

Scholarship Statement - Bonnie M. Perdue

Broadly defined, my research focuses on cognition from a developmental and comparative perspective. My research assesses changes in cognitive abilities across evolution as well as throughout the aging process. This research allows us to better understand various mechanisms underlying cognitive abilities and how the nervous system underlies such capacities. In addition, I have studied issues relating to animal welfare, and informal science education with the general public.

I have built a network of collaborators and peers to facilitate my scholarship and provide opportunities for Agnes Scott students to engage in the research process. In my field, it is critically important to establish and maintain connections because it is not usually feasible to have direct access to animals, or the range of species on which my research relies, and I take pride in keeping these collaborations strong and productive. In particular, I am still actively collaborating with nearby institutions including the Language Research Center (LRC) of Georgia State University, Zoo Atlanta, and a local nursery school, and have also established new collaborations. These connections also provide students at Agnes Scott College with opportunities to gain unique research experience and receive rigorous training in the scientific investigation of several critically important domains of psychological research. My main areas of focus are briefly described in the following sections as well as highlights from recently published work. In addition to publishing this work in peer-reviewed journals, this work has been presented at a variety of regional and national conferences, I have organized and chaired sessions on the topics, and have had some exposure to the general public through media outlets.

Comparative and Developmental Cognition

My primary training and research focus is on the evolution and development of cognitive abilities, in particular from a neuroscience perspective. This work includes testing with a wide range of animals including those from the order Carnivora (sun bears, giant pandas, Asian small-clawed otters), the order Primate (rhesus macaques, capuchin monkeys, chimpanzees, humans), and the order Proboscidea (elephants). This process of testing a range of species allows us to better understand how various abilities might have evolved in relation to certain genetic, social or environmental factors. In this line of work, I have investigated a variety of cognitive abilities in nonhuman animals including spatial cognition, self-control, prospective memory, metacognition, and choice behavior.

Recently published work has investigated similarities in human and nonhuman animal cognition in several domains such as metacognition (Perdue, Evans, & Beran, 2018; Beran, Perdue, Church, & Smith, 2016) memory processes (Perdue, Kelly, & Beran, in press), and self-control (Beran et al., 2016). For many years, these areas of cognition were thought to be limited to, or only reasonably developed in humans. However, the recent literature reveals a robust and rich evolutionary history of this ability including some of my recent work expanding these capacities to nonhuman primates. As examples of this work, Perdue et al., 2018 reports a study of “false memory” in chimpanzees similar to the robust finding in humans that categorically related content can lead to false recognition of related items. Perdue et al., 2018 found a high degree of flexibility and sensitivity of chimpanzee metacognitive abilities by implementing a tool based task.

In the last three years, we have expanded this work to include human children ranging from 2-5 years old. We continue testing the children throughout their time at the daycare which creates a longitudinal sampling of cognitive abilities. This work broadens the comparative perspective and our understanding of the ontogeny of these abilities. In addition, by implementing repeated testing protocols in children, as opposed to a single session, we can more closely mirror the animal work. This may allow for a more nuanced appreciation for developing cognitive abilities. Recent publications from this collaborative work include perception of sensory illusions in children (Beran, Perdue, Kelly & Parrish, 2017) and an investigation of prospective memory, or remembering to do something at a future time, in young children (Kelly et al., 2018).

Future work in this field will continue to identify areas of potential overlap in human and nonhuman cognition and continued longitudinal data collection on child cognitive development. These studies can take years to complete if we are working with the same child from age 2 until 5, so some of this work is already in progress, and new projects are on the horizon. I have also been able to involve a number of Agnes Scott undergraduate students in collecting data at the daycare and will continue to do so into the foreseeable future.

