



## Elephant Conservation: Reviewing the Need and Potential Impact of Cognition-based Education

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Conservation education programs centered on animal cognition seem to be effective in bringing humans closer to non-human species and thereby, influencing their conservation attitudes. Systematic evaluation of the impact of cognition-based education programs on the attitudes of participants has revealed positive feedback and an appreciation towards the species of interest. However, such evaluations are rare for species like elephants, which suffer severe conservation challenges such as high degrees of conflict with the local community. In this paper, we review the need for cognition-based education programs in elephant conservation as well as the need to evaluate these programs to assess their impact on conservation attitudes. In particular, we emphasize the need for such programs in the native ranges of elephants, which are more prone to human-elephant conflict, and argue that exposure to such programs may potentially increase the collaboration of the local community towards conservation efforts.

Education programs are an integral component of conservation efforts, both in situ and ex situ, with numerous studies reporting positive changes in attitude after implementation of these programs (Ancranetz, 2007; Ballantyne, Packer, Hughes, & Dierking, 2007; Burnett, Sills, Peterson, & DePerno, 2015; Espinosa & Jacobson, 2012; Hungerford & Volk, 1990). Strategies used to implement these educational programs range from community-based participation and exposure to wild animals for in situ educational programs (Chatterjee, 2008; Kideghesho, Røskaft, & Kaltenborn, 2007; Kuhar, Bettinger, Lehnhardt, Townsend, & Cox, 2007; Mehta & Heinen, 2001) to incorporation of live animals and interactive displays for ex situ educational programs (Awasthy, Popovic, & Linklater, 2012; Ballantyne et al., 2007; Brewer, 2002; Kruse & Card, 2004). However, few studies have examined the role that knowledge on animal minds (used interchangeably with animal cognition) plays in attitude change regarding conservation (Bielick & Karns, 1998; Bowler, Buchanan-Smith, & Whiten, 2012; Harley, Fellner, & Stamper, 2010; Sickler et al., 2006).

Evidence of the public's fascination with animal cognition is widespread, ranging from documentaries on animal cognition (e.g., *Ape Genius* on NOVA, Rubin, 2008, and *Inside the Animal Mind* on PBS, Kaufman, 2008) to popular news and magazine articles on animal cognition (e.g., National Geographic's article: *Minds of Their Own*, Morell, 2008), both of which include some of the "superstars" of the animal cognition world, such as Alex, the African Gray parrot and Koko, the gorilla. Part of this fascination with animal cognition is due to the connection we feel with non-human animals once we learn that many of them have similar abilities to our own (Bielick & Karns, 1998; Harley et al., 2010; Maust-Mohl, Fraser, & Morrison, 2012; Sickler et al., 2006). This connection, in turn, is argued to increase empathy towards the target animal/animals and, as a result, increase positive conservation attitudes (Sickler et al., 2006). In spite of this fascination with animal minds, only a few studies have assessed the impact of a cognition-based education program/exhibit on conservation attitudes. However, we do acknowledge that many conservation education programs around the

world, in addition to the few we cite here, may include some component of animal minds in their displays/presentations, but the effect of this knowledge on public attitudes has not been systematically assessed or published (Bielick & Karns, 1998; Bowler et al., 2012; Harley et al., 2010; Sickler et al., 2006).

The programs that have been assessed by these studies are the Think Tank at the National Zoo in Washington, D.C., where the public can watch cognitive research involving orangutans as well as learn about animal thinking in general (Bielick & Karns, 1998), the Living Links Center at the University of St. Andrews, where the public can watch cognitive and behavioral research involving brown capuchin (*Cebus apella*) and squirrel monkeys (*Saimiri sciureus*; Bowler et al., 2012), and the Living Seas at Disney's Epcot (Harley et al., 2010) and the Aquarium Think Tank at the New York Aquarium (Sickler et al., 2006) both of which focus on dolphin cognition. In these studies, a positive change in attitude was reported by the participants after being exposed to these programs. For example, visitors to the Think Tank at the National Zoo reported, "... a feeling of being more connected to the animal world," as well as having a more positive image of animals (Bielick & Karns, 1998, p. 16). Sickler et al. (2006) also reported that visitors to the Aquarium Think Tank reported an increased appreciation for dolphins (which did not involve live research but was focused on educational displays of dolphin cognition), which in turn may influence their conservation and welfare attitudes towards the species. Similarly, Harley et al. (2010) reported that the majority of comments from visitors to the Living Seas at Disney's Epcot who were able to watch dolphins during a cognitive research session consisted of positive feedback. Additionally, visitors spent more time watching the dolphins during these sessions than when a session was not in place. Bowler et al. (2012) also reported a similar pattern at the Living Links Center, with visitors spending more time at the research window when given a description and explanation of the research being conducted. These findings, albeit small in number, along with the public's fascination towards animal cognition, argue the need to systematically assess the impact that knowledge on animal cognition has on conservation attitudes. This is particularly important for species that are threatened with extinction due to habitat degradation and where a sustainable co-existence with the local community is highly challenging. One such glaring example involves elephants, including both Asian (*Elephas maximus*) and African (*Loxodonta africana*) elephants.

