

The effects of socialization on dogs

by

Sara Swanson

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Major Professor  
Dr. Alison Paige Adams

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## **Abstract**

Problem behaviors in domestic dogs (*Canis lupis familiaris*) can affect owner contentment and the human-animal bond as owners try to navigate management of their pet's behaviors. While some problem behaviors can be a result of either poor or lack of appropriate training exercises, others can also be rooted in fear. These fear-based behaviors, such as aggression and anxiety, have an ontological aspect where the potential for development for these behaviors can be linked to distress or lack of desensitization during primary social development. These behaviors have a significant effect on the human-animal bond. A large percentage of animals (approximately 30%) are surrendered each year, primarily due to fear-based behaviors, including aggression. This report culminates research and science behind the developmental stages of the domestic dog and examines how various human interventions within these stages can result in a positive effect on the dog's adult behavior and reducing the likelihood of fear-based behaviors.

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## Chapter 1- Introduction

### Historical Perspective

In the United States, *Canis lupis familiaris*, best known as the domestic dog, is a common choice for a companion animal. While there is an abundance of domesticated species that are now kept for companionship, mankind has had the longest relationship with the dog - one of the first domesticated animals. Unearthed remains of dogs have been dated up to 15,000 years ago, with other claims suggesting that the relationship could be extended further to approximately 30,000 years ago (Frantz et al., 2016; Ovodov et al., 2011).

Through unconscious proto-domestication, which turned into intentional, men and canines came together to form a working partnership. Dogs were used in Ancient Greece for protection and war purposes, as well as companionship (Lonsdale, 1979). Other historical working functions include hunting, herding, and livestock guarding. As the world expanded and progressed, dogs maintained their role as companions and partners. The same olfactory abilities used to help hunters have been further refined into training for law enforcement and search-and-rescue purposes (Bird, 1996; Jones et al., 2004; Oesterhelweg et al., 2008). Service dog training now encompasses training to help mitigate a variety of disabilities, from guide dogs that assist the visually impaired to psychiatric service dogs trained to help their handlers live a life with mental health disorders (Bremhorst et al., 2018). In particular, guide dogs offer an alternative to navigational aids such as canes (Eames et al., 2001).

While dogs have a long history of being valued working partners, there are still many that serve the role as a companion animal to many individuals and families. Approximately 48 million American households have at least one dog (American Veterinary Medical Association, 2019). In the United States, the domestic dog population is estimated to be 76,811,305



(American Veterinary Medical Association, 2019). Pet dogs are valued and loved by their owners. Economically, this significantly contributes to pet industry profits, which are estimated to top \$99 billion in fiscal year 2020 (American Pet Products Association, 2019).

### **Fear-based Behaviors and Stress**

While it is common knowledge that dogs are revered among American culture, this does not equate to high animal welfare standards. Studies have shown that fearfulness is a prominent temperamental disposition amongst dogs (Blackwell et al., 2013; Tiira et al., 2016). More common fear-based behaviors include anxiety, excessive vocalization, inappropriate elimination (urinating or defecating in undesired situations) and aggression (Blackwell et al., 2013; Tiira et al., 2016). Fear-based behaviors can prove to be difficult for many dog owners. Goals such as being able to take the dog along on errands or having friends over can be potentially seem unattainable to owners encountering extreme cases of fear-based behavior. Owners might turn to professional animal trainers or veterinary professionals or guidance; however, some might try to work through the problem behaviors on their own. These behaviors can put a strain on a dog owner's daily life, the relationship with their pet, and even the relationship with other household members due to disagreements over the animal and the management of the problem behaviors. Impulsivity, acting without foresight or forethought, can lead into increasing these reactions (Mitcham, 2015). Impulsivity can be linked to genetic differences, suggesting potential differences in breeds in likelihood for displaying impulsivity (Kubinyi et al., 2012). As such, potential for displaying heightened fearful responses can vary between breeds of dogs. Problem behaviors such as these increase a pet's likelihood of being relinquished or rehomed (New et al., 2000). In a 2015, survey of people who had relinquished a

pet, 30% of respondents cited aggression as their reason for rehoming the animal (Weiss et al., 2015).

