

Beyond a pet - contextualizing natural behaviors and welfare challenges for domestic dogs

Abstract

Scientific interest and research regarding the domestic dog have increased rapidly in recent decades - in tandem with the tremendous growth of the pet dog industry and associated popular culture - inviting widespread attention to a multitude of questions concerning the first domesticated species of animal. Significant progress has been made in identifying the historical contexts and biological mechanisms involved in, and critical outcomes of, the natural and artificial selective processes which have occurred since the dog's evolutionary divergence from wolves 10-40,000 years ago. The behavior of dogs as a species is now a popular topic of discussion catalyzing extensive questions within both the scientific community as well as the general public.

While encouraging, these investigations and subsequent conversations are readily frustrated by research limitations and societal conceptualizations that fail to fully accommodate a species - the "dog" - for which the extent and complexity of confounding genotypic and phenotypic variables contributing to behavior are exceptionally challenging to account. This has unfortunately resulted in frequent misinterpretation or over-generalization of findings as it relates to species-typical behaviors, with implications for welfare-critical habitat and behavioral interaction experiences and requirements in captive conditions for the domestic dog.

Extensive further research should be conducted in efforts to acquire data about the ecological variability of and scope of phenotype-specific behavioral diversity material to canine welfare in the interest of supporting a more complete range of natural behaviors, as well as greater opportunities for allostatic reconciliation in restrictive environments. The development, introduction, and employment of a comprehensive welfare-relevant ethogram of natural basal canine behaviors reflective of positive emotional valence may provide value in harvesting preliminary data about the natural behaviors most prevalent in and valuable for distinct canine phenotypes in the pet dog population.

Apples, oranges, and natural consequences

Though definitionally understood to be a singular biological species, the remarkable breadth of phenotypic diversity reflected in the modern canine gene pool (Parker et al., 2017; MacLean et al., 2019; Creevy et al., 2022; Bray et al., 2021; Dutrow et al., 2022; Salonen et al., 2023; Pongrácz et al., 2020, Pongrácz and Lugosi, 2024) has introduced a number of significant hurdles in attempting to thoroughly characterize, catalog, understand, and support the expression of typical species-specific behaviors distinct to the natural history of dogs (Pongrácz and Dobos, 2025) and thus important to welfare. Human interference with evolutionary processes via both artificial selection and conditions of captivity have obfuscated the natural mechanisms, functions, and development of canine behaviors under these increasing influences. The behaviors of many modern pet dogs subject to such significant and often bifurcating variables which are then subsequently observed, documented, studied, and discussed in both the literature and society may then reflect a somewhat narrow and misleading range of anthropocentric biases, inquiries, and interpretations related to what are effectively products of genetic and environmental perturbations (Pongrácz and Lugosi, 2024; Pongrácz and Dobos, 2025; Gryniewicz et al., 2026a, 2026b). Canine behavior may also reflect yet unidentified consequential genetic byproducts of these human interventions on selected traits (e.g. risk of attachment related disorders in dogs bred for neotenic ontogeny or

attentiveness to humans), as well as maladaptive responses to common pet keeping conditions for which the animals are not biologically prepared (Polgar et al., 2019; Arndt et al., 2022), as opposed to being representative of natural domestic canine phenotypes in general.

Though the vast phenotypic diversity observed in the domestic dog may not be considered sufficient enough to warrant the designation of any subspecies therein, phylogenetic research has consistently identified significant behavioral variation for those traits under selective pressure historically (MacLean et al., 2019; Dutrow et al., 2022; Salonen et al., 2023; Pongrácz et al., 2020, Pongrácz and Lugosi, 2024; Pongrácz and Dobos, 2025), which further confound efforts to draw conclusions about the normal behavior of these animals. Far beyond the more limited range of individual differences observed in other wild and domestic species, the extent of this artificial selection and genetic diversification that the domestic dog has undergone throughout the course of history is unrivaled in the animal kingdom - not only in regards to their morphology in modern breeding, but specifically regarding ecologically-rooted behavioral functions under artificial selective pressure such as those involved in foraging, hazard avoidance, and social/reproductive adaptations (Coppinger & Coppinger, 2002). Efforts to identify natural behavior in dogs should therefore be ecologically relevant (Pongrácz and Dobos, 2025), attending to those canine behavioral traits modified through both geographically-distinct environmental pressures (Parker et al., 2017) and subsequent selection for hypertrophied, muted, targeted, and redirected expression in anthropocentric historical contexts (Kolm et al., 2020; Lord et al., 2025b; vonHoldt et al., 2017; Brophey, 2018b and 2021). Such extreme artificial selection, in particular, has resulted in vast differentiation of related phylogeny-specific biological mechanisms and ontological consequences among individuals - influencing the emergence, prevalence, stylization, strategy, sequencing, intensity, and releasers of natural behaviors in various working breeds of dogs (Coppinger & Coppinger, 2002).

For example, those breeds of dogs developed for direct human intervention and cooperation in hunting game birds have undergone extreme phylogenetic selective pressure (if largely artificial) to inhibit elements of predation in order to be receptive to human directions in the process of searching for, locating, and acquiring prey (Dutrow et al., 2022). The modified mechanisms of feeding behaviors - e.g. *searching* by systematically “flushing” through tall grass to reveal birds, pointing or “setting” upon identified targets in paused *orient* responses designed to enable strategic human interventions - reflect not only the ultimate predatory functions of foraging for sustenance so critical to natural canine survival. They also indicate the distinct phylogenetically inherited receptivity to human influence primed to be further shaped through proximate experiences and ontological development in individual animals. Such naturally motivated behavioral instincts, contrasted from those predatory behaviors observed in other breeds valued for their independent hunting apart from human involvement (e.g. terriers, scent hounds) (Dutrow et al., 2022), inform both the understanding of as well as accommodation for these behavioral and welfare distinctions between such highly diversified breeds of dogs.

