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Kennel Enrichment: Exercise and Socialization of Dogs

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In the last 50 years, there has been a growing need for storage and management systems for the production and maintenance of large numbers of dogs. Unwanted dogs and strays, detained in kennels, stay for various lengths of time. Large kennels also produce dogs for sale as companion animals, for the service dog industry (police and guide dogs), for biomedical research, and for use by dog food companies. Across the United States, literally tens of thousands of dogs are born in kennels and spend their lives in kennels. The laboratory dog, the kennel dog, the service dog, and the companion dog are in an evolutionary transition period, accompanied by concomitant adaptation to stresses signaled by a high frequency of genetic disease and behavioral abnormalities. For kennel enrichment programs, such as socialization and exercise, the modern kenneled dog is a genetically moving target. Specific recommendations apply neither to all breeds nor to the variations within a single breed.

Fifty years ago, far fewer dogs were kept in kennels. The various dog industries were either nonexistent or much smaller, and dogs were more often handled on an individual basis. Because of the recent population increase, dogs have had to adapt genetically—both physically and behaviorally—to new systems of husbandry. Although the main goal for working-dog breeders and sports people has always been to develop fine working-animals (sheep, sled, and racing dogs), our modern kennel industries have overlooked their techniques of group kenneling, socialization of young dogs, and exercising of working animals. With the exception of the service dog industry, rarely is the modern kennel-raised dog expected to do anything except, in some sense, be a generic dog. Like most modern, companion-animal dog breeds, the laboratory beagle is simply a historical represen-
tation of its hunting ancestors. For the kennel dog industries, the less of the ancestor's behaviors they actually perform, the better. Howling, yelping, and rally calls in the laboratory beagle are obnoxious and might be considered a welfare concern (Sales, Hubrecht, Peyvandi, Milligan, & Shield, 1997).

Again, in the last 50 years, a large portion of the dog industry has practiced a form of eugenics as it selects animals that are structurally unique. Breeders are selecting for both little variation of form within the uniqueness and benign behavior. Compared to their immediate working and sporting ancestors, these dogs have sterile lives. They live in contrived environments on contrived diets (Kohane & Parsons, 1988).

THE STANDARD KENNEL

The standard kennel is a way of reducing the amount of labor per dog while fostering its survival. Kennels are a method of managing or producing, or both, large numbers of dogs, as cheaply as possible (Table 1). Currently, it is believed that keeping large numbers of dogs healthy, clean, fed, and sheltered requires ultraclean facilities. Animals are separated (perhaps in pairs) in kennels to reduce the transmission of disease. This fosters individual attention and prevents aggressive and injurious interactions between individuals. The main care effort

<table>
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<tr>
<th>Categories</th>
<th>Annual Turnover</th>
<th>&quot;Snapshot&quot; Population</th>
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<tbody>
<tr>
<td>Companion animal population</td>
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<td>52 million</td>
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<tr>
<td>Turnover</td>
<td>6.2 million</td>
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<tr>
<td>Pet store puppies</td>
<td>0.5 million</td>
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<tr>
<td>Hobby breeders</td>
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<td>Household breeders</td>
<td>3.7 million</td>
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<tr>
<td>Shelters</td>
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<td>Total</td>
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<tr>
<td>Euthanized</td>
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<td>Adopted</td>
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<tr>
<td>Returned to owners</td>
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<tr>
<td>No kill/Restricted access</td>
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<tr>
<td>Research dogs</td>
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<td>50,000</td>
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<tr>
<td>Purpose bred</td>
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<td>Random source</td>
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<tr>
<td>Racing greyhounds</td>
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<td>Working dogs</td>
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<tr>
<td>Guide dogs</td>
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<td>Assistance dogs</td>
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is focused on basic husbandry issues: a disease-free environment with adequate food and water.

Dogs raised in standard kennels are aberrant in one or more, or perhaps all, their organs. In comparative canid anatomy studies, there is a rule never to use skull measurement data from captive-raised wild canids because they are rarely species-typical. Atypical characteristics will be most prevalent in animals raised in the captive environment. Newton (1972) and Tipton, Carey, Eastin, and Erickson (1974) authored an in-depth study that perhaps disagrees with our conclusions.

