

BEHAVIOR ANALYSIS OF COMPANION-ANIMAL OVERPOPULATION: A CONCEPTUALIZATION OF THE PROBLEM AND SUGGESTIONS FOR INTERVENTION

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ABSTRACT: This paper conceptualizes the societal problem of companion-animal overpopulation and offers a framework to humanely reduce the current surplus of animals and prevent further overpopulation. Overpopulation is described as a societal problem, with the individual and collective behavior of people as a causal agent. Variables in the environment, including animal-welfare agencies and the pet industry, are also discussed as contributing factors. Behavior and environment factors described in the conceptualization are targeted in a proposed framework for intervention. The intervention framework details relevant target populations and agencies, target behaviors, and dependent measures for evaluating intervention programs. Finally, environmental contingencies are described that support current behavior deficits and will likely impede environment and behavior changes proposed in the framework. It is suggested that behavior analysis can be used to manipulate these contingencies to initiate and sustain proposed changes to beneficially impact companion-animal overpopulation.

Key words: companion-animal overpopulation, animal welfare, behavior analysis, social issues

The Humane Society of the United States (HSUS) estimates eight to ten million companion animals (i.e., cats and dogs) are relinquished to shelters each year and of those, four to five million are euthanized (HSUS, 2002). In fact, euthanasia is the number-one killer of all companion animals (Sturla, 1993). In addition to being placed in overcrowded shelters and euthanized, many animals stray or roam free, becoming nuisances and causing illness and injury in the community (Allen & Westbrook, 1979).

Professionals in the veterinary, animal control and animal welfare fields are now seeing companion-animal overpopulation as a "people problem" rather than an animal problem (e.g., Arkow, 1991; Arluke, 1991; Miller, Staats, Partlo, & Rada, 1996; Moulton, Wright, & Rindy, 1991). In other words, it is the behavior of people that has resulted in an overabundance of animals, and to solve the problem people must change their behavior. Professionals in the behavioral sciences suggest behavior and environment factors need to be considered when targeting behavior problems in the community (Geller, Berry, Ludwig, Evans, Gilmore, & Clarke, 1990). These factors are described here to help understand overpopulation, beginning with the human behaviors, namely behavior deficits, contributing to this societal "people problem."

BEHAVIOR FACTORS

The behavior factors indicated in overpopulation are behaviors of caretakers (i.e., pet owners). More specifically, behavior deficits, or a lack of doing necessary behaviors, contribute to overpopulation, namely deficiencies in pet-maintenance behaviors and pet sterilization.

Pet-Maintenance Behaviors

Pet maintenance refers to continuing to house and care for a pet once it is acquired. Many pets are not maintained after acquisition but instead are relinquished to an animal shelter or to the wild. Research conducted in animal shelters suggests at least 44% of animals in shelters were relinquished by caretakers and a significant number of stray animals appear to have recently been pets (Patronek & Glickman, 1994). Investigations into the reasons for relinquishment reveal pet-maintenance deficits are actually the result of two more specific behavior deficits among caretakers—animal-training behaviors and pre-acquisition planning behaviors.

Animal-training behaviors

Caretakers report behavior problems as the primary reason in 40% of dog relinquishments and 28% of cat relinquishments (Salman et al., 2000). The most common behavior problems reported for both dogs and cats are house soiling, aggressive behavior and property destruction (Haupt, Honig, & Reisner, 1996; Salman et al., 2000). These behaviors are actually typical animal behaviors (e.g., chewing and scratching) that become problems when an animal is placed in a human environment (Miller et al., 1996). Training an animal, which involves teaching the animal the contingencies of the human environment through behavior-analytic procedures, can prevent and/or treat these behavior problems and is critical for pet maintenance. In addition to disciplinary problems, many reported behavior problems seem to indicate incompatibility between caretaker and pet—a sign of the second behavior deficit in pet maintenance.

Pre-acquisition behaviors

Pre-acquisition behaviors are behaviors emitted prior to acquiring a pet in preparation of pet maintenance. They include knowledge acquisition behaviors and an analysis of necessary resources. Miller and colleagues (1996) found the most common behavior problem reported by relinquishing caretakers was “hyperactivity.” This could actually be the result of incompatibility between behaviors typical of an animal breed and a caretaker’s behavior or environment. For example, some dog breeds are very active and require a great deal of exercise while others are more sedentary. “Behavior problems” may occur when a caretaker’s environment and resources cannot accommodate an active dog’s exercise needs.