To date, these differing behavioral needs of dogs, while superficially indicated to accommodate species-specific expressions, have often been divorced from biological frameworks, poorly understood, or extrapolated from generally non-analogous human models - such as Maslow's Hierarchy of Needs (Griffin, et al., 2023) - by leading pet industry educators and professionals. Unwarranted emphasis is often additionally placed on the value of positive reinforcement training in

consideration of canine and other animal wellness (Pręgowski, 2015; Littlewood et al., 2023). Common consensus, then, for those principles and practices which are adopted, established, and applied by many professionals for such a phenotypically diverse species are unintentionally inadequate and delusive when guiding members of the general public in the animals' care. The kinds of behavioral needs of domestic dogs which are popularly identified - i.e. "running, resting, playing, exploring, and positive consistent interactions with humans" (Novack et al., 2023) - are largely anthropocentric, insufficiently recognized, and incompletely summarized in both the pet industry and the literature.

Excessive importance has also been placed on the anthropogenic niche of the species as obligate synanthropes, leading both pet market authorities and various academics to erroneously assert that all human environments are unequivocally a dog's natural habitat to which the animals are inherently well-suited, neglecting the profound effects of recent modernization and urbanization on these conditions (Meyer et al., 2022; Morris et al., 2011; Coppinger & Coppinger, 2002). Many natural canine behaviors and needs distinct to relative phenotypes may be consequently underattended. These shortcomings have direct repercussions for the practical application of animal welfare models for the species, as the scope of canine behavioral needs are superficially categorized and provisioned in captive environments for a species routinely presented to the general public as definitionally "pets". Further elaboration on, as well as breed-specific qualification of, the various components of canine behavioral ecology will be critical to improving education and standards of care for the modern pet dog population moving forward.

Harnessed, hypertrophied, and hijacked - feeding behavior in dogs

The ancestor of the domestic dog, the wolf, provided the raw genetic material for the evolution of the species we share our lives with today. The natural predatory behavior of wolves is regularly documented as distinctively adapted for predominantly cooperative group hunting of large prey (Coppinger & Feinstein, 2015; Wynne, 2021), but includes predation of smaller game as well (Stahler et al., 2006). Foraging behavior being sensitive to changing ecological pressures, adaptations to diminishing or emerging niches in food sources are also observed in the wolf. Less noted are those opportunistic scavenging behaviors for foods such as berries, other fruits, vegetation, and fish (Evavold et al., 2024; Freund, et al., 2023; Stahler et al., 2006), as well as carrion via scavenging and kleptoparasitism in cases of high inter-species predator competition (Elbroch et al., 2015).

The feeding behavior of the domestic dog is commonly distinguished from that of the wolf as being that of a scavenger distinct to their role as obligate synanthropes (Coppinger & Coppinger, 2016; Lord et al., 2025a), rather than that of an effective hunter (Coppinger & Feinstein, 2015; Wynne, 2021). However, the modified ecology of the world's naturally evolving free-roaming population of dogs only tells part of the story - reflecting the adaptation of the domestic dog to the anthropogenic niche provided by human environments around the world over the millenia. Predatory behavior in domestic pure-bred dogs has not only been preserved in the modern canine gene pool; it has been harnessed, manipulated, exaggerated, and exploited to various ends by humans throughout history (Coppinger & Coppinger, 2002; Lord et al., 2025b; Brophrey, 2018b and 2021).

Foraging for prey and the subsequent behavior of *predation* (the functional natural predatory sequence observed in the domestic dog's wild wolf ancestor: *orient–eye-stalk–chase–grab-bite–kill*

bite–dissect–consume (Coppinger and Coppinger, 2002)) has been extensively modified in the domestic dog, and is “considered one of the most characterising aspects of breed-specific behavior” (Broseghini et al., 2024). Post domestication, predatory behaviors in dogs have been under extreme selective pressure for purposes of hunting a variety of game and varmints, as well as herding livestock, and being virtually muted in livestock guardian breeds charged with protecting stock from other predators (Coppinger & Coppinger, 2002). Breeds of dogs were developed, for example, for both independent and cooperative hunting behaviors involving pronounced or specialized preliminary *finding/searching* of prey (Coppinger & Feinstein, 2015) - with scent hounds prized for tracking scents and gun dogs hailed for revealing and retrieving target animals. In herding dogs, the *eye, stalk, and chase* steps of the sequence are believed to have been exaggerated, with the *grab-bite* and *kill-bite* elements intentionally muted to prevent injury to managed stock (Coppinger & Coppinger, 2002). In terriers, the predatory sequence was preserved for purposes of independent vermin control in the interest of protecting food resources from rats, mice, foxes, etc. in human environments (Dutrow et al., 2022).

Departing from traditional ecological foraging behavior, these modified predatory behaviors no longer required a functional survival benefit for the animals; as such they may contradict ethological models of feeding behavior in wild species of animals. Rather, these manipulated motivations and motor patterns were preserved without evolutionary benefit for the species, as inherited instincts primed to be capitalized upon by people for a variety of human applications and interests.

Predatory partners, parasites, and puppets

The domestic dog has come to exemplify the concept of descent with modification. However the species' extensive human-manufactured biology has fundamentally conflicted with the natural criteria for such changes - adaptive individual and reproductive fitness. Save the world's free-roaming populations, many breeds of dogs have been essentially crafted and modified into instruments and tools employed for *human* feeding behaviors (as well as the protection of such acquired resources and territories enabling them). Some breed-specific, modified foraging behaviors may not only fail to serve the direct interests of the dogs themselves; they may further facilitate expensive or maladaptive motivations for the animals, compromising fitness and functional coping capacity - particularly in quotidian pet conditions of captivity further frustrating their expression. Though the dog's historical relationship with humans positions the species as a form of mutualism resulting in exceedingly successful outcomes by certain measures (e.g. population), a more thorough account of fitness consequences paints a complicated picture of this symbiotic arrangement that may include some parasitic exploitation of natural canine phenotypes by human partners historically as well as in modern society (Meyer et al., 2022).