Problem behaviors, in turn, affect the welfare of domestic dogs. Relinquishment to a shelter can be stressful for a dog without any fear-based behaviors to begin with. If owners choose not to rehome the dog, social interaction with humans might become limited if the owners choose to change the dog's living situation to prevent or outright avoid instances of problem behaviors. Dogs may sometimes end up living outside tethered or in a kennel with reduced contact. This causes welfare concerns, begging the question: "are dogs' needs, both physical and emotional, being met in situations like this?"

Additionally, the concern of stress extends to the canine half of the human-animal relationship. Not all stress is bad stress. Eustress is known as beneficial stress, it is an acute form of stress resulting in the release of dopamine. Distress is a negative affective state, and the type of stress experienced when animals feel fear. Part of the animal welfare Venn diagram by Michael Appleby (1999) includes affective states, and this is used to determine the welfare of an animal. Problem behaviors rooted in fear and aggression can limit a dog's welfare status by also prohibiting neutral or positive affective states from being predominant, instead instilling negative affects when faced with stimuli that trigger fear and distress.

To get to the root of problem behaviors and how humans can find a solution for them, a proper scientific approach for these behaviors must be established. Ethology is the study of animal behavior in an individual's natural habitat (Jensen, 2003). Due to the nature of ethology, it may not be the most appropriate choice for problem behaviors in domestic dogs, especially with regard to the human-animal relationship's effect on these behaviors. The ethology approach

is more suitable for studying behavior of wild animals, from the viewpoint of behaviors being naturally selected for in a population.

The scope of behaviorism is relevant to training dogs to perform specific behaviors. Behaviorism theory is that humans and animals learn through conditioning alone (Watson, 1924). While this can be applicable to training in respect to obedience in dogs, it neglects to take account for emotional or thought processes going on within an individual. As such, looking into the effect of socialization into a dog's ability to handle stress and maintain positive affective states would be inappropriate.

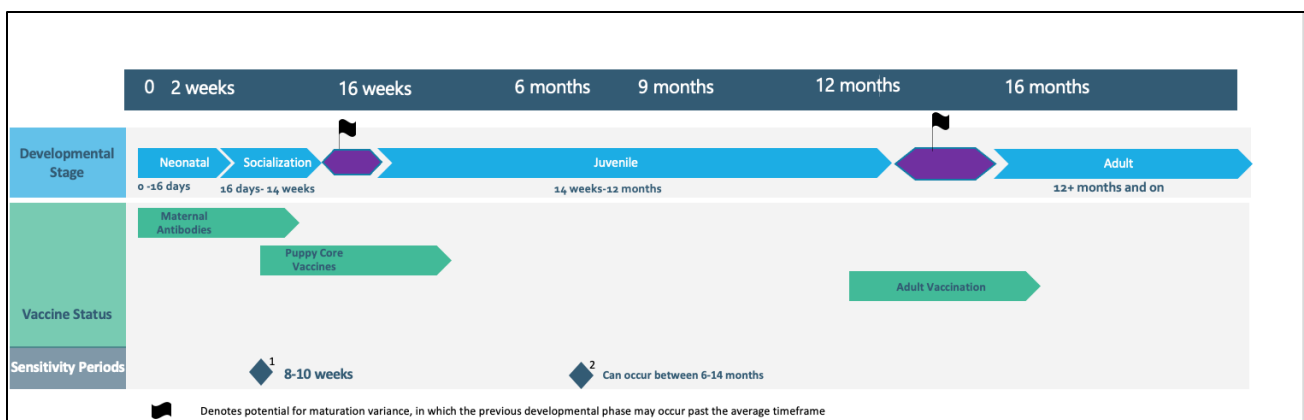
Applied ethology, however, is the study of behavior in animals that are managed by humans (Jensen, 2003). Due to our domestication and keeping of dogs, this would be an appropriate fit, as it also considers humans' effect on animal behaviors in the production, artificial selection for breeding and ownership of domesticated animals.