*References for recent **Comparative and Developmental Cognition** work*

Beran, M. J., **Perdue, B. M.**, Church, B. A., & Smith, J. D. (2016). Capuchin monkeys (*Cebus apella*) modulate their use of an uncertainty response depending on risk. *Journal of Experimental Psychology: Animal Learning and Cognition*, 42, 32-43.
doi.org/10.1037/xan0000080

Beran, M. J., **Perdue, B. M.**, Kelly, A. J., & Parrish, A. E. (2017). What's in a face (made of foods)? Comparing children's and monkey's perception of faces in face-like images of food. *Animal Behavior and Cognition*, 4(3), 324-339. doi.org/10.26451/abc.04.03.10.2017

Beran, M.J., **Perdue, B.M.**, Rossettie, M. S., James, B. T., Whitham, W., Walker, B., Futch, S. E., & Parrish, A. E. (2016). Self-control assessments of capuchin monkeys with the rotating tray task and the accumulation task. *Behavioral Processes*, 129, 68-79. doi.org/10.1016/j.beproc.2016.06.007

Kelly, A. J., **Perdue, B. M.**, Love, M. W., Parrish, A. E., & Beran, M. J. (2018). An investigation of prospective memory with output monitoring in preschool children. *American Journal of Psychology*, 133, 201-210. doi:10.5406/amerjpsyc.131.2.0201

Perdue, B. M., Kelly, A. J., & Beran, M. J. (in press). Assessing distinctiveness effects and "False Memories" in chimpanzees (Pan troglodytes). *International Journal of Comparative Psychology*.

Perdue, B. M., Evans, T. A., & Beran, M. J. (2018). Chimpanzees show some evidence of selectively acquiring information by using tools, making inferences, and evaluating possible outcomes. *PLoS ONE*, 13, e0193229. doi.org/10.1371/journal.pone.0193229
2018

Animal Welfare

Another area that dominates much of my research is the empirical study of animal welfare. Scientists are in a unique position to design studies to investigate how to improve or optimize the welfare of animals in a variety of captive settings including pets, farm animals, zoo animals and research laboratories. By identifying objective and replicable factors that improve welfare or achieve wellness in animals, policy implications can lead to better overall welfare in a variety of contexts. Much of my interest in this area was captured in my 2013 co-authored book, *Zoo Animal Welfare*, which outlines an objective scientific approach to this topic. I have continued collecting data in this domain and recently published some of this work including several overviews and reviews of the welfare field (Maple & Perdue, in press; Perdue, Beran, & Washburn, 2018).

I recently published work on animal welfare and choice with an Agnes Scott student, Ella Brown '15, as my co-author (Perdue & Brown, 2018). This project was funded through the Professional Development Committee and investigated choice behavior in human and nonhuman primates. There is a growing literature that too much choice may be paralyzing and have other unexpected negative effects (i.e., the "paradox of choice"). We investigated this in human and nonhuman primates and found strikingly similar

patterns of preference, suggesting that this aversion to too much choice has deep evolutionary roots and may be a relevant factor to consider in animal husbandry decisions.

Within the animal welfare literature, a recently growing topic of interest relates to “cognitive bias,” or certain biases in performance that emerge as emotional state fluctuates. More traditional welfare measures are increasingly being combined with the application of a “cognitive bias” approach which has the potential to measure more subjective aspects of emotional experience. Cognitive bias describes the way in which particular affective states are associated with biases in information processing, and provides a means of potentially tapping into valence (good to bad) of animal affect. I recently published work investigating the potential mechanisms underlying these biases in nonhuman animals (Perdue, 2017)

In the Fall 2018, I began collaborating with colleagues and the veterinary staff at Emory University and Yerkes National Primate Research Center to investigate cognitive bias alongside a number of other biological measures to assess welfare and monkeys are transitioned to a new outdoor enclosure space. We intent to submit grant funding for this research in the Spring of 2019.

I will also continue to work with bears, both giant pandas and sun bears, elephants, and flamingos and otters. This work includes cognitive questions as well as empirically driven welfare research. Much of this work has been carried out in collaboration with students in my lab, leading to over 25 student first authored presentations at local conferences or college based research exhibitions. Training the next generation of comparative psychologists is one of the most exciting parts of my job and I will continue to do so.