One of the resulting challenges, then, for the range of dogs which have been under such remarkable selective influence historically is the body of welfare implications for these complex behavioral traits. Good animal welfare is understood to include the environmental and experiential affordances for the expression of phenotype-specific natural behaviors that the animals are highly motivated to perform (Mellor et al., 2020; Littlewood et al., 2023; Miller et al., 2020). Inherited instinctual behaviors, particularly feeding behaviors, may be especially vulnerable to stereotypes if not effectively afforded and diversified in captive conditions (Pierdon, 2026). Extensive negative welfare implications of human intervention on the functional fitness of these animals is a concern;

some exaggerated selected behavioral traits and motivations could be deleterious to the interests of dogs in exchange for those of humans (Mazzini et al., 2025).

Hijacking the natural selection process through artificial selection for or against specific expressions or intensities of behaviors, certain elemental evolutionary principles (such as self-preservation and economy of behavior) have been effectively bypassed or over-ridden at the expense of the animals, resulting in the inheritance of traits that may have conflicted with evolutionary fitness (Menor-Campos, 2024; Careau et al., 2010; Brophrey, 2021). “Gameness” in terriers is an especially compelling example - where the perceived costs and resulting modulation of conflict engagement behavior and economical ritualization signaling has been diminished in favor of ecologically expensive aggression through human selection for this trait. Humans have arguably pulled on the genetic strings of dogs to such degrees in these cases that the animals are effectively involuntary canine puppets of sorts, exhibiting behaviors which not only lack adaptive benefit but may even reduce fitness as a matter of breed standard.

Predators as pets

As a result, the scope of inherited predatory sequence behaviors reflected in the modern canine gene pool may not only be difficult to accommodate in modern pet environments; their afforded expression may at times conflict with the fitness of the animals themselves. This presents a complex and unique challenge to welfarists and animal caretakers. Providing for the expression of behaviors an animal may be highly motivated to perform is beneficial in reducing distress and frustration; yet the engagement in those behaviors may assume a cost for the animal - particularly when certain rewarding activities foster vulnerability to behavioral addictions (Mazzini et al., 2025).

Future research could potentially reconcile such unnaturally conflicting forces, hopefully clarifying those behaviors most valuable to welfare in captive modern conditions which are so incompatible with their phylogeny. Examining the welfare repercussions of maintaining certain breeds of dogs in restricted conditions which either fail to provide for the relevant behavioral interactions, or potentially conflict with an animal’s interests in their engagement, could also be further instrumental to these ends (Sonntag & Overall, 2014). The costs and benefits of engagement in those highly exaggerated, diversified behavioral performances for which dogs have been historically selected is complicated and mostly unknown; though accommodations for behavioral differences are inevitably important to consider and necessitated in curated welfare provisioning.

In endeavoring to facilitate greater improvements in the 4th Domain, it may be prudent to first return to the basal elements of feeding behaviors in wolves as a point of reference for more comprehensively affording the expression of related behaviors in dogs. The many natural motor pattern elements involved in compositions of both appetitive and consummatory foraging behaviors in dogs (such as exploring, scent tracking, orienting, stalking, chasing, pouncing, digging, rooting, grabbing, shaking, tugging, dissecting, licking, chewing) are largely preserved if differentially distributed among breeds, and should be appreciated in affordance provisions for dogs in captivity to reduce frustration, distress, and other welfare consequences.

Canine foraging and predatory behaviors can be more completely understood as elements of sequential steps, with each involving a number of unique behaviors themselves. Coppinger & Feinstein, for example, identify the three stages as: *finding, acquiring, and consuming food* (2015).

Alternatively, the phases of *search*, *approach*, *chase*, and *bite* have been proposed (Broseghini et al., 2024). While certain consummatory-dominant elements of canine foraging behaviors (sniffing, licking, object manipulation, tugging, biting, chewing) have been popularly recognized and provisioned in the pet industry and popular market - with various treat dispensing objects, snuffle mats, tug toys, and chews now widely available - many feeding behaviors continue to be unidentified and underaccommodated. Particularly those behaviors involving the *finding* /*search* phases (exploring, scent tracking) are increasingly challenging to afford in captive conditions, as they generally require agency-directed activity in larger natural spaces. Other foraging behaviors, both predatory and scavenging, that human caretakers find generally undesirable or easily misplaced onto unwanted targets (i.e. digging, rooting, stalking, chasing, biting) are not only inadequately provisioned in most pet homes; many are routinely punished or modified through training and behavior modification. Even when these behaviors are humanely redirected to more desirable and manageable incompatible behaviors, certain welfare costs may persist if they are functionally prohibited without relief (Arndt et al., 2022).

Parenting - pups, packs, and pets

Further contextualizing the relative compatibility between natural domestic dog behavior and modern pet conditions are the reproductive systems and social structures of the species, as respectively influenced by anthropogenic genetic interventions and environmental conditions. The family structures observed in free roaming populations of domestic dogs represent a slight departure from their almost exclusively monogamous ancestral wolves. While monogamy is occasionally observed in domestic dogs, there is a high degree of behavioral plasticity within the consistently preserved, if somewhat less expensive, "k" parenting strategy in which extended care is provided to pups (Lord et al., 2013). Polygyny, polyandry, polygyndry, and promiscuity have all been documented, as largely subject to food availability (Hansen-Wheat & Wynne, 2025). The still relatively high investment in offspring care, feeding, protection, and rearing observed in domestic dogs is supported by a monestrous reproductive cycle (if largely non-seasonal as a result of increased food availability) in bitches (Fielding et al., 2020), allowing females to fully attend to the needs of their pups before coming into season again.