For several reasons, the study of dog developmental stages has increased in recent years. Socialization is becoming a key factor for people advertising litters, potential owners looking to buy pets, and dog trainers offering their services for owners (González-Martínez et al., 2019; Mitcham, 2015; Majecka, 2020). One problem that has arisen is that while many are using the same word, there are multiple definitions being attached to the term "socialization".

Colloquially, it is often used as a synonym of dog-to-dog interactions in the form of play, most notably in the cases of puppy classes that feature playtime breaks. However, socialization is a desensitization process in which puppies are exposed to novel stimuli and experiences; including different humans, animals, sounds, visuals and textures (Howell, 2015). More than playtime, socialization is a key process in which dogs learn and define relationships and emotions to humans, animals and experiences. By utilizing early socialization in puppyhood, humans can

assist dogs in adjusting to the world and what may come. Instead of allowing each novel experience to happen suddenly, appropriate simulations are put on by breeders and puppy raisers to allow for desensitization during prime developmental periods. It is important to note that socialization is only one ontological factor that goes into an adult dog's behavior. Other life factors, such as ownership and maternal care, as well as genetic and epigenetic contributions from previous generations also go into a behavioral profile of an individual dog. It is pertinent to note that socialization is a prominent ontological factor, but it is not the only component with an effect. Components, such as maternal care, prenatal influences, genetics and selective breeding, also contribute to a dog's complete adult temperament (Dietz et al., 2008; Mehrkam and Wynne, 2014).

**Figure 1-1** provides a visual summary of critical windows, vaccines, and common challenges puppies can face that will canalize behaviors. The following chapters will discuss socialization based on different developmental stages that will include: 1) Neonatal and Social Periods (birth to approximately 16 weeks old), 2) Juvenile Period (approximately 16 weeks to 16 months), and 3) Adulthood (based unknown history of socialization in previous developmental stages). In particular, there will be focus on various techniques and their effectiveness.



**Figure 1-1.** A visual summary of critical windows, vaccines and common challenges puppies can face that will canalize behaviors. This figure was composed using several resources (American Animal Hospital Association, 2017; Battaglia, 2009; Dietz et al., 2018; McConnell, 2007).

## **Chapter 2- In the Whelping Box: Neonatal and Social Periods**

Chapter 2 will first review previous studies on socialization in young puppies, dogs typically under 4 months of age. This section will also cover characteristics of the neonatal and socialization developmental periods and when puppies transition from neonatal to the socialization period. Aspects of socialization and early neurological stimulation and the results of these interventions will also be explored.

### **Previous Work**

Early research into the effects of early exposure to humans for dogs is not a recent venture. In 1961, Freedman et al. conducted a foundational project to that compared social attraction to humans between litters of puppies that were raised with their mothers for 14 weeks without human interaction, except for two weeks the puppies were removed and socialized. Categories of litters were separated into what age the puppies were removed from the dam; 2 weeks, 3 weeks, 5 weeks, 7 weeks or 9 weeks. All litters, including the control litters that were not removed for socialization, were again tested for social attraction towards humans, eating in strange situations, and amount of barking at the age of 14 weeks through 16 weeks of age.

Puppies that were removed at the age of 9 weeks scored highest on social attraction during final testing, with a score of 60% calculated from time a puppy spent interacting with a passive human. At the end of the final testing period when the puppies were 16 weeks old, puppies that were socialized beginning at 9 weeks of age were 5 times more likely to interact with a human than the control population.

The litters that were removed at 2-weeks-old had the lowest attraction score at the beginning of 14 weeks and end of 16 weeks. However, this group also exhibited the largest

change in social attraction. Their beginning score was less than 20%, which jumped to 50% at 16 weeks of age.

The control group contained litters with no socialization prior to the final testing at 14 weeks of age. This group consistently scored the lowest (ranked 6<sup>th</sup> out of 6) or second lowest (5<sup>th</sup> out of 6) in the various tests. For social attraction, the control group puppies first exhibited less than 10% on attraction scoring. By 16 weeks of age, this number had only risen to around 15%.