Some experts have noted that standard kennel methodology leads to rapid deterioration of the dog’s behavior. Two weeks in a kennel for sheltered dogs is often enough to ruin their chances for adoption. One example is the development of fence effects. Dogs quickly learn that obnoxious behavior gains them attention without serious consequences because of the fence barrier. The keeper screaming “shut up” at a noisy dog has just rewarded the dog for carrying on. The more obnoxious the behavior, the more attention is received. Dogs can quickly develop bad habits, sometimes in a period of hours, that are extremely difficult to correct (Fox, 1990). Instead of learning behaviors necessary for being good pets or working dogs, they learn performances that can prevent them from entering the noncaptive world.

Dogs are socially interactive animals, and require species-specific social environments to maintain mental health. Social interaction provides an outlet for autotelic motivations. In theory, being low on a dominance hierarchy is more healthy and rewarding than not being part of one.

Dogs raised in cell-like conditions can develop abnormal behaviors of extreme fear, kennel shyness, and atypical aggression, or become involved in acute stereotypies (Carlstead, 1998). Stereotypies such as route tracing, self-injurious behaviors, or coprophagy and hypertrophied behaviors such as barking are indicators of psychologically deprived animals (Fox, 1965; Thompson, Melzack, & Scott, 1956; Van der Heiden, 1992). Psychologically stressed animals might not be good experimental subjects, in that they do not represent what Loveridge (1998) calls the “outside world.” At the very least, obnoxious behaviors increase the expense of management, compromise good health, make the dogs unsuitable for nonkennel life, and create difficult working conditions for caretakers.

Recently, interest has grown in improving the minimum standard kennel, with a goal of bettering the welfare of dogs. Many investigators have studied single parameters of kennel design. What is the optimum temperature, optimum size (square feet per dog), or optimum noise permissible for the kenneled dog (Anthony, 1963; Bebak & Beck, 1993; Hite, Hanson, Bohidar, Conti, & Mattis; 1977; Hubrecht, Serpell, & Poole, 1992; Hughes, Campbell, & Kenney, 1989; Leadon & Mullins, 1991; Van der Heiden, 1992)? In many studies, however, it has been difficult to find noticeable differences in “well-being” with manipulation of single parameters (Clark, Calpin, & Armstrong, 1991).
The very assumption that each kennel parameter has an optimum dimension may be faulty, but, at present, this is what drives the regulation for dogs' welfare needs. For example, if animals are to be healthy, they should have enough room to exercise, if they want to. Thus, present United States Department of Agriculture standards for exercise require that dogs be provided with the opportunity to exercise. The minimum standard for the opportunity to exercise is to simply double the minimum cell dimensions. Even if the dog never moves, the legal exercise requirement is met.

THE ENRICHED KENNEL

Kennel enrichment research assumes that the animal's mental state is essential to good health and well-being (Shepherdson, 1998). Studies include recommendations to provide auditory, visual, or olfactory sensations. Additionally, objects to be manipulated and played with are seen as enrichment (Burghardt, 1996; Loveridge, 1998). Enrichment emphasizes social interaction with people and other dogs.

Loveridge's (1998) article seems admirable in cataloging what is presently perceived as a kennel-rich environment by the industry. The Waltham Centre for Pet Nutrition (WCPN) kennel is considered an improvement, because now kennels look and feel more like the home environment to the care providers. "The exercise and socialization of the dogs has given the WCPN a population of adaptable 'forward-coming' pets, visibly outgoing and stimulated as measured by our experience and by comments from scientific and non-scientific visitors" (Loveridge, 1998, p. 113).

The problem with this conclusion is that many of us have nonenriched kennels with dogs we might describe identically. The article does not address the problems kennels create, such as hypertrophied barking, stereotypies, or exercise deprivation. Has the frequency of fearful, shy, or aggressive individuals changed? There is little justification for why any of the enrichments were established, and there are no data in this article on whether hypotheses have been supported in the 10 years since the kennel was built.