Such intensive parental investments can have meaningful returns in the behavioral economics for such a highly social species of animal. Despite previous descriptions of reproduction in free-roaming dogs, bitches have since been observed as having extensive help from other social members or affiliations - with biparental care, allomaternal care, and alloparenting contributions noted in certain populations of dogs (Hansen-Wheat & Wynne, 2025). Furthermore, higher rates of offspring retention complemented by minimal dispersal ranges can increase the degree of relatedness between dogs in a given population. Delayed benefits of both socially reciprocal helping behaviors from mature offspring relations and optimized genetic representation in subsequent generations are then potentiated (Dawkins, 1976), possibly depending on the abundance of food resources (Hansen-Wheat & Wynne, 2025).

The highly cooperative social structures and associated behaviors observed in wolves have been ecologically modified in free-roaming dog populations, but they are far from ultimately diminished. Such sophisticated collaborative survival systems in wolf populations have had significant implications for the adaptive success of their domestic dog descendents, even positioning

relationships between humans and dogs for success through the inheritance of “cooperative baggage”, such as distinct cognitive capacities for intention-reading (Cordoni and Palgi, 2019).

While these kinds of natural social adaptations and skills have proved valuable for the free-roaming domestic dog as a species so highly dependent on human resources for survival (Bhattacharjee et al., 2018; Nandi et al., 2025), further human influence on canine welfare has not always been so beneficial for the animals. Dogs that have been subject to the consequences of artificial selection and conditions of captivity have experienced a range of interruptions to their reproductive and social behavior as a species. Frustration of natural courtship, mating, parenting, and related suites of social cooperation behaviors between conspecifics likely have significant consequences for canine wellness which have yet to be appreciated, as these highly motivated behaviors are prevented in captive breeding and traditional modern pet environments (Arndt et al., 2022; Mellor et al., 2020). Additionally, the routine practice of gonadectomy in pet dogs not selected for breeding programs may have significant short and long term negative health and welfare costs, especially when conducted early in life (Kutzler et al., 2020).

The pet-keeping of domestic dogs has increasingly confounded the reproductive physiology and behavioral ecology of the species, supplanting the natural parental and associated social experiences available to free roaming dogs with those of being involuntary dependent on human caretakers. The natural receptivity of and attention to human moods and intentions may have provided the initial collaboration opportunity between the species (Cordoni and Palgi, 2019); but further paedomorphic effects of the “domestication syndrome” on the domestic dog, pronounced in artificially selected morphological and behavioral traits in certain breeds, flipped the evolutionary family script entirely. Human beings, so vulnerable to the baby schema effect of their own evolutionary history (Lorenz, 1943; Bradshaw and Paul, 2010; Serpell, 2022) and themselves so socially deprived of parental and communal caretaking possibilities in modern conditions as social obligates (Grinde, 2024), have come to perceive themselves as adoptive parents of sorts of their pet dogs as they derive their own fitness benefits from the exchange (Serpell, 2002).

Though the world’s free-roaming dogs have arguably benefitted from the vast anthropogenic resources and evolutionary care-taking tendencies in the human population, their own species-specific social structures and associated needs have not been eradicated. Dogs may now be uniquely adapted to proximity to and relationship with humans (Coppinger & Coppinger, 2016; Kolm et al., 2020; Lord et al., 2025a), but their need for relationship with conspecifics has not been dissolved as a result (Gryniewicz et al., 2026a). Relationships with human beings alone are not ultimately likely to be sufficient in themselves to meet the complex social needs of the species, at least for a great many dogs. Dogs are, ubiquitously, highly social animals dependent on conspecific relationships for optimal welfare, regardless of social group size and flexibility (Bonanni and Cafazzo, 2014; Gryniewicz et al., 2026a).

Social selections and the modern canine family

The social behavior of dogs in relation to other canines, however, is not quite as universal as this biological need for conspecific relations. Canine social behavior has been under tremendous selective pressure historically - from the process of domestication enabling human relationships with dogs (Kolm et al., 2020; Solomons et al., 2021) to specific selections for human-directed attention, companionship and cooperation in functional tasks (Kolm et al., 2020; Pongrácz and Lugosi, 2024;

Pongrácz & Dobos, 2025). These social behavior influences have been highly consequential in successfully positioning the distinct heritage of certain dog breeds for a range of intended consequences, such as increased receptivity to training and human direction in herding dogs (Kolm et al., 2020; Dutrow et al., 2022, Jeong et al., 2025) or amenability to human expectations behaviors, and conditions through temperament selection (Bray et al., 2021; Hare and Woods, 2024), and conversely increased aggression towards unfamiliar conspecifics in the case of those breeds whose selected functions (such as livestock protection) necessitated it.

Additionally, unintentional consequences of these social selective pressures may have predisposed certain breeds of dogs for risk of developing pathologies such as separation-related behavior and anxiety (Pongrácz et al., 2020 & Pongrácz and Lugosi, 2024). Regardless of these adjustments, however, dogs maintain their natural biology as a social species of animal which naturally evolved in close relationship to other conspecifics as an important aspect of their ecological niche. The social deprivation common to modern pet dogs in Western urban environments (as characteristic to single dog households with only brief managed transactional interactions with other dogs in lieu of natural social groups) has had severe consequences for not only the social and public behavior of dogs, but for their ability to regulate arousal and stress, and function emotionally, cognitively, and physiologically as well (Lei et al., 2020; Powell et al., 2025; Gryniewicz et al., 2026a, 2026b).