Freedman et al. (1961) concluded that the prime window for puppy socialization with humans must occur before 14 weeks of age, given that the control group scored so poorly on human attraction and other tests. The researchers noted that for the litters removed at two-weeks-old for training, puppies were too physically immature to properly interact with the experimenter. Litters trained at three weeks of age showed the most interest in the experimenter, immediately drawn to them and began interacting via pawing and biting. As the age of puppies increased, wariness of a human within the first few days rose. However, these groups would later go on to have higher scores on social attraction during final testing, increasing along with the age of removal.

Early research in the consequences of early handling and socializing were not only limited to the scope of companion canines. For military dogs, the United States military developed and implemented the Bio Sensor program throughout 1968-1976. While dubbed Bio Sensor, it became commonly known as the "Super Dog" program. The goal of the Bio Sensor program was to develop dogs that had a superior advantage for the requirements and stress of military work, especially during the course of the Vietnam War (Battaglia, 2009). The Bio

Sensor program entailed puppies undergoing daily neurological stimulation from 3 days old to 16 days old. These exercises and descriptions will be detailed later within this chapter.

### **The Neonatal Period- Developed for Learning**

A reason why the neonatal and socialization periods are a major period of a dog's learning for its life is because of how puppies develop. It begins right at whelping, or canine birth. Different species have different developmental stages from birth until adulthood. These developmental differences and resulting social mannerisms can be seen on the altricial-precocial spectrum. Precocial offspring are relatively independent after birth, such as horses and some species of birds. Precocial young are able to be mobile shortly after birth and are born with their all five senses developed, they also often forage while still nursing. Alternately, super-precociality results in offspring that are immediately independent and able to survive on their own after birth (Schneiber, 2017). The opposite end of the spectrum is altricial offspring, which are underdeveloped compared to precocial species. The family *Canidae* is a suitable example of this, in which canine pups are born with their eyes and ears closed, have limited mobility, and a large reliance on their mother for survival (Schneiber, 2017).

In order to be survive independently at days of age, appropriate responses must be formed quickly to potentially dangerous stimuli. Fear-based behaviors become necessary for staying alive from predators. In contrast, altricial animals require care from another creature as they mature. The Latin root, *alere*, translates "to care for, nourish, nurture". While young precocial species quickly learn avoidance, the slow development of altricial young allows for early handling for a period of time. This so-called blank slate allows for handling programs such as Early Neurological Stimulation (ENS) to be performed that will have an effect on puppies.



In domestic dogs, the neonatal period lasts from day of birth until around 16 days of age (Battaglia, 2009; Dietz et al., 2018). Due to their altricial nature, pups are reliant on their dam (mother) for assistance with basic bodily functions such as eating, defecating and maintaining body heat. Their eyes and ears are closed at birth and will remain this way until after they reach the two weeks of age. Therefore, these two senses are not utilized for a majority of the neonatal development period.

One sense they do have, and heavily rely on during the neonatal stage, is touch. The puppies' mother will maintain close contact to help the puppies maintain proper body temperature and allow them to nurse without struggling to search for her. A mother dog will lick her puppies to stimulate digestion and elimination (Foyer et al., 2016).

Tactile stimulation given to altricial creatures such as dogs during the neonatal development period has been a topic of study. One species that has been utilized for these studies is the laboratory rat. Like dogs, rat pups are born dependent on their mother and without sight or hearing developed.

In the Caldji et al. (1998) study, researchers studied rat mothers with their pups and how often the mothers engaged in licking, grooming and arched-back nursing (LG-ABN) with their litter. Mothers were categorized into high LG-ABN, frequently observed grooming and taking care of their pups above the mean, or low LG-ABN, in which mothers were observed caring for their young in LG-ABN behaviors below the mean quantity. The pups raised from these litters were later used in behavioral testing upon maturation. For this, researchers conducted two tests. The first test (food test) recorded how long it would take a rat to start eating food in a novel environment, and how long they ate. The second test (exploration test) looked at how long the rat would explore in a novel environment. Offspring of high LG-ABN mothers readily explored for

longer periods of time in the exploration test. In the food test, they took less time to begin eating, averaging 200 seconds latency, and spent a longer time eating food. Rats raised by low LG-ABN mothers spent minimal time exploring, averaged taking around 500 seconds to begin eating food, and very little time spent eating food.

