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Norms and variance fail to predict butterfly effects on social dynamics by idiosyncratic individuals

Commentary on **Owens et al.** on *Wildlife Personality*

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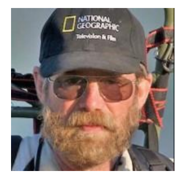
Abstract: Adaptations and adjustments to current environmental conditions are manifest in behavioral norms. Knowing norms facilitates population-level prediction, but doesn't predict individual behavior where idiosyncrasies might trigger "butterfly effects." Knowledge of individual quirks is particularly important for risk assessment and management during close encounters between humans and potentially lethal wildlife, including bears (Ursus spp.). Innovative foraging techniques can alter population vigor and viability. Traits at the tails of a bell curve might hold the greatest potential for adapting to environmental change.

Steve Stringham and **Lynn Rogers** have closely observed black and brown bears diet, habitat use, social relations, maternal care, hibernation, communication, aggression, and causes of bear–human conflict since the early 1970s. **Website**



Ann Bryant's BEAR League teams have helped the public minimize conflict with bears through direct interaction with bears, public education, and scientific research since 1998. **Website**

The long-term dynamics of human groups are difficult to predict even at the level of populations, where individual differences in behavior have a chance to average out into recognizable norms. These norms can occasionally be disrupted by especially eccentric individuals (such as Galileo, Marie Curie, or Elon Musk) whose innovations can sweep through a population, altering its culture, its geographic distribution, and presumably its genetic success over short and long terms – eventually producing new norms. Even less eccentric individuals can markedly alter the fate of small human groups.

Might eccentric individuals likewise have marked influence on the fates of animal populations and species? Research to answer questions about the impact of individual influences diverges fundamentally from conventional research by North American wildlife managers whose primary goal has been to produce animals for harvest by sport hunters. Population demography and behavior have been addressed mainly in terms of the numbers of members of each age-sex class and the class's reproductive potential (e.g., birthing X offspring every Y years). That focus has largely ignored the genetic and behavioral diversity among individuals of each age and sex within any species or population. By contrast, conservation biologists *have* supplemented concern for population productivity with concern for genetic diversity and its influence on long-term population viability. Yet they have so far paid little attention to cultural or personality diversity within populations. The same has been true of ethologists concerned primarily with typical behavior within a species or population, as this adapts the group to its current range of environments.

The importance of individual differences among animals within a subpopulation was perhaps first dramatized by research on chimpanzees (*Pan troglodytes)*, begun in 1960, where social dynamics were heavily influenced by matriarch Flo and by a few dominant males such as David Greybeard and Mike (van Lawick-Goodall 1971; see also deWaal 2019). Even more important than social influences that might be limited to an individual's lifetime or troop, are those influences perpetuated across multiple lifetimes and subpopulations. Consider chimpanzee tool use to fish for termites or to crack nuts (van Lawick-Goodall 1971; Boesch & Boesch 1990). Cracking nuts with stones dates back >4,000 years (Mercader et al. 2007). Might each of these innovations have been initiated by a single individual, much as happened when the Japanese macaque (*Macaca fuscata*) "Imo" learned to wash sand off potatoes before eating them – a trait that eventually spread throughout her troop and beyond. (Kawamura 1954; Itani and Nishimura 1973).

Such findings marked a turning point in ethological studies where research on behavioral norms expanded to include eccentricities that could generate "butterfly effects[1]." Each mutation first appears in a single individual. New cultural traditions can likewise be innovated by individuals. It is these mutants and culturally eccentric individuals, more than normal ones, that provide the potential for evolutionarily and culturally tracking and adapting to environmental change. It thus behooves ethologists to assess not only normal behaviors, but also eccentric behaviors, including those on the tail ends of "bell" curves.

Although a bear's relative dominance can have profound effects on its social behavior and perhaps on its boldness, there are numerous other behaviors – e.g., play, courtship, mating, maternal care, predation, cannibalism, foraging. etc. – that can be quite variable at any given social rank. Idiosyncrasies are particularly obvious in prey-capture techniques (Luque & Stokes 1976; Gill 2011), in how prey are eaten (Stringham unpubl. data), and in which prey are targeted. Some adults of both sexes kill one another's cubs and might eat them; other adults are benign toward one another's cubs (Stringham et al. unpubl. data). Some bears have become

[1] What I call "butterfly effects" could alternatively be called "black swan events" (Anderson et al. 2017) using the terminology of the economist Nassim Nicholas Taleb (2010).

notorious killers or scavengers of livestock (Storer & Tevis 1955) even in areas where other bears ignore the same prey.

Despite the putative asocial nature of bears, some behavioral innovations have spread rapidly. During the first decade of the 21st Century, black bears in the Tahoe Basin, at the border of California and Nevada, were seldom able to obtain anthropogenic food from glass jars without breaking the jar. Now, jars are normally accessed by unscrewing the top. The jar is held in the crook of a bear's arm, while the palm of the other hand presses against the lid, and twists it sideways. A few other bears have figured out how to access allegedly "bear proof" trash dumpsters. Bears that forage on anthropogenic food sources, much as they do on natural sources, risk being perceived as dangerous and condemned to death by wildlife managers – rather than being appreciated, and studied for their cleverness that might eventually facilitate population-level adaptation to anthropogenic habitat changes.

To facilitate viewing bears, whether for research or recreation, with minimal disturbance to bears and risk to humans, we assess which bears in our study area tolerate having viewers within say 50 – 200 m of them. We assess the degree to which tolerance encompasses not only whether bears remain without fleeing or coming toward viewers, but also which other behaviors (e.g., grazing, fishing, nursing, courtship, mating, or play) they will perform, and how efficiently, within those distances, under any given set of environmental conditions (e.g., proximity to escape cover and to other bears). Assessing behavior in terms of averages plus/minus variance fails to capture genetic and cultural eccentricities that govern the outcome of interactions among individuals and perhaps ultimately the dynamics of populations.

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