaluation expert with over 40 years' professional experience in Southeast Asia, Africa, Latin America, the Caribbean, North America and Europe, in planning, conducting and evaluating field projects and in senior administrative and leadership roles. He was a senior staff member at the Oxford-based consultancy, The Environment & Development Group (EDG), during 1994-2013. He undertook a variety of long- and short-term consultancy missions and project work, both independently and with EDG, in project/programme monitoring and evaluation, environmental assessment and land use planning, community-based natural resource management, protected area monitoring and management, and biodiversity research and conservation. Since 2013, Dr Lindsay has been an independent consultant on assignments for international donor agencies and NGOs in Africa and Asia.

Dr Lindsay has been actively involved in research on the ecology of African elephants with the Amboseli Elephant Research Project of southern Kenya since 1977, focussing on the relationships between habitat conditions, foraging behaviour and population dynamics. His work continues on policy support for elephant conservation, international trade in ivory and live elephants under CITES, and efforts to improve their well-being in both the wild and captivity.

Education

Ph.D. Zoology, 1995, University of Cambridge
M.Sc. Zoology, 1982, University of British Columbia, Vancouver, Canada
B.Sc. (Hons.) Zoology, 1974, University of British Columbia, Vancouver, Canada

Summary of selected employment record

- Myanmar: Monitoring & evaluation of Human-Elephant Coexistence project (Elephant Family, 2019-present)
- UK/ Europe: Support to African Elephant Coalition, CITES CoPs & Intersessional Committees (Fondation Franz Weber, 2017-present)
- Tanzania: Terminal Evaluation Kilombero wetlands conservation (Enabel - Belgium, 2018)
- UK/ Brussels: Revision of project design for Sustainable Wildlife Management Project (EU/FAO, 2018)
- UK: CITES Information Document on live trade in African elephants (Humane Society International, 2017)
- Japan: Survey and report on solitary elephants in Japan's zoos (Elephants in Japan/ Zoocheck, 2017)
- Kenya: Guidelines for transboundary conservation projects in Africa (European Commission, 2017)
- Mongolia: Results Framework, Forest conservation project (FAO, 2015–16)
- UK/ South Africa: Support to African Elephant Coalition, CITES CoP17 (FFW, 2015-16)
- Tanzania: Mid-term Evaluation CBNRM project suite (EC, 2015–16)
- Tanzania: MTE southern Tanzania parks (SPANEST) project (UNDP/GEF, 2015)
- Thailand: MTE Sustainable management of biodiversity (SMBT) project (UNDP/GEF, 2014–15)
- Zambia: Benefit sharing study in Zambia's Game Management Areas (UNDP, 2014–15)
- Cambodia: Revision of MTE of Sustainable Forest Management project (UNDP/GEF, 2014)
- UK/ Global: Revision of Monitoring & Reporting Framework for UNREDD, 2011-15 (FAO, 2013-14)
- Botswana: Terminal Evaluation Improved Sustainability of Protected Areas project (UNDP/GEF, 2013)
- UK/ Central Africa: Gaps & options for elephant conservation in Central Africa (CMS/UNEP, 2011)
- Kenya: National Conservation & Management Strategy for Elephants (Kenya Wildlife Service, 2007–08)
- South Africa: Contributing author SA Elephant Assessment (CSIR, 2007)
- South Africa: Corresponding member Science Round Table (Dept. Env. Affairs & Tourism, 2005–06)
- Cambodia: MTE Conservation of Cardamom Mountains forest (UNDP/GEF, 2004-05)
- UK/ Chile: Technical support at CITES CoP12 (Care for the Wild International, 2002, 2004)
- Mali: Initiating Measures to Protect Gourma Elephants (US Dept. of State/ USFWS, 2003–2005)
- Jordan: Range ecologist (IFAD, July 1995)
- Botswana: Support to stakeholders' conference: African Elephant in the Context of CITES (EU, 1994)
- Botswana: Wildlife Ecologist/ Elephant policy, Department of Wildlife & National Parks (EU, 1988-92)
- Kenya/ UK: Research & analysis, PhD - Amboseli elephant ecology, University of Cambridge (1982-87)
- Kenya/ Canada: MSc - Amboseli elephant ecology, University of British Columbia, (1977-82)
- Kenya: Field ecologist Amboseli National Park (New York Zoological Society, 1977-79, 1983)

Publications

Scientific publications and technical reports

Lindsay, K., Chase, M., Landen, K. & Nowak, K. (2017) The shared nature of Africa's elephants. *Biological Conservation*, 215:260-267.

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Lindsay, K., Kiiru, W. & Sitati, N. (2008) *Kenya National Elephant Conservation and Management Strategy – Draft*. Report to Kenya Wildlife Service, Government of the Republic of Kenya, Nairobi.

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Media articles:

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Power Point presentations:

2018: *Elephants in Japan.* PAWS International Captive Wildlife Conference 2018, 9-11 November 2018. Performing Animal Welfare Society, Los Angeles.

2018: *Elephant conservation: International trade in live African elephants: an update.* PAWS International Captive Wildlife Conference 2018, 9-11 November 2018. Performing Animal Welfare Society, Los Angeles.

2018: *The lives of elephants in the wild and in captivity.* 9th International Symposium on Primatology and Wildlife Science. 3-5 March, 2018. Primate Research Institute, Kyoto University. During March 2018, the presentation was also given to meetings for: the City Council of Kofu: a group of zoo keepers and Directors including the Executive Officer of the Japanese Association of Zoos and Aquariums in Morioka; a public audience in Tokyo.

2016: *Elephant conservation: International trade in ivory and living elephants.* PAWS International Captive Wildlife Conference 2016, 11-13 November 2016. Performing Animal Welfare Society, San Andreas.

2014: *Elephants, captivity and conservation.* PAWS International Captive Wildlife Conference 2014, 8-10 November 2014. Performing Animal Welfare Society, Los Angeles.

2012: *An update from Amboseli Elephant Research Project: Reliable knowledge about elephant biology and conservation.* PAWS Summit for the Elephants 2012, 28-30 March 2012. Performing Animal Welfare Society and Oakland Zoo, Oakland.

2012: *Foraging and ranging of wild African elephants: implications for captive management.* PAWS Summit for the Elephants 2012, 28-30 March 2012. Performing Animal Welfare Society and Oakland Zoo.

2011: *Elephant conservation: Living in the real world.* Toronto Elephant Summit: Elephant challenges: Climate, care and costs. 16 April 2011. Toronto City Council and Toronto Zoo.

2006: *Elephant needs in captivity: Learning from nature.* Chicago City Council and Lincoln Park Zoo, 23 February 2006, Chicago.