While the sophisticated, economical, ritualized signaling (including olfactory, visual, and auditory) observed in free-ranging dogs is well documented (Bonanni & Cafazzo, 2014; Bonanni et al., 2017; Hansen-Wheat & Wynne, 2025), the social behavior and communication of artificially selected and environmentally captive dogs is conversely compromised by remarkable pressures arising from a wide variety of sources (Gryniewicz et al., 2026a). The range of both subtle and pronounced species-specific affiliative and agonistic signals observed in free-living, naturally selected populations which serve to manage interactions and mitigate risks between both social group members and local conspecifics (including affiliative and submissive posturing, facial licking, social referencing and alignment, greeting rituals, play sequences, or ritualized spacial social pressure, tensed muscles, low growls, barking, marking, etc.) are often stunted through intervening artificial selection and captive conditions in modern pet dogs. Communicative fluency may be subsequently underdeveloped, leading to social anxiety or conflict (Gryniewicz et al., 2026a).

The absence of a conspecific social environment for both developing juveniles and adults creates cascades of additional challenges for such animals, who are socially handicapped to various degrees as a result of their species-specific cultural estrangement. The concept of socialization in pet dogs, particularly puppies, could be unintentionally designed to prepare captive canines for the exposure to and often transactional interactions with other dogs they will encounter throughout their lives, but may not provide a functional substitute for the natural development of social behavior in the species (Gryniewicz et al., 2026a).

The additional intervening forces of human physical restrictions in behavioral interactions with other dogs often prevent or deny the expression of natural behaviors in dogs, interrupting or even admonishing efforts to communicate with other animals. Particularly concerning is the interruption of olfactory literacy, signaling, and navigation for a species whose brain is dominated by the olfactory cortex (Horowitz, 2010). This can occur as a practical consequence of space restrictions which do not afford the regulation of distance in confined rooms, yards, or leashed exchanges. Without these

spacial affordances for flight in the face of social tensions, aggressive behavior can result (Rommers et al., 2014). It can also result from demands for obedience and attentiveness to human handlers. Many modern pet dogs are therefore biologically under-prepared or unnaturally influenced in communication fluency, and further lack sufficient opportunities to learn and improve these skills (Gryniewicz et al., 2026).

The morphological and behavioral variation represented in the scope of canine phenotypes further complicates this already troublesome picture; dogs are products of pressures of human influence for traits that may directly or indirectly modify both their signaling and perception of other canine signals, their movements and postures, and even their playstyles as products of artificial selection. Misunderstandings between dogs, therefore, may easily abound. Such challenges are additionally complicated by the deleterious effects of forced social structures in pet home environments which do not reflect natural social group and relationship establishment, development, conditions, or maintenance between conspecifics (Mech, 1972). Subsequent intervention dependence is potentially further catalyzed in environmental management and separation between social members in multi-dog households - leading to excessive confinement in crates, rooms, kennels, etc. which further interrupt natural social behaviors such as social sleeping, which are available in free-roaming and well-curated conditions.

The interactions and relationships that dogs share with humans, while elemental to their ecology as a species, are unduly over-emphasized in modern pet conditions. The persistent anthropocentric perceptions of dogs as a species positioned to meet human needs and interests have largely diminished the biological integrity of the species, if accidentally. The sometimes unreasonable emotional dependence that many modern people have on their pet dogs, as well as the unhealthy codependence on people routinely fostered by them, may be exceedingly problematic in consideration of canine welfare (Meyer et al., 2022; Gryniewicz et al., 2026a, 2026b). Human conditions of evolutionary mismatch (Li et al. 2018; Longman & Shaw, 2025; O et al., 2024) may disproportionately burden pet dogs as surrogate social members for their own species, as a kind of enrichment compulsory to human biology (Longman & Shaw, 2025; Serpell & Paul, 2012). Despite the level of enjoyment that humans and dogs are able to naturally share together as compatible social partners, it is important to recognize the potential for undesirable outcomes in the relationship, particularly in modern conditions of captivity in which dogs have been largely stripped of their autonomy (Meyer et al., 2022; Pierce, 2016, 2023).

“Pet”

Significantly challenging a comprehensive understanding of canine behavior and welfare are a number of anthropogenic “pet” constructs and biases regarding the behavior of the domestic dog as a species. These historical and cultural influences are critical to account, if misunderstandings and malpractice regarding canine behavior in modern society is to be overcome and the welfare of dogs meaningfully improved (Sonntag & Overall, 2014). Though the relationships between humans and dogs have long been complicated and imperfect, the “petification” of dogs (Meyer et al., 2022) has introduced an entirely new range of problems for these animal dependents in the last century (Sonntag & Overall, 2014).

Dogs have been increasingly marketed to the general public as pets since the Victorian era (most aggressively after World War II as USDA government- sanctioned commercial breeding initiatives

for farmers (Animal Folks, 2011)), with profound economic ripples of subsequent demand for both puppies and their related products. The competing financial interests of the subsequently booming pet industry marketplace and ultimate welfare interests of the animals have often been in conflict as a result. As the once-prized functional roles of dogs diminished in both necessity and opportunity, and dogs were instead popularly positioned as “pets”, the friction between canine phenotypes and these new pet environments and expectations fostered frustrations and conflict in a number of ways.

As human families, lifestyles, schedules, and habits rapidly changed with the peak of the Digital Revolution, the demand for pet dog training designed to manage or “fix” the behavioral consequences of discord between canine phenotypes and pet conditions gradually emerged in the latter part of the 20th century. Most people had little to no knowledge about, memory of, or direct experience with the extent of the many highly specialized behavioral functions for which canines were artificially selected (i.e. various styles of hunting, scent tracking, herding flocks, varmint control, livestock protection, bloodsport, conquest, etc.), knowing the domestic dog species simply as an intended “pet” for whom such work was now obsolete and undesired (Meyer et al., 2022; Morris et al., 2011; Coppinger & Coppinger, 2002; Sonntag & Overall, 2014; Brophey, 2018a, 2018b & 2021). Pervasive negligence of animal sentience and antiquated concepts of human exceptionalism and dominion over animals (Webb, 2025) only further potentiated misplaced assumptions and actions in efforts to mediate these misgivings and their consequences.