The motivation for kennel enrichment often seems to be, in large part, public relations: "Research establishments live in an increasingly visible and public world which is becoming less tolerant of care standards that differ from those the public demand" (Loveridge, 1998, p. 113). It is true that we who maintain kennels have been forced by the public to rethink how we treat our dogs (a good thing), but, at the same time, we have been forced to comply with government and humane society standards, which are often arbitrary, trivial, or simply cosmetic. Being forced to adopt the house pet standards uncritically should not be viewed as a testable hypothesis.
The conceptual problem, therefore, is to construct a theory and advance testable hypotheses as to what constitutes enrichment. Is it an attempt to make the dog feel better or lead a more natural life? As ethologists, we have to define those terms and collect quantifiable data.

**THE ENRICHED RESTORATION KENNELS**

A number of researchers (mainly working in zoos) are trying to develop enriched facilities to raise animals suitable for restoring depleted wild populations. Not only are these animals physically and psychologically healthy, they are also educated and prepared for reintroduction to their natural environment (Markowitz & Gavazzi, 1996). This means the captive environment must facilitate the acquisition of species-typical behaviors.

In order for animals to graduate from the captive environment and be restored to their natural environment, the animals must

1. Be physically normal (i.e., have the adaptive phenotype).
2. Be physically conditioned to cope with feeding, reproductive, and hazard-avoidance tasks.
3. Be capable of innate behavioral displays necessary for survival.
4. Learn the necessary skills for survival.
5. Learn how to learn new skills and adapt to environmental deviations (solve puzzles and effectively recruit their cognitive abilities for surviving).

Psychological and physical well-being are redefined here as the capabilities of animals to develop and display their adapted (species-typical) phenotype. The goals of most dog kennel managers should be identical to those of zoo restoration ecologists. Agents of enrichment should be goal oriented, in the sense that they allow the animal to develop normally, both physically and behaviorally. Animals who can survive in their natural environment are simply defined as normal.

By adopting restoration philosophy, we ensure that kennel animals are truly representative of the natural population, thus facilitating both physical and behavioral experimentation. Research animals, even those in terminal experiments, are expected to be representative samples of noncaptive dogs; that is, if released they would be physiologically and behaviorally normal.

The restoration goals of managers supplying dogs to the service- and companion-dog markets include providing an environment that adequately prepares the dog’s personality for adult noncaptive tasks. Research animals and sheltered animals should be qualified for adoption after their kennel stay is over.

The restoration philosophy for kennel dogs goes beyond simple empathy for the feelings of a caged animal, by defining a developmental goal for the individual.
animal. It also gives the ethologist the goal of determining what constitutes species-typical behavior.

EXAMPLES

In our kennels at Hampshire College, we practiced restoration ecology with dogs, although it was not the focus of the research. Our task was the production of large numbers of dogs for a breed-specific working life. We worked (at separate times) with both sled dogs and sheep-guarding dogs. The sled dogs had to be conditioned (exercised) in such a way that they developed the working phenotype and behavior necessary to run fast in a team. The assumption of our research was that the superior working-dog would be physiologically and anatomically different from the nonworking dog of the same breeding (Phillips, Coppinger, & Schimel, 1981; Sands, Coppinger, & Phillips, 1977).

We also imported and produced in our kennels over 1,400 livestock-guarding dogs. In an effort to replace lethal predator–control systems in the United States, these dogs were bred and their behavioral ontogeny manipulated to produce working (experimental) animals for the sheep industry. In order to achieve the working behavioral phenotype, sheep-guarding dogs have to be bonded (socialized) with sheep at critical periods of their development.

Our research required that our kennels prepare dogs for their adult lives. Exercise and socialization had to be facilitated and not left to autotelic motivations. The intent of the kenneling methodologies was to foster (develop) the correct anatomy and behavior in working breeds.

We chose individuals bred from working stock and did not try genetically to manipulate the population to achieve greater success. We assumed, like the restoration ecologist, that the individual had the working genotype. Therefore, if the individual failed to show the working typical phenotype, our task was to understand what went wrong with developmental events.