With a steady increase in human populations leading to a decline in elephant habitats, most of the local communities in their native range face severe conflict from the largest living terrestrial species and a keystone species: the elephants (Lenin & Sukumar, 2011; Riddle, Schulte, Desai, & van der Meer, 2010). Factors contributing towards habitat loss for elephants mainly include deforestation and agricultural land conversions, which result in restricting elephants into smaller population pockets within a fragmented habitat (Leimgruber et al., 2003; Nelson, Bidwell, & Sillero-Zubiri, 2003). Due to paucity of resources in the fragmented landscape, isolated elephant populations often resort to crop raiding and thus, get into conflict with local human communities (Leimgruber et al., 2003).

Management of human-elephant conflict (HEC) is one of the major conservation challenges, which requires active participation from the local community (Nelson et al., 2003). Thus, we argue that education programs incorporating information on elephant cognition could potentially have a significant impact on increasing appreciation and empathy for these species, and in turn, impact conservation attitudes positively. We do acknowledge that changes in attitudes do not necessarily lead to long-term changes in behavior (Ballantyne et al., 2007), but we argue that attitude change is a first and important step in implementing conservation measures and changes. We also argue that with elephants being a highly social and cognitively complex species (MacLean et al., 2014; Plotnik, de Waal, & Reiss, 2006; Plotnik, de Waal, Moore, & Reiss, 2010; Plotnik, Lair, Suphachoksakun, & de Waal, 2011), a cognition-based education program will garner more interest and be more impactful to the local community. Our argument is because similar education

programs on dolphins as well as orangutans, two cognitively complex species, were successful in changing conservation attitudes of the public (Bielick & Karns, 1998; Harley et al., 2010; Sickler et al., 2006). The rest of this paper will therefore focus on discussing the current state of HEC, reviewing conservation education studies on both wild and captive Asian and African elephants, and revisiting our argument in favor of cognition-based education programs as an important tool for animal, and more specifically, elephant conservation.

### **Human-Elephant Conflict (HEC) and Education Programs**

A major concern in the field of conservation biology is HEC, incurring a huge socio-economic cost and acting as a potential threat to wild populations of elephants (Hoare 2000; Hoare, 2001; Lenin & Sukumar, 2011; Riddle et al., 2010; Sukumar, 2006). Conflict arises due to direct and indirect interactions between humans and elephants, and there are multiple reasons behind conflict, including habitat fragmentation, lack of resources, human encroachment, and elephant migration patterns (Fernando et al., 2008; Nelson et al., 2003). With the lack of quality data on elephant numbers (both Asian and African), combined with illegal killing of elephants for ivory (Blake & Hedges, 2004), it is imperative to conserve the existing population of elephants and thus develop effective mitigation measures to resolve HEC.

Mitigation measures aimed at resolving conflict have been multifaceted, including crop guarding by farmers, physical barriers like electric fences, and chemical and noise repellants (Lenin & Sukumar, 2011; Nelson et al., 2003; Osborn & Parker, 2003). However, most studies have demonstrated that a single control measure is not effective in reducing conflict and some measures are too expensive to implement under field conditions (Osborn & Parker, 2003). An integrated, low-cost approach involving the local community may be more sustainable and successful in terms of resolving HEC (Zhang & Wang, 2003). As a part of the integrated approach, conservation education programs at the community level would play a major role in altering people's attitudes towards elephants (Kwamboka, 2013), therefore leading towards a sustainable coexistence.