Other than behavior problems, personal reasons are among the most common motives caretakers report for relinquishing their pets. Reported personal problems include lack of environmental resources (i.e., time, money, and space), allergies, conflicts between a child and the animal, moving, and the addition of a person (e.g., spouse, roommate, or child) or another pet into the home (Haupt et al., 1996; Scarlett, Salman, New, & Kass, 1999). By reviewing personal resources and behavior patterns prior to acquiring a pet, caretakers can choose a pet compatible with this lifestyle, thereby preventing future problems. In addition to ensuring a successful match between caretaker and pet, acquiring knowledge is an important pre-acquisition behavior.

Studies consistently find that caretakers who relinquish their animals, compared to those who retain them, have much less knowledge about animal behavior, healthcare, the expenses of animal caretaking, and female canine and feline estrous cycles (Kidd, Kidd & George, 1992; New et al., 2000). In addition, caretakers who relinquish their pets report desired pet behaviors inconsistent with typical animal behaviors. In a study specifically investigating why people acquire animals, caretakers reported acquiring a pet so it would a) facilitate childrearing, b) protect the home, and c) facilitate social contacts (Endenburg, Hart, & Bouw, 1994). These pet behaviors will likely not occur without the necessary instructive and supportive caretaker behavior (i.e., animal training), which may contribute to disappointment and subsequent relinquishment. Acquiring knowledge about animal behavior, as well as general animal health care, prior to acquiring a pet could prevent relinquishments of this type.

Sterilization

Animal sterilization (i.e., spaying or neutering) is a critical caretaker behavior associated with control of companion-animal overpopulation. Due to the exponential growth rate of companion animals (HSUS, 2002), sterilization is a critical behavior that should be targeted in efforts to reduce overpopulation. Although sterilization legislation has been at the forefront of attempted solutions to overpopulation (Arkow, 1991; Sturla, 1993), there are no published evaluations of whether or not the legislation is being enforced and if it has had any impact on the problem.

In addition to legislation, low-cost spay/neuter programs are in place nationwide. They are based on the assumption caretakers don't sterilize their pets because they can't afford the procedures and are abundant in rural and urban areas across the country (e.g., Stockner, 1991). However, cost is not high on the list of reasons caretakers report for not sterilizing their pets. Researchers surveyed four communities via telephone, querying caretakers (n = 144) about their animals' sterilization status (Manning & Rowan, 1992). Of the 209 animals in the sample, 18.6% were not sterilized. Only 5.3% of the intact animals were reportedly not sterilized because of the cost of the procedure, suggesting that financial cost is not a major impediment to sterilization, and therefore low-cost programs may not be an effective means to combat overpopulation.

The most common reason caretakers reported for their lack of animal sterilization was that sterilization was not necessary because the animal was confined (31.6%), followed by wanting to breed the animal (23.7%), the animal was too young (18.4%), and that sterilization is inconvenient (10.5%). An interesting finding most relevant to overpopulation is that of the female animals in the sample that were sterilized, 20% had given birth to at least one litter of offspring prior to sterilization (Manning & Rowan, 1992). This is consistent with common myths about female animal sterilization, in which case many caretakers falsely believe female animals must go through one estrous cycle or give birth to one litter of offspring prior to being sterilized (New et al., 2000).

ENVIRONMENT FACTORS

The most relevant factors of a societal problem to investigate with behavior analysis are environment factors—the antecedents and consequences of problem-related behaviors. Surely the deficits in animal-training behaviors, pre-acquisition behaviors, and sterilization are key contributors to overpopulation, but it is important to examine the contingencies surrounding these behavior deficits in order to alter them. Unfortunately, these environment factors may be the least salient source of overpopulation, and therefore they are rarely defined and targeted for intervention. Current environment factors for overpopulation are a) ineffective shelter policy and b) promotion and inaccurate depiction of animals by the pet industry and the media in general. These environment factors must change in order to initiate and sustain relevant behavior change.