Being inexperienced with canine behavior, families often sought guidance from those perceived as authorities in dog behavior and training, such as those working with police or military training programs (Pręgowski, 2015). Many contemporary dog training concepts and methods originated in these foundations of structural obedience and incomplete models of canine social behavior based on observations of captive wolf populations (Mech, 1999; Coppinger & Coppinger, 2002; Miklosi, 2007; Pręgowski, 2015), or were otherwise acquired as trade secrets or wives tales of sorts; mythology therefore dominated the pet dog training industry and popular practices in the general public in efforts to control the behavior of dogs. The rigid dominance hierarchies established and maintained in these unnatural forced social groups of wolves introduced an erroneous model of canine behavior (Mech, 1999; Van Kerkhove, 2004; Pręgowski, 2015) that would sadly persist in public concept and practical application through the 21st century.

While pet dogs benefitted from increasing scientific attention and professional education in the pet industry towards the end of the 20th century, another problem unfortunately emerged. The post WWII prejudice against the field of ethology in the United States (given its association with Nazi Germany at the time) had critically influenced the fields of psychology and animal behavior, elevating the field of behaviorism in the spirit of free-will models viewing behavior as distinct from genetic control. A persistent bias against ethological frameworks and ultimate perspectives in favor of the more proximate behaviorism lens and Applied Behavioral Analysis in the United States may very well have come to compromise certain progress in both research and practice concerning pet dogs (Pręgowski, 2015), as popular myths such as “it’s all how you raise them” rapidly prevailed. Many dogs and families have subsequently been failed by the fallacious popular belief that dogs can be trained to inhibit or exhibit any behavior regardless of other phenotypical factors (Sonntag & Overall, 2014), as a result of a hyper-fixation and excessive reliance on behavior modification training to modify canine behaviors to align with human conditions and expectations. By effect,

many natural canine behaviors have failed to be contextualized within the phylogenetic history of dogs, and so are now readily misunderstood as abnormal by both caretakers and canine professionals and unafforded in captive pet conditions (Sonntag & Overall, 2014).

The cultural cart before the horse - “pet” dog behavior and training

Efforts to modify, manage, or otherwise “treat” the expression of these natural canine behaviors (or the welfare and behavioral fallout of their prevention) through such behavior modification and training may further compromise the already challenged welfare states of these animals in the increasingly captive conditions of recent decades (Grandin, 2010; Morris et al., 2011), even when solely through positive reinforcement procedures grounded in solid behaviorism science (Pręgowski, 2015).

One of the most pronounced examples of these misinformed behavioral interventions is that of the “treatment” of separation and attachment related anxiety behaviors in dogs. Since dogs have become popularized as pets, changing human lifestyles and pet practices in countries like the United States (e.g. both parents working long hours, children often involved in extracurricular activities, dogs being kept indoors rather than allowed to roam and interact with other conspecifics) have come to routinely require that dogs be left at home alone for 6-10 hours a day. As a highly social species of animal (Gryniewicz et al., 2026a) that has further been selected for elevated human dependence in many popular breeds (Dutrow et al., 2022; Pongrácz et al., 2020; Pongrácz and Lugosi, 2024), the domestic dog is often not biologically prepared for long periods of separation from bonded social members, and can experience extreme levels of distress as a result (Pongrácz & Dobos, 2025, Polgar et al., 2019; Arndt et al., 2022).

Rather than principally attending to the underlying conditional mismatch of such isolating standard pet dog keeping practices, behavior modification training is commonly employed in efforts to reduce the behavioral symptoms of the animals’ distress - vocalizations, urination/defecation, destructiveness, attempts to escape/reunite with social members. While aversive methods intending to punish and so reduce the expression of these behaviors (e.g. painful or frightening consequences for barking delivered by electric collars) are more commonly recognized as reducing the welfare state of the animal, training procedures intending to improve coping capacity through a combination of desensitization, counter-conditioning, and positive reinforcement may also have unintended consequences.

The functional resolution of allostatic signals arising from perceived dangers in cases of social separation may be prevented when social members remain unavailable, resulting in chronic and maladaptive activation of the stress response (Arndt et al., 2020). The incremental exposure to and trainer-perceived desensitization of conditioned stimuli associated with the unconditioned stimuli of human absences (such as picking up car keys or putting on shoes), may reduce the saliency of these environmental signals and a dog’s subsequent responses to them without fundamentally mediating the negative emotional state experienced during owner absences. Both positive and negative operant reinforcement of quiet behavior in contexts of separation from people - e.g. providing treats or alleviating owner withdrawal upon criteria occurrence respectively - may be systematically applied in efforts to train a dog to tolerate isolation. Additionally, foraging enrichment opportunities (such as treat dispensers or favorite chews) may be consistently paired, as new conditioned stimuli, to owner separation in efforts to change the conditioned association a dog has

to owner departures. These environmental enrichments may not be sufficient, however, in compensating for social deficits (Lei et al., 2020).

Indeed, even those canine behaviors so universally equated with an enthusiastic “happy dog” and showcased by proponents of the positive dog training movement - swoopy or circling tail wagging, jumping up, eager social engagement, motivation to participate in training, etc. - may not preclude negative potential welfare consequences when comprehensive welfare is ultimately underattended (Pręgowski, 2015; Mazzini et al., 2025). Excessive motivation to engage in certain available behaviors and experiences may be enabled as a product of reduced environmental complexity and alternative opportunities for interactions in other capacities, as stereotypical or vacuum behaviors in social or problem solving opportunities. For this reason, motivation and preference testing in captive animals may produce misleading data about behavioral needs and wants under such “priming effects” (Mason and Burn, 2011). Enthusiasm for activity participation can not be accurately determined apart from these influences, particularly when drawing conclusions about the benefits of such experiences and welfare state of the animals.