The following observations illustrate the complexity of anatomical and behavioral developments considered important in creating working dogs.

The Effect of Dog Food on Socialization and Exercise

Fifty years ago, most dogs ate scraps generated by humans. Most dogs in the world may still live on human waste products. Modern Western pets and kennel populations eat commercial dog food. It is perhaps hard to fathom that there could not be a perfect diet or that dogs are not adapted to a perfect diet. It is important, however, to recognize that growing wild animals are not adapted to having a complete nutrient complement—for example, a perfect set of amino ac-
ids—on demand. An evolutionary biologist's basic assumption is that, in nature, all members of a species are competitive for limited food resources. Under natural systems, gene products must be surplus to the occasional nutrient input. To account for unpredictable scarcity, biochemical pathways are adapted to run longer than a minimum growth period.

Even granting that response mechanisms that can control the limits of growth exist, adequate studies show that growing more rapidly than normal can create anatomical abnormalities, such as long bones without the normal trabeculae. Wild animals have to search and capture food, which require nutrients for energy and repair. Food for maintenance and growth has to be more than the metabolic needs created by foraging behaviors.

As a population, modern dogs must adapt not only to commercial diets, but also to a diet that is presented to them with no social, behavioral, or exercise requirement. In our kennels, this created some unique problems.

The Relation Between Feed and Socialization

For dogs (and other species), food quality has direct and profound effects on behavior (Ewald & Orias, 1983; Muller-Schwarze, Stagge, & Muller-Schwarze, 1982). As the perceived quality of feed increases, the frequency and intensity of food defense behaviors also increases (Melzack & Thompson, 1956). Animals raised together during critical periods of social development show aggressive hierarchical relationships in the presence of high quality foods but not low quality foods (Ewald & Carpenter, 1978). Food aggression exists between cages. In theory, food defense behavior becomes developmentally hard-wired, in the sense that continued reinforcement of performance affects growth and development of the neurohormonal systems. Fence-jawing, excessive barking, food pan defense, and aggression toward intruders by caged animals are common reactions at feeding time.

Uncontrollable aggressive behavior is the number-one complaint of people working with dogs (Borchelt & Voith, 1996; Houpt, 1985). Because fear and aggression are very difficult to extinguish by operant conditioning, some researchers believe that cage-aggressive animals have genetic predisposition for the display (Goddard & Beilharz, 1985; Houpt, 1985). Nevertheless, developmental ontogeny and environmental factors need to be studied.

The literature tends to refer to aggression as a unitary behavior. The dog is aggressive. An ethologist places “aggressive” or, technically, agonistic behavior (Borchelt & Voith, 1996) displays in specific categories: foraging, reproductive, and hazard-avoidance activities. The quality, frequency, and sequencing of these behaviors, which define an animal’s personality, are environmentally contextual as well as products of the animal’s developmental history.
In our kennel experiments, aggression in paired dogs or litters was reduced and controlled by feeding (unpalatable) pig pellets. We picked pig pellets because puppy growth was comparable to pups raised on commercial (enriched) puppy feeds (Langeloh, 1990). In experiments where dogs were switched from low-quality food to meat, instant and often ferocious fighting ensued. We learned this low-quality food technique by observing European sheep camps where five or more otherwise ferocious dogs would be fed whey (92% water, 8% solids) in a single trough.

Feeding low palatability rations allowed us to house our dogs in groups. We reduced or eliminated intra- and intercage aggressiveness, which had behavioral and management advantages. It allowed dogs to participate together in nonaggressive activities such as social play and exercise.

There is a relation between food quality and activity patterns. Burghardt (1984) summarized the role of play in adjusting energy budgets in young animals. In our own studies, hyperactive, juvenile livestock-guarding dogs were more apt to develop partial sequences of predatory motor patterns toward sheep—a fault in these breeds. We frequently reduced food digestibility for animals showing the onset of these unwanted behaviors. Many innate motor patterns will extinguish after onset if the animal is not allowed to reinforce the sequence.