Additionally, tactile stimulation in rats has been studied outside of the effect of fearfulness. Rats have been observed to have greater success at some behavioral tasks, such as object recognition, when given tactile stimulation by researchers (Richards, 2012). In dogs, amount of maternal care has been linked to traits such as confidence and aggression. Dogs that had a mother with higher scores of maternal care were more confident and less aggressive than those who received less maternal care (Foyer et al., 2016).

Rats and dogs branch off phylogenetically into different orders, Rodentia and Carnivora, respectfully (Cannarozzi et al., 2007). This accounts for morphology and adult behavioral differences. However, given the similarities between neonatal characteristics and maternal care for canines and rats (altricial young, nursing from mother, mother caring for pups through contact, licking to stimulate excretion in pups), incorporating outside tactile stimulation during a time of development for puppies can be vital to raising puppies in relation to minimizing stress reactions and fear-based behaviors (Czerwinski, 2016).

### **Early Neurological Stimulation**

Due to the importance of tactile stimulation during this neonatal stage, handling by humans is crucial. The military's Bio Sensor program utilized ENS exercises to stimulate puppies' neurological systems at an earlier age in an effort to create superior working dogs for military use (Battaglia, 2009). After its use in the American military, civilian dog breeders began to utilize ENS in their breeding programs.

The ENS exercises are as follows:

1. Tactile Stimulation- the handler holds the puppy and using a Q-Tip, “tickles” or stimulates between the puppy’s toes on one foot for 3-5 seconds
2. Head held up- the handler holds the puppy perpendicular to the ground, head directly above the tail for 3-5 seconds
3. Head held down- the puppy is held perpendicular in a reversed fashion, with the head pointing towards the ground for 3-5 seconds.
4. Supine position- the puppy is held in the handler’s hands with its back on their palms and muzzle facing up for 3-5 seconds.
5. Thermal stimulation- a towel is placed in a refrigerator for five minutes, then removed. The puppy is placed on the towel for 3-5 seconds. The puppy is allowed to freely move and is not forced to remain on the towel.

As the litters raised with ENS started to mature, differences between them and their counterparts raised without ENS were observed. Effects that were observed in canines that were subject to ENS protocol from ages of 3 to 16 days of age were improved heart rate, stronger heart beats, increased adrenal function, increased stress tolerance and stronger immune systems (Battaglia, 2009).

With the use of ENS exercises, this early introduction to stress stimulates the nervous system in the developmental timeline than what puppies would experience with no human intervention. One important aspect that those who wish to utilize ENS for puppy raising is that overstimulation can have adverse effects, just as it can in adult dogs. Battaglia cautions to not extend the duration of the exercises or perform them more than once per day (2009). If additional stressors are

encountered during the ENS period, such as tail docking or dewclaw removal, it would be astute to not perform ENS exercises on that day to avoid excessive stress.

### **The Socialization Period**

Following the neonatal period is the socialization period. This period begins approximately around 3 weeks of age and ends between 12-14 weeks of age (Battaglia, 2009). With the puppy's newly developed senses of sight and hearing, they are able to fully perceive their environment during this developmental stage. Variance for length of the socialization period can be found between breeds and maturation rate.

As the puppies grow during this period, they utilize their newfound senses and locomotion to explore the world around them. Play between littermates starts increasing in level and duration as the puppies grow. Socialization, in the individual learning focal point, is often used to describe desensitization to various stimuli. This includes exposing the puppy to new experiences, objects, animals, people and sounds that it will experience throughout its life in efforts to create a positive association (Howell et al., 2015). This critical stage occurs after puppies are three weeks of age due to their delayed development in sight and hearing, of which many experiences are perceived through. With this, most experiences that a puppy will be exposed to are novel to them. They have no prior emotional memory and response that would otherwise bias these experiences. Lack of exposure to these experiences before initial wariness and sensitivity periods could result in fear responses at a later age (Cutler, 2017; McConnell, 2007). Thus, this period is important for breeders and puppy raisers alike. It is an opportunity to prepare the canines they raise for a lifetime of living as a companion in a human's world.