The rise in HEC highlights the importance of developing effective conservation education programs, both in situ and ex situ. Although ex situ programs do not directly involve communities exposed to HEC, public participation in ex situ education programs is important for raising awareness and providing funds for wild elephant conservation. For example, Hacker and Miller (2016) found that up-close elephant encounters at San Diego Zoo's Safari Park had the greatest effect on guests' conservation intent and Swanagan (2000) found that visitors who had more exposure to elephants in the form of attending elephant shows at Zoo Atlanta were more likely to support conservation (in the form of returning solicitation cards asking for their opinion on the moratorium on ivory, which were later forwarded to the White House). Additionally, many comparative psychologists engage in elephant cognition research at zoos, such as Busch Gardens (Tampa, FL), the Lowry Park Zoo (Tampa, FL), The National Zoo (Washington, D.C), Disney's Animal Kingdom (Orlando, FL), and the Oakland Zoo (Oakland, California), ranging from mirror self-recognition (Plotnik et al., 2006; Plotnik et al., 2010) and problem-solving (Foerder, Galloway, Barthel, Moore, & Reiss, 2011; Highfill, Spencer, Fad, & Arnold, 2016) to studies on personality (Grand, Kuhar, Leighty, Bettinger, & Laudenslager, 2012; Highfill, Fad, Makecha, & Kuczaj, 2013; Horback, Miller, & Kuczaj, 2013) and communication (Günther, O'Connell-Rodwell, & Klemperer, 2004; Soltis, Leighty, Wesolek, & Savage, 2009). Zoo programs that allow the public to observe this research would likely increase their appreciation and connection to elephants, similar to the dolphin cognition research program at the Living Seas (Harley et al., 2010), the Think Tank at the National Zoo (Bielick & Karns, 1998), and the primate research program at Living Links Center (Bowler et al., 2012).

Similarly, in situ conservation programs are excellent avenues in which to develop education programs with an elephant cognition component, or if an educational program is already in place, incorporate a cognitive component. Save the Elephants (STE), along with scientists and educators at Disney's Animal Kingdom, developed an educational program aimed at increasing primary school children's attitudes towards elephants in and around Samburu National Reserve. The children's attitudes before the program was implemented included a fear of elephants, mainly due to the danger they pose towards humans and their crops. Although some children displayed positive attitudes towards elephants, this was primarily due to their value as a resource (e.g., tourism, ivory). Therefore, the program was developed to increase children's perceptions of elephants as "admirable" animals by providing information on how elephants contribute to the ecosystem, the ways in which they are able to adapt to their environment, ways in which to mitigate HEC, and safe behavior when around elephants. The program utilized pre- and post-evaluations, photos, video, visual aids, and indoor and outdoor activities, including observing elephants in their natural environment. The results of the program demonstrated an improvement in knowledge and how elephants are perceived, due to a better understanding of elephant behavior as well as their similarities to humans, the latter of which provides support for the use of elephant cognition in local education programs (Kwamboka, 2013).

Many organizations working in the field of elephant conservation are in a good place to follow STE's lead. One such organization is Joshua Plotnik's Think Elephants International. Plotnik has published numerous studies on elephant cognition (MacLean et al., 2014; Plotnik et al., 2006, Plotnik et al., 2010; Plotnik et al., 2011) and started Think Elephants International (TEI) in 2011. One component of TEI's educational program consists of teaching pre-college populations about scientific research on elephant cognition and behavior, a goal that we are directly encouraging. Additionally, they have taken the first step in systematically assessing how their education program impacts the participants' knowledge by conducting pre- and post-program surveys. Preliminary comments on TEI's website suggest that the results of these surveys are encouraging regarding conservation attitudes of local pre-college populations (<http://thinkelephants.org/education/>). We argue that implementation of cognition-based elephant education programs will not only educate the local communities about the current conservation status of the elephants, but will also contribute towards developing a positive attitude towards the species-in-conflict.

Although awareness towards HEC is widespread, and funding for mitigation efforts is readily available, there has been surprisingly little focus on assessing the impact of elephant conservation education programs, both ex situ and in situ. We argue that it is essential to conduct systematic analyses on the effects that elephant education programs have on conservation attitudes, using population-based surveys that monitor the attitudes of local communities towards conflict scenarios, as well as measuring participants' involvement in conservation activities (e.g., volunteering to monitor elephant behavior/migration patterns or participating in an alternative crop program). Additionally, it is essential to determine the type/types of educational material that will have the greatest impact on conservation attitudes, including knowledge on elephant cognition. Implementation and assessment of these programs is especially important for in situ elephant conservation, particularly in HEC prone areas involving the local community, but are lacking, with no known studies assessing the impact of in situ educational programs for Asian elephants. We argue that the implementation and assessment of educational programs, including cognition-based elephant education programs, is important for measuring the attitudes of local communities in HEC prone areas, and is the first step in forming collaborations among the local communities, educators and scientific researchers in contributing towards improved conservation efforts and decision-making.