Our assumption was that hyperactivity and the resulting development of motor pattern display were consequences of young animals using play routines to adjust for surplus energy. Enrichment, in this sense, could mean manipulating the quality, palatability, and digestibility of food to reduce socially interactive stresses and thus enhance the individual's sense of well-being. If, however, we wanted to foster innate motor patterns, we would adjust the feed accordingly.

In our college kennel, feeding dining hall scraps reduced fecal odors—at least to our noses. However, each of the commercial dog foods produced a distinctive odor. Anal odors are important social signals for canids. Are stresses (aggression, fear, reproductive inhibitors, including population response mechanisms) generated by the quantity and quality of fecal material in a kennel? Could nervousness and stress reactions be triggered or ameliorated through manipulation of fecal odor in enrichment programs? Some of us think so (Fox, 1990).

Relation Between Feed and Exercise

The working dog, like the wild animal, is conditioned, not exercised. There are metabolic differences between animals simply exercised and animals who are conditioned. Functional animals are selected for their ability to be conditioned to a particular performance. In wild canids, conditioned motion is a requirement of feeding, reproductive, and hazard-avoidance activities.
Phillips et al. (1981) pointed out that the metabolic efficiency of dogs changes with a number of environmental variables, including ambient temperature, time since last feeding, and the conditioning of the animal. For the functional animal, feed is a way of replacing nutrients and energy expended during vigorous performance. The reverse question is asked of the kenneled animal: How much exercise is needed to balance metabolic needs of surplus ingestion?

Exercise for kenneled animals is interactive with quality and quantity of feed (Crowell-Davis, Barry, Ballam, & Laflamme, 1995a, 1995b). Canids in general tend not to move until they are hungry. Running or movement is adaptive to food-gathering, reproduction, or hazard-avoidance activities. For most species, movement is a goal-oriented functional activity, performed for a reward.

Food products often remained in our dogs' digestive tracts for up to 36 hr. Feeding a dog every 24 hr might lead to an animal resistant to any movement. Overfeeding could cause negative results in experiments where the kennel size is enlarged in anticipation of increased exercise behavior. Bebak and Beck (1993) and Hite et al. (1977) found no differences in aggression or play correlated with kennel size, but spatial distancing increased with larger kennels. However, the larger cage size is not the cause of spatial distancing. It is more likely a result of resource competition: food.

There are other interactive effects between digestibility and exercise. Running dogs move nutrients through the gut at a more rapid rate than sedentary animals. In kenneled sled dogs, the digestive tract can be emptied during daily exercise within 1 hr. Increasing the quality or quantity of food does not compensate for nutrients lost by the peristaltic action created on the gut by running. Thus, for very active animals, feed must be more digestible and fed after performance to maintain body health. Manipulating feed quality (palatability and digestibility) should be viewed as a kennel enrichment tool.

**Relation Between Socialization and Exercise**

Animals in standard kennels are severely restricted in the expression of psychophysical (innate) responses. Lack of expression of internally motivated displays is thought to be stressful. It is also thought that stereotypies are displacement activities for unexpressed motor patterns (Fox, 1965). The extent of that stress could be measured biochemically (Leadon & Mullins, 1991; Newton, 1972) or in the frequency of displacement activities, stereotypies, coprophagy, and barking (Fox, 1965; Levy, 1954).

In the restoration kennel, environmental boredom is not simply that the animal has not enough to do but rather that the animal is prevented from carrying out internally motivated motor patterns. Even the so-called enriched kennel environments make few conscious provisions for the elicitation of specific internally motivated motor patterns.
Our observations suggest that barking is an innate motor pattern, evoked by novelty and fear, and increased in the presence of other dogs. Our congenitally deaf dogs bark normally in response to the same visual and olfactory signals that elicit barking in normal dogs. Many factors increase the frequency of barking: windy or moonlight nights, overcast days. Barking is sometimes unbearable at feeding times or in the presence of a bitch in estrus. This suggests barking is primarily an agonistic response to conflicts with other individuals who are competing for food or reproductive access and territory. Hypertrophied barking is the result of the cage preventing the dog from responding appropriately to sign stimuli.

