

● 高潔 特定助教

Jie GAO (Assistant Professor)

研究課題: Four-legged intelligence: how domestic animals see the world

専門分野: 比較認知科学 (Comparative cognitive science)

受入先部局: 野生動物研究センター (Wildlife Research Center)

前職の機関名: 国立研究開発法人情報通信研究機構 未来ICT研究所 脳情報通信融合研究センター
(Center for Information and Neural Networks, Advanced ICT Research Institute, National Institute of Information and Communications Technology)



Humans have been domesticating animals for thousands of years. While many studies have focused on how domestic animals benefit humans, more research is rising on how they fundamentally perceive the world and how humans could improve their welfare. I plan to focus on domestic ungulates to systematically study their perception, and to compare them with their wildlife relatives. These investigations will elucidate how they perceive and adapt to the environment, as well as the function of the evolutionary and human factors on shaping minds.

More specifically, I am interested in studying perception for forms and shapes, social cue perception, and cross-modal per-

ception. Studies on their form and shape perception will show the basic and critical properties of animals' visual perception. Studies on social cue perception, e.g., perception for faces and bodies, will help clarify how they receive social cues from both humans and conspecifics. Studies on cross-modal perception will provide insights into how they coordinate information from multiple sensory channels and pathways. At the same time, I plan to compare across species to examine the effects of different physiological structures and domestication history. Together, these investigations will reveal intriguing areas of the picture of how domestic animals perceive the world, how they adapt to the anthropogenic environment, and how their mind is shaped by evolution and human factors.

Comparative cognitive science

One of the fundamental questions in the field of cognition is how our mind is shaped to become what it is. To answer this question, one significant perspective is to study non-human animals. There is no fossil of mind. By comparing non-human animals and humans, or comparing among animals, we could infer the possible status of the common ancestors, thus rebuilding the evolutionary path of the mind. Therefore, comparative cognitive science provides valuable information on how the mind is shaped by evolution.

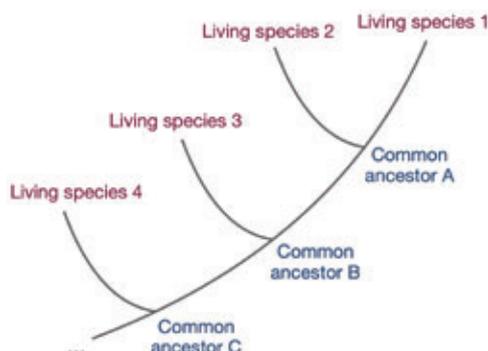


Fig. 1 A scheme on the rationale of comparative cognitive science.

This shows a part of an evolutionary tree. In comparative cognitive science, we compare the perception and cognition of different living species (for example, living species 1 and 2) so that we could infer the perception and cognition of the common ancestors (for example, common ancestor A), thus being able to rebuild the evolutionary path of the mind.

I would like to use an example from my previous studies to explain the rationale further. I have been studying body perception in chimpanzees, humans' closest living relatives, and humans. It has been found that humans use a specialized way to visually perceive images of human bodies: we show much better performance in recognizing bodies when they are upright than when they are inverted (upside down), and this inversion effect is not found for other objects, such as houses. This indicates a holistic way to perceive bodies, which may result in quicker detection and recognition of bodies, an extremely (and quite literally) vital group of objects for us. My studies in chimpanzees showed that chimpanzees also have this inversion effect, and only for bodies, not for other objects.

This result suggests that the common ancestor of humans and chimpanzees might also be equipped with this specialized body processing, indicating that the brain already had something special for an important object in life (bodies), early in evolution. If other studies found this phenomenon in other animals, we could then conclude that this appeared earlier in evolution. At the same time, we would learn that this specialized visual processing manner is rather fundamental for animals.

Why domestic ungulates?

Ungulates, as land mammals, are a major group of animals during the course of evolution. Research on their perception and cognition will contribute to our understanding of the evolutionary factors in shaping the brain. For domestic ungulates, more theory-driven research is gradually rising apart from research from applied perspectives. It is anticipated that this will reveal how they see the world in a more systematic and comprehensive way.

Our mind is not only shaped during evolution. It could also be affected by the environment. When we compare animal species, the traits that are preserved by evolution often indicate more evolutionarily fundamental functions, while the different ones reveal possible effects from distinct living environments. By comparing domestic ungulates and their wildlife relatives, we could examine the effect of a particular kind of environment: human factors. Understanding how domestication changes animals' perception and cognition could deepen our knowledge of how the mind is shaped. Also, by using this knowledge, we could provide better living conditions for domestic animals.

Research contents

I plan to study species of odd-toed ungulates (e.g., horses, donkeys, and their wildlife relatives, zebras) and even-toed ungulates (e.g., goats, sheep, and their wildlife relatives, giraffes). My research content is to examine their perception systematically, from basic visual perception to more complex, integrated perception for a comprehensive understanding.

Apart from understanding ungulates' cognitive abilities, another aim of my research is to compare domestic and wild species to study the effects of domestication. The impacts of domestication can exist in many aspects, including morphology, physiology, personality, and of course, perception, cognition, and behavior of animals. I am particularly interested in the possible effects on their perception for the environment.

For example, domestic animals may have become better at recognizing certain shapes and forms frequently appearing in an anthropogenic environment, such as squares. Also, they may tend to avoid social conflicts and may be more sophisticated at processing social cues compared to wild ones.

Methods

I will use behavioral observations and tasks for my research. At first, we train animals using food rewards to let them learn about the experimental paradigms. Experiments usually require an object-based platform, or a computer-controlled setting using touchscreens. Other methods, such as physiological measurements, will also greatly help with the experiment. For example, they provide information on animals' arousal levels so that we could infer their emotional status in experiments related to social contexts. Based on my experience, I will try to design suitable devices and paradigms to test ungulates. I hope it will not only help with my research but also benefit others interested in the exciting journey to explore the mind of these four-legged beings.

References

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