Shelter Policy

Many animal shelters have policies that hinder the adoption of animals. For example, some shelters do not allow the public to handle animals before adopting them (H. Wadell, personal communication, August 27, 2002), denying potential caretakers to interact with an animal to ensure they are compatible, a crucial pre-acquisition behavior. Another ineffective policy is that many animal-control facilities and some shelters do not accept help from volunteers because of injury liability (H. Wadell, personal communication, August 27, 2002). This seems antithetical to the limited resources given as reasons shelter policies are not enforced (Nassar & Fluke, 1991). Volunteers could assist in enforcing shelter policies and act as community change-agents, educating adopters and the public as a whole.

Often shelter policies prohibit staff from asking why an animal is being relinquished. In some cases, caretakers relinquish an unwanted pet and quickly replace it with a new pet that later is also relinquished (Bandow, 1982). These “repeat offenders” are recognized by animal shelter staff but are seldom turned away because shelter policy and a need to place animals do not allow staff to turn down adopters (Arkow, 1991).

The most salient example of ineffective shelter administration is the animal shelter facilities themselves. Most facilities are plain, concrete buildings located in

rural areas out of sight of the public. When acquiring a pet, the local animal shelter is dismal and inconvenient, compared to brightly lit, well-advertised pet stores located in the main shopping areas of town.

Pet Industry

It is estimated that American pet-supply industry sales currently produce profits of \$23 billion per year, and it is projected these sales will total \$30 billion in 2003 (Maeda, Han, Marshall, & Thompson, 2000). Professionals in the industry discuss the increase in companion animals as a positive sign people are appreciating the value of pets (Maeda et al., 2000). Unfortunately, the number of these “valued” pets entering shelters and being euthanized suggests this is not the case. Because the pet-supply industry is so lucrative, businesses put significant effort into marketing their products to the pet consumer. In doing so, media advertising plays a major role in pet-supply sales, and may contribute to overpopulation.

The media has been implicated as a contributing factor in several community problems due to the effects of observational learning (e.g., Geller, 1988a, b; Holbert, Kwak, & Shah, 2003; Will, Porter, Geller & DePasquale, in press; Winett, Leckliter, Chinn, Stahl, & Love, 1985). Observational learning is learning a behavior by observing the behavior of another person and the consequences following that behavior (Bandura, 1977). Observational learning can impact human behavior by demonstrating new behaviors, and by illustrating reinforcement or punishment of already-learned behaviors. Bandura (1965) demonstrated that children who observed aggressive behavior resulting in no aversive consequences displayed the same aggressive behavior when given the opportunity.

As a current example of observational learning in the media, Geller (1988a, b) and Will et al. (in press) researched unsafe driving behaviors depicted on primetime television. Both studies found that television shows often include driving scenes in which characters do not use safety belts and receive no consequence. Because of the media’s impact through observational learning, community-based interventions often target this source to create behavior change (e.g., Sabido, 1981).

With regard to overpopulation, pet supplies are advertised on television and the Internet, in newspapers and magazines, and on pet-supply packaging (e.g., dog-food bags). In these advertisements, animals are typically shown with no collar, tags, or leash. Unacceptable animal behavior (e.g., chewing on shoes) is portrayed as endearing (Nowell, 1978). Companion animals are also used in the media to sell products unrelated to pet supplies, from alcoholic beverages to bathroom tissue, and are regularly the subject of television shows, movies and books (e.g., Mayer, 1985; Rylant, 1994).

In all of these venues, pets are often depicted inaccurately. Media messages depict positive consequences of animal acquisition (i.e., companionship) but do not depict negative consequences of the behavior deficits mentioned above (i.e., behavior problems, personal problems, pet-maintenance failure). In addition, the

animals used in advertisements are often puppies and kittens, again illustrating a behavior deficit (i.e., sterilization) without the negative consequence of the deficit (i.e., unwanted offspring).

The behaviors involved in overpopulation are not the sole contributors. Rather, behaviors are a result of environmental contingencies. The environment factors above are critical to the behavior deficits resulting in overpopulation. Therefore, a comprehensive intervention framework must describe ways to target these environment and behavior factors.

A FRAMEWORK FOR INTERVENTION

The intervention framework describes target populations or agencies, desired behaviors, and dependent measures. The framework is divided into five levels with each level describing components to target and change in order to benefit overpopulation. Figure 1 illustrates the proposed framework for intervention.

Level 1 lists two major goals—control the already-present surplus of animals and prevent further overpopulation of animals. Level 2 lists objectives for reaching each of the goals. Objectives for controlling the current surplus are to a) use excess animals as resources, and b) responsibly increase the number of animals adopted from animal shelters.

