The Ungulate Mind
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Bovine: 1. Of, relating to, or resembling a ruminant mammal of the genus *Bos*, such as an ox, cow, or buffalo. 2. Sluggish, dull, and stolid. *The American Heritage Dictionary of the English Language, Third Edition*.

As the definition of bovine suggests, many see a cow standing in barnyard muck, its head lowered, a rope of drool hanging from its mouth, and conclude that the space between its ears is filled with bone, or perhaps air. A horse that has traveled the same path many times is likely to shy away in fright when it encounters a newspaper or other new object near the path. These and other common observations support the general view that the ungulates are a fairly dim lot. Clever Hans excepted, no ungulate is or was the subject in tests of cognitive ability. However, ungulate brains are not conspicuously small (Eisenberg 1981), so we might ask whether there is an under-appreciated mental ability in the group. I am going to argue that the ungulates are smarter than previously believed, but that their cognitive abilities are specialized, and likely limited to just a few kinds of situations. Like vervet monkeys (Cheney and Seyfarth 1990), ungulates appear to have domain-specific cognitive ability. However, these domains are conspicuously different than those that brought about the intelligence of monkeys and us.

Intelligence and predictive cognitive ability are ecological adaptations. For monkeys and other primates, the relevant aspect of the ecology, that part of the animals' environment that selects for mental ability, is the social environment. Monkeys and apes appear to gain fitness advantages by being able to predict the actions of other group members, and by their ability to use social signals to manipulate the behavior of conspecifics (de Waal 1982). Perhaps because of anthropocentrism, this social intelligence hypothesis, as it is called, has dominated discussion on the evolution of cognition. However, I think that other ecological domains may be the movers of intelligence in other taxa. Just as other environments may select for sensory abilities that are alien to us (e.g., echolocation in bats, electric field communication in mormyrid fishes, and magnetic field orientation in birds and bees), so other environments may select for cognitive abilities that we may not immediately recognize as such.

In the ungulates, two aspects of ecology are likely to create selection for specialized cognitive ability. These aspects are predation on young and the dynamics of polygynous mating systems. I am going to discuss ungulate cognition from the perspective of my observations on pronghorn (Byers 1997), but I do not think that pronghorn represent a special case. Many other ungulates live in similar ecological circumstances, have almost identical behavioral traits, and likely to have similar sets of cognitive traits.

Predation on Young and what Mothers do about it

Generally, the ungulates avoid being eaten by predators either by being large-bodied or by being fast runners, or both. For many of the fast ungulates, such as pronghorn, all deer, and many species of antelopes, the young are not fast runners when first born. A specialized strategy called hiding has evolved (FitzGibbon 1990; Lent 1974). Hiding represents coordinated behavior of the mother and her young. Shortly after birth, the mother leads the tottering infant away from the birth site, then signals to it to move away. The infant walks a sort distance and reclines. Now the incredible part of the hiding strategy begins: the infant remains motionless, and refrains from urinating or defecating, for 3-4 hours, until the mother returns. Upon the mother's return, the infant sucks in a load of milk that would kill a non-follower ungulate (Carl and Robbins 1988), and it urinates and defecates into the mother's mouth in response to her licking. The adaptive value of hiding is that it conceals the location of the slow infant from predators. The concealment depends on coordinated behavior of the mother and the infant. The infant must recline and remain motionless, and the mother must somehow not give away the