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## References

- Ancrenaz, M., Dabek, L., & O'Neil, S. (2007). The costs of exclusions: Recognizing a role for local communities in biodiversity conservation. *PLoS Biol*, *5*, e289.
- Awasthy, M., Popovic, A. Z., & Linklater, W. L. (2012). Experience in local urban wildlife research enhances a conservation education programme with school children. *Pacific Conservation Biology*, *18*, 41–46.
- Ballantyne, R., Packer, J., Hughes, K., & Dierking, L. (2007). Conservation learning in wildlife tourism settings: Lessons from research in zoos and aquariums. *Environmental Education Research*, *13*, 367–383.
- Bielick, S., & Karns, D. (1998). Still thinking about thinking: A 1997 follow-up study of visitors to the Think Tank exhibition at the National Zoological Park. *Washington, DC: Smithsonian Institution, Institutional Studies Office*.
- Bowler, M. T., Buchanan-Smith, H. M., & Whiten, A. (2012). Assessing public engagement with science in a university primate research centre in a national zoo. *PLoS ONE*, *7*, 1–9.
- Blake, S., & Hedges, S. (2004). Sinking the flagship: The case of forest elephants in Asia and Africa. *Conservation Biology*, *18*, 1191–1202.
- Brewer, C. (2002). Outreach and partnership programs for conservation education where endangered species conservation and research occur. *Conservation Biology*, *16*, 4 – 6.
- Burnett, E., Sills, E., Peterson, M. N., & DePerno, C. (2015). Impacts of the conservation education program in Serra Malagueta Natural Park, Cape Verde. *Environmental Education Research*, *22*, 538 – 550.
- Chatterjee, R. (2008). Protecting farmlands and conserving elephants. *Environmental Science and Technology*, *42*, 7029–7029.
- Espinosa, S., & Jacobson, S. K. (2012). Human-wildlife conflict and environmental education: Evaluating a community program to protect the Andean bear in Ecuador. *Journal of Environmental Education*, *43*, 55–65.
- Fernando, P., Kumar, M. A., Williams, A. C., Wikramanayake, E., Aziz, T., & Singh, S. M. (2008). Review of human-elephant conflict mitigation measures practiced in south Asia. *AREAS technical support document submitted to World Bank. WWF – World Wildlife Fund for Nature*.
- Foerder, P., Galloway, M., Barthel, T., Moore, D. E. III., & Reiss, D. (2011). Insightful problem solving in an Asian elephant. *PLoS One*, *6*, e23251.
- Grand, A. P., Kuhar, C. W., Leighty, K. A., Bettinger, T. L., & Laudenslager, M. L. (2012). Using personality ratings and cortisol to characterize individual differences in African elephants (*Loxodonta africana*). *Applied Animal Behaviour Science*, *142*, 69–75.
- Günther, R. H., O'Connell-Rodwell, C. E., & Klemperer, S. L. (2004). Seismic waves from elephant vocalizations: A possible communication mode?. *Geophysical Research Letters*, *31*, 1–4.
- Hacker, C. E., & Miller, L. J. (2016). Zoo visitor perceptions, attitudes, and conservation intent after viewing African elephants at the San Diego Zoo Safari Park. *Zoo Biology*, *35*, 355 – 361.
- Harley, H. H., Fellner, W., & Stamper, M. A. (2010). Cognitive research with dolphins (*Tursiops truncatus*) at Disney's The Seas: A program for enrichment, science, education, and conservation. *International Journal of Comparative Psychology*, *23*, 331–343.
- Highfill, L., Fad, O., Makecha, R., & Kuczaj, S. (2013). Asian elephants (*Elephas maximus*) may demonstrate stable personalities. *International Journal of Comparative Psychology*, *26*, 223 – 240.
- Highfill, L., Spencer, J. M., Fad, O., & Arnold, A. M. (2016). Performance on a means end task by Asian elephants (*Elephas maximus*) in a positive reinforcement-based protected contact setting. *International Journal of Comparative Psychology*, *29*, 1–10.
- Hoare, R. E. (2000). Projects of the human - elephant conflict taskforce (HETF) - results and recommendations. *Pachyderm*, *28*, 73–78.
- Hoare, R. E. (2001). Management implications of new research on problem elephants. *Pachyderm*, *30*, 44–48.