The objectives proposed for preventing further surplus target the two main behavior deficits described above—pet-maintenance behavior and sterilization. These two objectives are listed in the framework together because the same environment factors affect them. Level 3 lists the target populations or agencies for each strategy, which are described below. Subsequent levels consist of specific desired behaviors (Level 4), and dependent measures for evaluating each strategy (Level 5).

CONTROLLING THE CURRENT SURPLUS

Animals as Resources

A substantial percentage of the millions of cats and dogs currently in animal shelters and animal-control facilities will not be adopted and will be euthanized. Destroying healthy animals by the millions is a waste of a valuable resource that could potentially aid in human health and functioning. Recent literature is abundant with case studies and quasi-experiments depicting the impact of companion animals on the physical and mental health of humans, from improving blood pressure and heart rate in cardiac patients (e.g., Allen, 2003; Freidmann, Katcher, Lynch, & Thomas, 1980; Serpell, 1991; Siegel, 1990; Stallones, Marx, Garrity, & Johnson, 1990) to reducing depression and anxiety in clinical samples (e.g., Barker & Dawson, 1998; Fine, 2000; Raina, Waltner-Toews, Bonnett, Woodward, & Abernathy, 1999). The intervention framework proposed here suggests surplus animals be used as a resource in these domains.

Companion animals can serve in institutional settings, interacting with residents in medical and psychiatric inpatient hospitals, nursing homes, juvenile

Level 1—Goal:	Control Current Surplus		Prevent Further Surplus		
Level 2—Subgoal:	Animals as Resources	Increase Adoptions	Promote Pet-Maintenance Behaviors, Sterilization		
Level 3—Target Population:	Service Institutions	Animal Shelters	Industry and Media	Animal Welfare	Caretakers
Level 4—Behaviors:	<ul style="list-style-type: none"> • Screen shelter animals for service 	<ul style="list-style-type: none"> • Allocate funds • Renovate • Screen animals for service 	<ul style="list-style-type: none"> • Disseminate information 	<ul style="list-style-type: none"> • Disseminate information • Enforce • Record 	<ul style="list-style-type: none"> • Pre-acquisition behaviors • Animal training • Sterilization
Level 5—Dependent Measures:	<ul style="list-style-type: none"> • Number of relinquishments, adoptions, and sterilization status • Media, advertising, and packaging content 				

Figure 1. Proposed Intervention Framework.

detention centers, and prisons. Preliminary research in this area suggests patients or residents in facilities with companion animals are less withdrawn (Corson, Corson, Gwynne, & Arnold, 1977), more responsive to treatment (Brickel, 1979), and have increased positive social behavior (Kongable, Buckwalter, & Stolley, 1989). Animals can also be used in psychotherapy to facilitate client-therapist relationships (Fine, 2000), as service animals assisting people with physical disabilities (Beck, 2000), and in school settings to facilitate education with special child populations (Katcher & Wilkins, 2000). Although all animals from shelters may not qualify to serve, because of physical ability and temperament, capitalizing on shelter animals that can serve in any of these settings would turn an excess into a resource. Animal shelters could make it standard to screen dogs entering shelters for these purposes.

The target agencies proposed for using animals as resources are the organizations that train and place animals for therapy or service and animal shelters. The specific desired behaviors for therapy or service organizations are to train and place shelter animals in programs where possible, rather than breeding dogs for these purposes, as is often the case (Fine, 2000). Animal shelters could screen shelter animals and notify training organizations when they have animals with abilities sufficient for service.

Adoption Promotion

In addition to using excess animals for service, intervention efforts must include promoting adoption at animal shelters. Animal shelters are the target agency for this strategy. They must become more visible and inviting to potential caretakers, thereby promoting adoption. Changes may include moving shelters into urban areas, posting signs advertising the locations of shelters, and renovating shelters to make them more appealing. Of course, this requires allocation of funds for renovation and relocation.

Shelter-related changes can come about through educating those who own, direct, and manage animal shelters to allocate funds appropriately. For example, shelters are currently spending a significant amount of money on ineffective spay/neuter programs (Stockner, 1991). Some of this money could be allotted to shelter advertisement. In addition, non-profit organizations and animal-welfare foundations offer grants to shelters for renovation expenses, which could be used to renovate facilities. Animal shelters could benefit from assigning one staff member or a volunteer to fund-raising or grant writing for these purposes.