It is therefore necessary to further contextualize observable behavior and perceived positive results - whether gauging interest and engagement in foraging enrichment or hypothesized acceptance of isolating conditions. Even when positive methods of training and behavior modification are employed with favorable observable results - reducing the behavioral symptoms of acute distress related to social separation - it is possible that a parasympathetic stress response related to the irreconcilability of isolation related allostasis persists as the prevailing tone, resulting in the appearance of calmness in the animal (Porges, 2011; Gryniewicz et al., 2026b). If isolation is perceived as punishing by the animal, and such isolation is unavoidable as a matter of daily life in pet conditions, then it is also possible that the dog comes to adopt a habitual state of learned helplessness (Seligman, 1972). In such cases, the intervening behavior modification may buffer the symptomology of the distress caused by separation, without effectively reducing the experience or welfare consequences of it.

Stress is of course complex and unique to individual differences (Beerda et al., 1997); it also influences a number of interdependent systems in the body (Kielbik & Witkowska-Piłaszewicz, 2024), and is reciprocally affected by them. Many other common, seemingly innocuous features of modern pet life routinely alter the emotional homeostasis of dogs (Grigg et al., 2021), perceived initially as a threat by the amygdala and subsequently transmitted to the hypothalamus, activating the stress response (Siracusa, 2026a). Such catalyzing physiological events may be behaviorally evidenced, but may also go unnoticed by attending humans. Depending on the nature of the stressor and the phenotypical characteristics of the individual animals, dogs may attempt to escape from or potentially defend themselves against a stimulus by respectively cowering, tail tucking, lowering of the head/ears or barking, growling, baring teeth, snapping, lunging, or biting (Abrantes, 1997) when the sympathetic tone of the stress response prevails. Given that dogs are understood to have less developed prefrontal cortex regions than those of their human companions (Siracusa, 2026a), rendering them largely unable to modulate or inhibit emotional reactions, it is particularly worrisome that humans often attempt to punish the behavioral evidence of routinely or chronically stressful events for pet dogs. Almost more concerning are those less apparent parasympathetic stress responses of pet dogs, which may seem to pet guardians to indicate a state of calmness or

otherwise “good” behavior in a variety of settings (Porges, 2011; Gryniewicz et al., 2026b; Siracusa, 2026a, 2026b).

Behavioral indices of welfare deficits (Mellor et al., 2020) in modern pet dogs which are labeled as “behavior problems” can present additional layers of consequences as further restrictions, punishments, inhibitory demands, social conflict/alienation, social isolation, or even surrender to shelters or behavioral euthanasia (Siracusa et al., 2017; Kiełbik & Witkowska-Piłaszewicz, 2024) are potentiated. Reframing public queries about problematic canine behaviors from “how should I train the dog?” to “how should I meet the dog’s needs?” could be instrumental in improving not only the welfare of both pet dogs and their families, but in fact the very behavioral challenges experienced as well. The origin of increasing behavior problems in pet dogs (Pierce, 2023; Beaver et al., 2024) may be better understood through a more thorough accounting of the features of modern pet environments and their consequences for the *umwelt* (von Uexküll, 1934/2010) of our canine companions.

Pet dog environments

Environments - literal, social, and emotional - introduce exponentially complex factors of influence for canine behavior and welfare. They therefore present cascades of potential welfare consequences for captive animals who so frequently experience both acute and chronic stress throughout their lives. These environmental and social factors are so far insufficiently captured in the existing data (Gryniewicz et al., 2026a, 2026b), indicating a need to identify those external conditions and socio-ecological values most consequential to individual internal states and canine welfare overall in future research.

The intrinsic further environmental heterogeneity observed across a species so widely geographically dispersed and inconsistently managed by humans creates additional challenges for research and practical welfare applications (Powell et al., 2025). The increasingly restrictive anthropogenic conditions of captivity in which many of these animals live - particularly in urban environments in which the majority of pet dogs reside in developed nations - may greatly prohibit, alter, compromise, qualify, and confound canine ethology on an even greater scale (Polgár et al., 2019; Puurunen et al., 2020; Meyer et al., 2022; Gryniewicz et al., 2026a). The welfare repercussions of such evolutionary mismatch for animals in “intensely homed” (Pierce, 2023) captive environments for which they are not biologically prepared may be significant on a multitude of levels for both human and non-human animals (Arndt et al., 2022; Li et al., 2018; Volsche and Sobol, 2025), particularly in regards to the exponential ramifications of the social ecology of the species on welfare guidelines.

While the majority of pet dogs now live in single dog homes without access to bonded conspecifics (Anderson et al., 2023; Gryniewicz et al., 2026a), and so are at greater risk of developing fearfulness in their lives (Powell et al., 2025), the human loneliness epidemic has simultaneously increased (Louv, 2019) alongside human risk aversion in new social conditions compromising stability of relationships (Cudworth, 2017; Gryniewicz et al., 2026b). These effects may be compounded by co-regulation (Sundman et al., 2019) and the reciprocal reinforcement of shared vigilance and codependence between people and their canine companions - the stress consequences arising from highly managed and socially compacted human cultural infrastructures prioritizing control and risk-aversion over exploration and negotiation of, as well as resilience and

competence in navigating, interactions and events of uncertainty in modern life (Gryniewicz et al., 2026b). Though environmental variability in pet home conditions will continue to challenge efforts to generalize theories or conclusions, certain deleterious impacts of urban lifestyles on dog behavior and wellness have been identified (Puurunen et al., 2020; Powell et al., 2025).