Variation in population numbers in our kennels alters the frequency of performance of many stress-related activities. Spatial relations within the cage change with visibility of other individuals (Wells & Hepper, 1998). Contrary to a popular claim, dogs are not pack animals. In nature, pariahs and strays tend to feed as solitary individuals or filial pairs (Daniels, 1983; Daniels & Bekoff, 1989). Their living and feeding in a room of tens or hundreds of animals would be an enormous deviation from their species-typical environment.

Exercise Effects on Dog Development in the Kennel

As we have discussed, feed affects anatomical and behavioral conformation. Exercise also affects conformation. A major part of atypical development may be related to movement or lack thereof. There is ample embryological evidence that organ systems cannot grow normally if they do not function normally. Legs not only can run but must run in order to grow. Animals who break a leg during a critical growth period, forcing the leg to be immobilized, suffer a short leg. The genes for leg length are not prescriptive. An immobilized leg has a different developmental trajectory from one that walks and one that runs. Kittens reared in darkness are anatomically and physiologically modified (Garey & Pettigrew, 1974). Sagittal crests are a developmental phenomenon partly dependent on type of feed (exercising of the jaw). Physical and behavioral phenotype are traits of an animal that result from a cascade of developmental events. There is always a synergistic effect between gene products and the developmental environment. Genes are not prescriptive. Developmental events that happen early in ontogeny have greater effects on structural and behavioral outcomes than later events (Serpell & Jagoe, 1995). Most important, in every developmental system, physical or behavioral, there is a critical period when environmental perturbations have permanent, sometimes deleterious, effects.

Dogs are social animals. This simply means that they have periods in their lives when the growth of their central nervous system is sensitive to the interaction with other animals (Freedman, King, & Elliot, 1960; Scott & Marston, 1950). For many of us, the critical period is a growth process (Coppinger & Smith, 1989). Social growth cannot be immobilized at the critical period of development or the animal
will not develop a normal (social) central nervous system. It is exactly the same illustration as the immobilized leg or hip. Social behavior must be exercised in order to grow.

Kennel-shy animals are probably the extreme case in point. Spookiness to humans is a permanent deformation of the animal’s personality. It is a developmental response to an environmental deficit. Some strains of dogs are much more sensitive or show larger variation of responses to the kennel environment, indicating polygenic predispositions.

The testing of maze bright and maze dull rats is illustrative of the effect of cages on these behavioral dispositions. There was no difference in intelligence, per se, between the two strains of rats; rather, bright or dull scores were results of differential fear responses to the testing apparatus (Estep, 1996). Cooper and Zubek (1958) showed that early enrichment had no effect on adult learning ability of maze bright rats but noticeably increased abilities of the maze dull strain.

By inference, it could be concluded that kennel shyness is a polygenic characteristic with a large environmental component: The same claim is made about almost every genetic disease of dogs, including hip dysplasia. In the correct environment, however, which includes proper nutrition, exercise, and socialization, dogs are not kennel shy, even if they do carry the genes.

We think there is presently a misconception in the dog world about gene action. Heritability studies assess the contribution of the gene (nature) and of the environment (nurture). There is little accounting for the interactions between them.

In a review of Orthopedic Foundation for Animals literature in Komondor Komments, the author says that “Hip dysplasia is an inherited trait involving multiple genes .... CHD [Canine Hip Dysplasia] is a developmental disease” and, much later, “There are no environmental factors which cause CHD” (Anonymous, 1998, p. 15). Such statements result in breeders taking a eugenic course of action without understanding the developmental events and the environmental components of that development. That there are specific outcomes to environmental perturbations, such as shyness, during critical periods should be the signal that genes are not prescriptive in the absolute sense. There is increasing discussion in the literature that phenotype is “an interaction of genes, developmental processes and environmental variability” (Chang & Smith, 1999, p. 1169). What is true of phenotype is also true of behavior.