In addition to making shelters more inviting, shelter staff could make the animals within the shelters more desirable. Many people believe animals in shelters are there because there is something inherently wrong with them (Wells & Hepper, 2000), and indeed many of these animals do have behavior problems (New et al., 2000). Therefore, it is important for shelter staff to assess animals and improve their chances of being adopted. This could mean using behavior analysis to train animals in basic pet obedience (e.g., housetraining, walking on leash) and advertising special behavioral qualities of certain animals.

With regard to training relinquished dogs, several community programs do so in an innovative, cost-effective manner. Animal shelters have teamed up with correctional institutions, and sent hard-to-place dogs to prisons (Virginia Department of Corrections, 2002) and detention centers (Harbolt & Ward, 2001) to be trained by inmates. Once these dogs acquire basic obedience skills, they are adopted by families, thereby transitioning from being “hard-to-place” to having a waiting list of potential caretakers (S. G. Blake, personal communication, December 11, 2002).

Of course, promoting adoption must be done responsibly so ineffective, uninformed caretakers don't adopt animals and continue to contribute to overpopulation. Therefore, the proposed framework identifies several target populations and behaviors aimed at prevention.

PREVENTING FURTHER SURPLUS

The strategies for this branch of the framework involve the two behavior deficits described earlier. Because most animals in shelters were put there by caretakers and many are the product of unwanted litters (Arkow & Dow, 1984), pet-maintenance behaviors and sterilization are critical behaviors for this task. They are listed together because they interact with the same environment factors and the same target populations or agencies are in need of behavior change.

Target Populations or Agencies

Caretakers who relinquish their pets to shelters are the most obvious target population. However, other groups are part of the animal-welfare system that contributes to caretaker behavior deficits. Changes in the environment can provide long-term relationships between animal-welfare professionals and support long-term change of individuals, a necessary component of community research (Altman, 1995). The target populations for this goal are the pet-supply industry, animal-welfare agencies (e.g., animal shelters, veterinarians, and animal control) and individual caretakers.

Pet-supply industry. Because of the need for overpopulation education and awareness, education is a necessary antecedent for the various desired behaviors of every target population. The media is a most effective tool for mass education and awareness. Indeed, the media has helped address other large-scale community issues such as cardiovascular health (e.g., Meyer, Nash, McAlister, Maccoby, & Farguhar, 1980) and energy conservation (e.g., Geller, Winett & Everett, 1982). In behavioral science, the media is recognized as a source for information and learning via observational learning (Bandura, 1986).

As for funding media campaigns, the pet-supply industry could reserve a segment of their \$30 billion advertising budgets to provide informational messages that promote animal-shelter adoption, pet-maintenance behaviors and sterilization. These messages could be incorporated into their existing television and radio commercials, newspaper and magazine ads, product packaging, and sales coupons. Messages can be distributed using print and information technologies, an

appropriate medium for educating individuals not likely to be available for face-to-face intervention (Napolitano & Marcus, 2002).

Animal-welfare agencies. Animal-welfare agencies include those directly involved in the care and maintenance of excess companion animals. This group includes animal-control agencies and animal shelters, which are located in the same facility in many communities (Sturla, 1993), and veterinarians. Their roles are to a) disseminate information, b) enforce policy and legislation, and c) record companion animal information. First, disseminating information includes informing caretakers, whether they are adopters at animal shelters or animal-control facilities or are patrons at veterinary offices. These agencies are charged with informing caretakers about a) overpopulation, b) species-specific animal behavior, c) relevant animal-training techniques, d) sterilization, e) specific information for pursuing animal sterilization, and f) local animal-control laws. In addition, staff can help caretakers select an animal that is compatible with their environment and resources. Adoption is a critical point of contact with caretakers, similar to point-of-purchase interventions designed to promote socially-responsible behavior (Geller, Russ, & Delphos, 1987).

Secondly, animal-welfare agencies can prevent overpopulation by enacting and enforcing appropriate policies at animal shelters and animal-control facilities. This includes requiring sterilization of all animals adopted, following adoptions to assess whether animals are sterilized, and providing incentives for caretakers who do sterilize their animals and disincentives for those who do not. These procedures require appropriate training, vigilance and dedication from shelter staff and volunteers. County officials who determine animal-control budgets are included in this target population, since limited finances and resources are the most common reasons given for a lack of enforcement (Sturla, 1993). These officials must use findings from local investigations to determine an adequate animal-control budget and designate a sufficient number of officers for each county.