Many other common shared pet conditions in developed nations are increasingly incompatible with the biological rhythms of dogs (as well as humans). Features of modern human lifestyles and environments have combined with tendencies to associate quality pet care with greater control and restraint (Gryniewicz et al., 2026b), reducing agency-driven adherence to the circadian systems and related maintenance behaviors such as sleeping, elimination, and grooming. These activities and their cycles are almost entirely dependent on human perceptions, convenience, and schedules in captivity as standard pet keeping husbandry practices; conceptions of acceptable provisions for and interruptions to these needs are subsequently skewed in popular culture.

Dogs are polyphasic sleepers with natural diurnal circadian biological rhythms, and as such sleep primarily overnight as well as for bouts of time throughout the day (Schork et al., 2022). Some breeds of dogs, such as livestock guardian breeds, do however often maintain the crepuscular patterns of wild canids to meet demands of protecting stock against predators during dawn and dusk (Mosley et al., 2020) - indicating the potential for variation between breeds in this regard as well. Pet dogs are generally treated homogeneously in sleeping expectations and affordances (and periods of activity as a result), which can introduce challenges not only in genetic differences but in ontological considerations for age and development. Beyond these concerns for reduced phenotype-specific accommodations, many pet dogs may experience environmental disruptions to healthy sleep patterns as a consequence of light and noise pollution in homes and cities, human activities and schedules, inability to regulate temperature effectively in confined spaces, social isolation or overcrowding. These effects are mostly unintentional, if common; many modern humans also suffer sleep disruption (and their associated health problems) in these shared environments as well (San and Arranz, 2024). Intentions to share “what’s good for the goose” as “good for the gander” with dogs who are increasingly perceived as family members (Stamataki and Tragantzopoulou, 2025) may have profound consequences for canine welfare.

Contradictions (and so common conflicts) in grooming behaviors provide another good example of problems arising from both human intervention in canine genetics as well as the shared modern exposome. Dogs have been bred for maladaptive physical traits that humans find desirable (Bognar et al., 2025), including coats that require extensive human care (McDonald et al., 2022). Human grooming preferences for sterility, scented shampoos, and appearances may additionally conflict with natural canine behaviors of rolling, scratching, chewing, and licking (Jones, 2026) - which may ironically increase after grooming treatments. Many dogs further protest the restraint and experiences associated with modern grooming too, introducing subsequent layers of potential welfare consequences during these often distressing experiences, with both bonded humans and strangers, for these humanizing practices. Selective pressures have predisposed some breeds of dogs for increased touch sensitivity as well (Dutrow et al., 2022).

Possibly the strangest norm that has been extended to and adopted for modern pet keeping practices is that of “potty training”. In the same way that young humans are taught to inhibit their biological rhythms for elimination behaviors in the interest of urinating and defecating in defined

appropriate locations, pet dogs are expected to learn to relieve themselves outside of the home in most cases. While practical enough in theory, this practice has become preposterously unreasonable for many modern pet dogs who are left confined at home for extensive periods of time on a daily basis (Polgar et al., 2019) without access to elimination areas (or humans from whom they can request such access). In fact, to the author's knowledge, pet dogs are the only species of captive animal that cannot relieve themselves as needed. This prevention of allostatic reconciliation and relief from related discomfort introduces extensive physical, mental, and behavioral consequences for countless dogs on a daily basis - in many ways exemplifying the chronic dysfunction so many pet dogs experience in such modern anthrodependent pet conditions (Bekoff and Pierce, 2019).

Dysfunctional ecology - a modern pet dog's world

Illusive welfare deficits persist beyond the experience of negative emotional states for dogs living in modern conditions of captivity. The absence of experiences which provide for positive emotional states, such as those phenotypically indicated in species-specific "flow" expressions (Littlewood et al., 2023) of seeking and securing resources, accomplishing tasks with pleasure and competency, positively engaging with bonded social members, etc. may further compromise the wellness of pet dogs in a variety of ways when these behavioral interactions are not adequately afforded (Littlewood et al., 2023). The lack of activation in critical reward or pleasure related systems and hormones in the body - e.g. the endogenous opioid system, dopamine, serotonin, oxytocin - can also effectively reduce the welfare of pet dogs in insufficiently enriched environmental and social conditions. Compounding these potential impacts, the absence of certain social conditions with conspecifics in captive settings may not only fail to contribute to positive welfare but even reduce the capacity of an animal to manage stressful events overall (Gryniewicz et al., 2026a).

The challenges experienced by modern pet dogs should therefore be recognized as inter-dependent and compounding variables which may not only manifest in traditionally recognized acute stress signaling, body language, and defensive responses. Displacement and other common dog behavior problems arising from incompatible pet conditions (Coppinger & Coppinger, 2002; Morris et al., 2011; Meyer et al., 2022; Brophey, 2018a, 2018b & 2021), hyper-attentiveness to human cues (Gryniewicz et al., 2026b), low behavioral diversity (Miller et al., 2020), and more insidiously "calm" parasympathetic stress responses and learned helplessness resignation to circumstances (Seligman, 1972) are readily potentiated and introduce countless possible indicators of distress and underlying welfare concerns. The specific physiological and behavioral manifestations of such stress will be highly dependent on the distinct characteristics of both the individual animal and their environment, as they attempt to cope with their own unique pet conditions and experiences as highly variable phenotypes within the species.

Conclusion

Understanding the influence of both species-specific and phenotypically distinct selective pressures on the behavior of pet dogs is paramount to the development of adequate welfare-critical behavioral interaction inventories and subsequent ethograms informing standards of keeping and practice for the modern pet dog population. Cultural obstacles to the adoption of such an ecologically relevant contextualization of natural dog behavior related to behavior problems should be identified and challenged in the interest of improving husbandry practices, designing conditions supporting greater behavioral diversity, and accommodating good welfare.

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