- Horback, K. M., Miller, L. J., & Kuczaj, S. A. (2013). Personality assessment in African elephants (*Loxodonta africana*): Comparing the temporal stability of ethological coding versus trait rating. *Applied Animal Behaviour Science*, *149*, 55–62.
- Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental Education. *Journal of Environmental Education*, *21*, 8–21.
- Kaufman, F. (Executive Producer). (2000). Inside the animal mind (Television series). *Green Umbrella, Thirteen/WNET New York, & the BBC*.
- Kideghesho, J. R., Røskoft, E., & Kaltenborn, B. P. (2007). Factors influencing conservation attitudes of local people in Western Serengeti, Tanzania. *Biodiversity and Conservation*, *16*, 2213–2230.
- Kruse, C. K., & Card, J. A. (2004). Effects of a conservation education camp program on campers' self-reported knowledge, attitude, and behavior. *Journal of Environmental Education*, *35*, 33–45.
- Kuhar, C. W., Bettinger, T. L., Lehnhardt, K., Townsend, S., & Cox, D. (2007). Evaluating the impact of a conservation education program in the Kalinzu Forest Reserve, Uganda. *IZE Journal*, *43*, 12–15.
- Kwamboka, V. A. (2013). Living in harmony with elephants. *International Zoo Educators Journal*, *49*, 43–46.
- Leimgruber, P., Gagnon, J. B., Wemmer, C., Kelly, D. S., Songer M. A., & Selig, E. R. (2003). Fragmentation of Asia's remaining wildlands: Implications for Asian elephant conservation. *Animal Conservation*, *6*, 347–359.
- Lenin, J., & Sukumar, R. (2011). Action plan for the mitigation of elephant-human conflict in India. Final Report to the U.S. Fish and Wildlife Service. *Bangalore, India: Asian Nature Conservation Foundation*.
- MacLean, E. L., Hare, B., Nunn, C. L., Addessi, E., Amici, F., Anderson, R. C., . . . & Boogert, N. J. (2014). The evolution of self-control. *Proceedings of the National Academy of Sciences*, *111*, E2140–E2148.
- Maust-Mohl, M., Fraser, J., & Morrison, R. (2012). Wild minds: What people think about animal thinking. *Anthrozoos*, *25*, 133–147.
- Mehta, J. N., & Heinen, J. T. (2001). Does community-based conservation shape favorable attitudes among locals? An empirical study from Nepal. *Environmental Management*, *28*, 165–177.
- Morell, V. (2008). Minds of their own. *National Geographic*, *213*, 36–61.
- Nelson, A., Bidwell, P., & Sillero-Zubiri, C. (2003). A review of human elephant conflict management strategies. *People and Wildlife Initiative. Wildlife Conservation Research Unit, Oxford University*.
- Osborn, F. V., & Parker, G. E. (2003). Towards an integrated approach for reducing the conflict between elephants and people: a review of current research. *Oryx*, *37*, 80–84.
- Plotnik, J. M., de Waal, F. B. M., & Reiss, D. (2006). Self-recognition in an Asian elephant. *Proceedings of the National Academy of Sciences*, *103*, 17053–17057.
- Plotnik, J. M., de Waal, F. B. M., Moore, D., & Reiss, D. (2010). Self-recognition in the Asian elephant and future directions for cognitive research with elephants in zoological settings. *Zoo Biology*, *29*, 179–191.
- Plotnik, J. M., Lair, R., Suphachoksakun, W., & de Waal, F. B. M. (2011). Elephants know when they need a helping trunk in a cooperative task. *Proceedings of the National Academy of Sciences*, *108*, 5116–5121.
- Riddle, H. S., Schulte, B. A., Desai, A. A., & van der Meer, L. (2010). Elephants- a conservation overview. *Journal of Threatened Taxa*, *2*, 653–651.
- Rubin, J. (Producer). (2008). Ape Genius [Television broadcast]. Boston, MA: NOVA, National Geographic Television & Film., John Rubin Productions, & WGBH.
- Sickler, J., Fraser, J., Gruber, S., Boyle, P., Reiss, D., & Webler, T. (2006). Thinking about dolphins thinking, understanding the impact of social narratives on public acceptance of cognitive science research. New York, NY: Wildlife Conservation Society.
- Soltis, J., Leighty, K. A., Wesolek, C. M., & Savange, A. (2009). The expression of affect in African elephant (*Loxodonta africana*) rumble vocalizations. *Journal of Comparative Psychology*, *123*, 222–225.
- Sukumar, R. (2006). A brief review of the status, distribution and biology of wild Asian elephants (*Elephas maximus*). *International Zoo Yearbook*, *40*, 1–8.
- Swanagan, J. S. (2000). Factors influencing zoo visitors' conservation attitude and behavior. *Journal of Environmental Education*, *31*, 26–31.
- Zhang L., & Wang, N. (2003). An initial study on habitat conservation of Asian elephant (*Elephas maximus*), with a focus on human elephant conflict in Simao, China. *Biological Conservation*, *112*, 453–459.

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