In addition, animal-welfare personnel must act when legislation is inappropriate or ineffective, informing county officials and the public of needed legislation. In addition, the public must be informed of legislation in order for it to have an effect (Geller, 1990). Given that laws differ between counties and states and are rarely enforced (Sturla, 1993), and that individuals are ignorant about other caretaker information (Kidd et al., 1992), it is likely caretakers are uninformed of legislation that affects them as caretakers.

Lastly, animal-welfare agencies could be part of a systematic reporting system of overpopulation. The reporting system would provide a way to reliably record and report a) the numbers of animals relinquished, b) reasons animals are relinquished, c) numbers of animals adopted, d) numbers of stray animals in the community, e) numbers of relinquished animals that are intact (i.e., not sterilized) and f) reasons animals are still intact. Animal shelters are a key source of information as to which caretakers have behavior deficits that contribute to overpopulation and why. Such a reporting system is necessary to guide prevention efforts and evaluate their efficacy.

Pet industry. The target agencies of the pet-supply industry include a) those in the business of selling companion animals (i.e., pet stores, animal breeders); b) pet-supply manufacturers; and c) pet-supply distributors. Distributors include pet stores, grocery stores, department stores, and convenience stores. Sources indicate pet supply manufacturers are planning to target these areas to increase distribution of products (Maeda et al., 2000).

The desired behavior of all those involved in the animal industry is to disseminate information about overpopulation. In other words, inform consumers about basic pet care and overpopulation prevention strategies. This could be done through businesses directly informing patrons at the point of pet or pet-supply purchase and informing in media advertisements. In addition to messages in advertisements and on package labels, stores can display informational messages located next to products, whether at the local pet store or in department stores.

Caretakers. Last but certainly not least, individual caretakers are a relevant target population. Although one study suggests relinquishers are more likely to be men under the age of 35 (New et al., 2000), there is no published large-scale epidemiological study on relinquishers. Thus, interventions should target the general public. The desired behaviors of caretakers are pet-maintenance behaviors, including animal-training and pre-acquisition behaviors, and sterilization. The framework depicted in Figure 1 can guide intervention program implementation because it specifies critical target populations or agencies and the specific behaviors necessary for each target group. In addition, Level 5 lists dependent measures for assessing the impact of intervention programs.

DEPENDENT MEASURES

The main dependent measures are the media content of relevant pet-industry advertisements, as well as companion-animal demographics, including: a) the number of pets adopted and relinquished and b) the sterilization status of companion animals. Currently, this information does not exist, locally or nationally. Estimates that do exist are based on hypothetical projections from local investigations with questionable validity (e.g., Nassar & Mosier, 1991; Patronek & Glickman, 1994; Patronek & Rowan, 1995). A unified standard of reporting is necessary to define the problem further and evaluate progress of intervention approaches.

This will entail animal-welfare agencies systematically collecting data and reporting hierarchically, from county to state to national authorities. This hierarchy will hold local municipalities accountable for collecting and reporting animal population data, encouraging proactive behavior of animal-welfare professionals. In turn, animal-welfare professionals will hold individual caretakers accountable. Being held accountable is crucial to large-scale change and makes it more likely those involved will develop self-accountability or personal responsibility (Geller, 2001). In addition, systematic reporting can guide local officials to assign necessary animal-control resources, resulting in improvements for staff. However, time and money are required to initiate a reporting system. This is consistent with

many solutions in the intervention framework—proposed behaviors are currently under the control of other environmental contingencies.

CURRENT ENVIRONMENTAL CONTINGENCIES

The intervention framework lists several target populations or agencies and desired behaviors to beneficially impact overpopulation. However, natural contingencies are currently in place that contribute to behavior and environment factors and will likely hinder initiation and maintenance of the proposed changes. In other words, the framework suggests impacting behavior and environment factors that are under the control of additional environmental contingencies not addressed in the framework.

The most effective consequences to motivate behavior change are soon, certain, and sizeable (Geller, 2001; Skinner, 1953). Table 1 lists the natural consequences of behaviors proposed in the intervention framework to prevent a further surplus of animals. The crux of the overpopulation problem and the contributing contingencies can be seen in this table. The soon and certain natural consequences of the proposed behavior changes are negative and the positive natural consequences are uncertain and delayed.