RECOMMENDATIONS

Change the Dog

Theoretically it is possible to select and genetically engineer a strain of dogs that would be perfectly adapted to the research or kennel environment. Such animals might be perfectly happy in a kennel and become stressed if taken out of the lab-
oratory or exercised. They would be so perfectly adapted to a kennel that it would be immoral to take them out. This is not an outrageous possibility. Society produces cage-adapted rats, for behavioral and medical research.

Paradoxical as it might seem, the dog industry’s predominant attitude is “change the dog.” If the dog does not succeed in the environment we have contrived, then change the dog. At one guide dog organization, German shepherds have a substantially poorer success rate than crossbred retrievers. The institutional response based on heritability studies is to sort among the shepherds and select a genetic strain that responds favorably to the environment provided. There is little questioning of environmental parameters to which the breed is responding negatively. The goal is to create a strain of shepherds that behaves as well as golden retrievers. Genetic selection to fit the dogs to their management needs is the solution.

It is not an isolated scheme. In our studies of kenneled dogs and companion animals, it appears to be the accepted methodology. Whether the question is hip dysplasia or any number of so-called genetic diseases, or any number of obnoxious behavioral characteristics, the solution is to dispose of the character with a eugenic technique. Take all breeds, the assistance dog industry seems to be saying, let them look different, but behaviorally homogenize them. Some of us feel that is outrageous.

It is perhaps noteworthy that some research institutions in the United States tend to get their dogs from the companion animal world, not from the working dog market. This population of animals is already selected not to have cognitive intentionalities that elicit innate motor patterns. These innate behaviors, essential in the working dog, are often obnoxious to the pet owner. For we who are thinking of kennel enrichment programs, these generic dogs should be easier to understand and to provide for.

Change the Kennel (Environment)

Producing large numbers of dogs (experimental or companion animals) may be the controlling variable. Large numbers of dogs under one roof, in visual, auditory, and olfactory communication with one another, create stress. Stresses produced by hyper-social interactions impair physical and behavioral development as well as interfering with an animal’s sense of well-being.

How kennels need to be designed and in what ways dogs need to be attended are not well known. The precise effect of kennels on dogs is unknown. What we do know is that dogs in kennels exhibit unique sets of behaviors.

Kennels we looked at in Europe where adult dogs were brought together in groups showed surprisingly little interaction between dogs, except in the presence of people. In our group kennels, social play behaviors were frequent, often robust. There is the possibility that encouraging social play would be instrumental in con-
ditioned exercise of the participants (Bekoff, 1989). One advantage to group kenneling is the reduction of barking. Hetts, Clark, Calpin, Arnold, and Mateo (1992) found that socially isolated animals exhibit the greatest numbers of bizarre or hypertrophied behaviors.

The observation that action and interaction accrue with the presence of a person indicates that people are a valuable resource for dogs, a fact that some enrichment programs take into account (Loveridge, 1998). We need the ethological information of why dogs are competitive for human attention (Hubrecht, 1993; Hughes et al., 1989).

We like the restoration ecologist approach. We think cages could be designed with puzzles. If dogs want to eat they have to solve problems and exert themselves. Maybe they have to push some sequence of buttons that reverses from time to time. The energy required to achieve the problem should be equal to the reward.

The feed, drink, and exercise tasks that puppies are required to perform should be anticipatory of the tasks they must perform as adults. A service dog could learn to push elevator buttons for food, learning about delayed gratification at critical periods of cognitive development. Thus, future guide dogs, military dogs, or even household dogs could develop the cognitive skills necessary to be responsible adults (Thompson et al., 1956). Watching adults performing helps prepare pups for similar tasks (Slabbert & Rasa, 1997).

Developing puzzle cages can be interestingly complex, requiring space-age technology. For some of us, the real fun is in knowing what the dog will be able to do with that new technology. It will be a wonderful way to find out about a dog's cognitive abilities while exercising those abilities and enriching their environment.

ACKNOWLEDGMENTS

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We dedicate this article to Helenty Homans, whose donation built our present kennel, but who shuddered when she first saw it, leading us to try to understand what was wrong with the state of the art.

REFERENCES


