Introduction to the Special Issue

Fay E. Clark[1*]

[1]Bristol Zoological Society, United Kingdom

*Corresponding author (Email: fclark@bristolzoo.org.uk)

Abstract – A special issue on the interface between cognition and care for animals in captive settings. Within the special issue are papers examining different aspects of cognitive tasks as possible outlets for different terrestrial animals often found in captive settings such as zoological facilities and laboratories.

Keywords – Cognitive enrichment, Welfare

This special issue is entitled "Cognitive Enrichment and Welfare." The interface of cognition and care is gaining interest from researchers across the globe, and a special subset of enrichment known as 'cognitive enrichment' is coming to the fore. However, cognitive enrichment is still an unfamiliar practice to many people who work with captive animals; there has been no formalized definition of cognitive enrichment and approaches have varied greatly across different captive settings. In laboratories, for example, cognitive enrichment has been used to describe broad environmental changes that affect an animal's performance on cognitive tasks. In contrast, cognitive enrichment in farms and zoos often describes cognitively challenging tasks that affect behavioral indicators of welfare. In order to establish the current state of play in this burgeoning area of research, I have collated original research articles from authors with different foundational approaches to animal cognition and welfare. The contributed papers are biased towards charismatic mammal species but this reflects bias in the field as a whole, largely due to the species we have chosen to house in captivity and study from a cognitive perspective over the past fifty years.

Cognitive scientists will be interested to learn how their experimental paradigms, originally designed to test the limits of cognitive skill, are now being implemented in far less controlled zoo settings for enrichment purposes. Animal welfare scientists will find that increasingly, their assessment frameworks are being incorporated into cognitive testing paradigms to ensure that cognitive research is not detrimental to animal welfare. This special issue aims to highlight how cognition and care can merge, resulting in research which should ultimately enhance captive animal welfare standards.

I begin the special issue with a review of the entire field of cognitive enrichment entitled "Cognitive Enrichment and Welfare: Current Approaches and Future Directions." In this paper (Clark, 2017), I explore in detail the many approaches to cognitive enrichment thus far, and identify several common difficulties. These include how to provide the correct level and frequency of cognitive challenge to captive animals; how to assess whether cognitive skill is being stimulated sufficiently; how to provide cognitive enrichment practically to isolated animals and social groups; how to assess the welfare outcomes of challenge; and finally, how staff and visitor perceptions of cognitive enrichment affect its

uptake and development. The paper concludes with several practical suggestions for incorporating computer technology into cognitive enrichment. For researchers who are less interested in highly computerized animal management strategies, I also promote the behavioral concepts of 'competence' and 'agency' to stimulate cognition over a wider environmental canvas.

The review article is proceeded by four research papers on capuchin monkeys, squirrel monkeys, macaque monkeys, gorillas, and rhinoceroses, housed in laboratories, zoos, and associated research centers. The first research paper takes a highly novel approach to cognitive enrichment, which does not aim to provide cognitive challenge via physical tasks or devices. In "Is Mixed-Species Living Cognitively Enriching? Enclosure Use and Welfare in Two Captive Groups of Tufted Capuchins (*Sapajus apella*) and Squirrel Monkeys (*Saimiri sciureus*)," Daoudi, Bahidi, and Buchanan-Smith (2017) examine whether two primate species that are sympatric in the wild may provide cognitive enrichment to each other. The authors conclude that mixed species housing was not cognitively enriching as per their working definition, but did provide appropriate cognitive challenges contributing towards enhanced welfare.

Next, the special issue addresses how cognitive bias research could be used to investigate the effects of environmental changes such as enrichment on affective state. Two papers address this research focus. First, McGuire, Vonk, Fuller, and Allard (2017) introduce a new method for assessing "optimism" and "pessimism" in zoo gorillas as a function of a forage manipulation task. In "Using an Ambiguous Cue Paradigm to Assess Cognitive Bias in Gorillas (*Gorilla gorilla gorilla*) during a Forage Manipulation" the researchers concluded that an ambiguous cue paradigm, although it avoids some problems associated with more traditional cognitive bias tests, may be rendered ineffective due to subjects' innate preferences for particular stimuli. Thus, this paper serves as a cautionary note on the challenges of adequately assessing affective states in nonverbal species, while also advocating for the importance of such methods. Second, Perdue (2017) recognizes that in parallel to advancements in cognitive enrichment, we require advancements in our ability to assess enrichment via cognitive bias testing and more specifically the methods we use. Perdue's fresh insight offers another word of caution to researchers in this field. In "Mechanisms Underlying Cognitive Bias in Nonhuman Primates," responses by rhesus macaques (*Macaca mulatta*) and tufted capuchins (*Cebus apella*) in laboratory cognitive tasks may not be solely due to changes in affective state; they may also be affected by external factors such as changes to the payout structure of the task.

The final paper in this issue, "Simple but Temporally Unpredictable Puzzles are Cognitive Enrichment," evaluates the enriching properties of a physical object. Krebs and Watters examine how the incorporation of time-delays and audible cues transform a relatively simple food puzzle into an enriching cognitive challenge for an Eastern black rhinoceros (*Diceros bicornis michaeli*). This exciting example of collaborative and crowd-funded zoo science puts a new spin on traditional feeding puzzles, taking the design of a commercial dog feeding toy and making it suitable for the cognitive needs of a large ungulate. Rather than providing a static challenge, the rhino is able to control the location of the task.

This is the first known collection of peer-reviewed articles to address the interface of cognition and care; it will therefore act as a springboard for further debate. My greatest hope is that "Cognitive Enrichment and Welfare" will help to foster new research collaborations. As researchers in this area (or indeed researchers interested in joining), we require an ability to be critical but non-judgmental of research paradigms used in laboratories, farms, and zoos, and a willingness to learn from, and build upon, approaches in each setting. I am grateful to the Chief Editors of *Animal Behavior and Cognition* for encouraging this special issue and for their unwavering support in all stages of the process.

References

Clark, F. E. (2017). Cognitive enrichment and welfare: Current approaches and future directions. *Animal Behavior and Cognition, 4,* 52–71. doi:10.12966/abc.05.02.2017

Daoudi, S., Badihi, G., & Buchanan-Smith, H. M. (2017). Is mixed-species living cognitively enriching? Enclosure use and welfare in two captive groups of tufted capuchins (*Sapajus apella*) and squirrel monkeys (*Saimiri sciureus*). *Animal Behavior and Cognition, 4*, 72–90. doi:10.12966/abc.06.02.2017

Krebs, B. L., & Watters, J. V. (2017). Simple but temporally unpredictable puzzles are cognitive enrichment. *Animal Behavior and Cognition, 4*, 119–134. doi:10.12966/abc.09.02.2017

McGuire, M. C., Vonk, J., Fuller, G., & Allard, S. (2017). Using an ambiguous cue paradigm to assess cognitive bias in gorillas (*Gorilla gorilla gorilla*) during a forage manipulation. *Animal Behavior and Cognition, 4*, 91–104. doi:10.12966/abc.07.02.2017

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