For example, the intervention framework proposes the pet industry inform the public about companion-animal overpopulation and behaviors necessary for secondary prevention. The immediate consequence of informing the public is a loss of money for businesses. Eventually such a business's consumers may appreciate the assistance, which in turn should influence more business. The norms should change and similar to other social problems (Geller, 1992), it may become socially approved and good-for-business when companies disseminate relevant overpopulation information when marketing their products. However, this is an uncertain, delayed consequence.

Similarly, the intervention framework proposes animal-welfare agencies inform the public, enforce policy and legislation, and systematically record companion-animal demographics. As illustrated in Table 1, the immediate natural consequences of these behaviors are a loss of time and money. Only in the long term, after the various behavior and environment changes have had a positive effect on overpopulation and there are fewer excess companion animals, will the positive consequences of a reduction in workload and distress be experienced. As for the caretaker population, the immediate consequences of animal training are a loss of time and money. The desired consequence—a well-behaved pet resulting in the avoidance of behavior and personal problems—is delayed. Again, the immediate, certain consequences are negative and the positive consequences are delayed and uncertain.

In order to initiate and maintain the proposed behavior changes, intervention is necessary to alter these environmental contingencies. This can be done by adding immediate external consequences or by bringing the natural delayed consequences into the present (Skinner, 1953). Examples of adding positive external consequences could include a) offering government funding and tax

TABLE 1. CONTINGENCY ANALYSIS OF THE BEHAVIORS
PROPOSED TO PREVENT FURTHER ANIMAL SURPLUS.

Target Agencies	Desired Behaviors	Natural Consequences	
		Immediate	Delayed
Pet Industry	Inform	Money (-)	Positive Image (+)
Animal Welfare	Inform, Enforce, Record	Time and Money (-)	Less Work, Distress (+)
Caretakers	Pet maintenance, Sterilization	Time and Money (-)	Avoid Problems (+)

breaks for animal shelters and pet suppliers that practice overpopulation prevention, and b) giving work-related rewards for shelter or pet-store staff and animal-control officers active in relevant target behaviors. With regard to animal-welfare agencies informing, enforcing, and recording, federal grants could be given to areas that implement effective policies. Research shows policies are adopted faster in states that receive these types of incentives, compared to those that do not (Welch & Thompson, 1980).

In addition to government funding, behavior analysis could be used with individual caretakers to encourage desired pet-maintenance and sterilization behaviors. Incentive/reward programs (Geller, 1993) could be used by animal-welfare agencies. For example, caretakers who provide documentation of animal sterilization or demonstrate effective animal training could be entered in a raffle to win cash or pet supplies. Animal-welfare staff could receive the same type of program centered on the behaviors of informing adopters, enforcing policies, and recording companion-animal data. The intervention framework in Figure 1 should be used to direct intervention efforts, with an understanding of the contingencies currently in place, as depicted in Table 1. In order to initiate and maintain appropriate behavior change, behavior analysis is necessary to define and change these contingencies.

CONCLUSION

This paper proposed a behavior-based conceptualization of companion-animal overpopulation and a framework to guide intervention efforts in reducing this societal problem. The intervention framework details various target populations or agencies, desired target behaviors, and dependent measures for evaluating intervention efforts. The crux of the problem, as with many community problems, is that environmental contingencies currently in place support behavior deficits and may impede behavior change. The framework is an initial step in intervening, detailing the necessary behaviors. The next logical step is to use behavior analysis to manipulate environmental contingencies resulting in the desired behaviors.

Although it is not obviously stated, research encompasses all aspects of the proposed framework. Potential researchers and agents of change include a) animal-welfare agencies, b) traditional research groups who have been uninvolved in animal welfare (e.g., behavior analysts, community psychologists and epidemiologists) and c) officials who investigate other community problems (e.g., county health departments, town councils and city planners). The literature reviewed here consists mostly of case studies, exploratory survey studies, and correlational studies that do not lend themselves to causal inference (e.g., Arkow & Dow, 1984; DiGiacomo et al., 1998; Frommer & Arluke, 1999). As the intervention framework makes clear, this problem is vast and has many contributing factors. Concerted efforts are needed for systematic intervention at individual, group, and societal levels.

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