*References for recent **Animal Welfare** work*

Maple, T. L. & **Perdue, B. M.** (in press). Duane Rumbaugh’s influence on the science and practice of animal welfare. *International Journal of Comparative Psychology*.

Perdue, B. M., Beran, M.J., & Washburn, D. A. (2018). A computerized testing system for primates: cognition, welfare, and the rumbaughx. *Behavioural Processes*. doi.org/10.1016/j.beproc.2017.12.019

Perdue, B. M., & Brown, E. R. (2018). Irrational choice behavior in human and nonhuman primates. *Animal Cognition*, 1-8. doi/10.1007/s10071-017-1156-9

Perdue, B. M. (2017). Mechanisms underlying cognitive bias in nonhuman primates. *Animal Behavior and Cognition*, 4(1), 105-118. doi.org/10.12966/abc.08.02.2017

Informal science education with the general public

My mid-tenure sabbatical involved a project to implement an educationally focused component to a zoo exhibit to engage visitors with cognitive science. This project is actually still ongoing and I have had an opportunity to engage many Agnes Scott students in this project. Specifically, we installed a video kiosk at the Sun Bear and Tiger Terrace at Zoo Atlanta to display content relating to a previous research project I had conducted on sun bear touchscreen computer cognitive testing. I wanted to investigate how exposure to scientific research might alter visitor experience, with a specific focus on visitor behavior, attitudes and knowledge. Various aspects of this work have been presented at regional and national conferences, including the Southern Society for Philosophy and Psychology (Perdue et al., 2017), the Comparative Cognition Society (Perdue et al., 2016) and an invited presentation at the American Psychological Association meeting (Perdue, 2018). I am currently in the process of submitting some of this work for publication in a peer-reviewed journal with an Agnes Scott student, Bailea Robinson '19, and intend to publish it in 2019.

This work has also led to an increased interest in collaboration with the Zoo Atlanta Education staff. We are working on plans to make continued modifications to the exhibit space and introduce interactive video kiosks that will reach a broad sampling of the public who visit the zoo.

Another extension of this work is represented in a recently submitted multi-million dollar grant to the National Science Foundation. The proposed work will bring together cognitive researchers from at least six leading institutions around the United States to form an advisory group for advancing public education opportunities at zoos. This grant was submitted in collaboration with a colleague from Emory and will be reviewed in Spring of 2019 and will yield an exciting array of new projects in the coming years.

*References for recent **Informal Science Education with the General Public** work*

Perdue, B. M. (August, 2018). *Educating the Public about Comparative Psychology*. Invited paper presented at the American Psychological Association annual meeting, San Francisco, CA.

Perdue, B. M., Smith, N., Dhingra, R., Rudolph, H. & Thomas, M. (March, 2017). Science at the zoo. Paper presented at the 108th annual meeting of the Southern

Society for Philosophy and Psychology, Savannah, GA.

Perdue, B. M. , Johnson, J., Brown, E., Johnson-Ulrich, Z., & Vonk, J (November, 2016). From touchscreen computers to zoo visitor education: Cognitive research in sun bears. Paper presented at the Fall meeting of the Comparative Cognition Society, Boston, MA.

Perdue, B. M. & Hampton, R. (under review). Cognitive connections: Developing and assessing methods for engaging zoo visitors with concepts and methods in cognitive science, National Science Foundation, 09/01/2019 – 09/01/2023

In summary

Overall, my scholarship continues to embrace a range of topics, all of which are grounded in my training and interest in cognition and the neurological and developmental processes that underlie it. I am also continuously interested in finding ways to apply that knowledge in a variety of settings including the classroom, the zoo and with the general public. I plan to continue these lines of research as outlined above for the duration of my career in academia.