In modern vernacular, socialization is often coined in terms of classes and outings. For example, it would be recommended to socialize a puppy with other puppies during "puppy

kindergarten” or have a family’s new canine addition be greeted by a multitude of unfamiliar humans. What this common approach fails to touch on is that a companion dog experiences more in its daily life than social interactions with humans and other dogs.

Thus, socialization programs developed by researchers and breeders encompass a multitude of stimuli. Major themes of socialization include tactile stimuli, auditory stimuli, visual stimuli, interaction with people and interaction with the environment (Vaterlaws-Whiteside and Hartmann, 2017). Tactile experiences can include petting puppies, introducing puppies to different floor surfaces, introducing puppies to wearing a collar and allowing the puppy to interact with different textures in their environment. An important aspect to note is that not every dog lives the same life. A police k9 would have to work through the stress of the various working environments encountered in the field (Lopes et al., 2015) In contrast, dogs that are selected for household companionship will likely not have to endure that kind of stimuli. Selection of appropriate stimuli to socialize puppies to will be dependent upon the intended purpose of the puppies’ future.

Visual stimuli can include introduction to sudden movement they might encounter (for example, an umbrella popping open), rolling items, such as a suitcase or wheelchair, allowing puppies to explore their reflection in a mirror, and some puppy caretakers include letting a television play within eyesight of the puppies (Vaterlaws-Whiteside and Hartmann, 2017).

Auditory stimuli can cover a variety of sounds a puppy might experience; such as electronic device tones, sounds that household appliances make, trash bags being opened, thunder and vacuum cleaners (Vaterlaws-Whiteside and Hartmann, 2017). Interactions with people include being held, being petted, playing with humans, as well as encountering humans

that appear different than their daily caretakers (Dietz, 2018; Vaterlaws-Whiteside and Hartmann, 2017).

Environmental interactions include experiencing environments outside of the area the puppies are raised in, walking on various surfaces outdoors, and crossing thresholds such as doors. Rather than keeping puppies in only the area they are raised in, allowing exploration is encouraged (Vaterlaws-Whiteside and Hartmann, 2017). The backyard is different than the puppies' pen and is environmental socialization, despite not seeming like a novel environment to humans. Continuing this tangent, the front yard is a novel environment from the backyard for puppies, even though the only thing separating the two might be a fence.

Like with ENS, it is vital that the caretakers facilitating the socialization allow the interaction to be appropriate for the puppies. Too much stressful exposure could result in unintended negative consequences, such as creating a fear-based response to stimuli rather than neutral or positive responses. Just as underexposure can be detrimental, overexposure can unintentionally create the same pathologies (Battaglia, 2009).

Puppies who receive appropriate socialization are more confident than their under-socialized counterparts. Helen Vaterlaws-Whiteside and Amandine Hartmann (2017), tested an extended socialization protocol on litters raised at an assistance dog breeding facility. Study litters were raised using the research protocol as well as the facility's socialization standard, where control litters only encountered items listed on the facility's standard. A key difference between the two were that the research plan had the puppy taken away from its littermates and mother for exercises, while the facility protocol exercised their plan for the whole litter at the same time. Results showed that puppies raised on the extensive protocol scored more favorably in interactions with people and interactions with the environment. Additionally, the study

puppies scored higher on assistance dog prospect testing and exhibited lower rates of problem behaviors, such as separation-related behaviors, general anxiety, distractibility and body sensitivity.

The effects of socialization, or lack thereof, can impact adulthood. Puppies raised in commercial situations, such as those sold at pet stores, are raised in more of a farm environment rather than a kennel or home. This environment can be overly stressful during the socialization developmental period, often past the level of comfortable desensitization. Dogs that are bought from pet stores are more likely to exhibit problem behaviors than dogs purchased from breeders (Pirrone et al., 2016). Based on the study by Pirrone et al. (2016), problem behaviors that were prevalent in dogs bought from pet stores as puppies versus those obtained from individual breeders included house soiling (15% vs 5%), body licking (30% vs 14%), separation-related behaviors (30% vs 17%) and owner-directed aggression (21% vs 10%). While it is to be noted that the ontogeny of the dogs beyond the socialization period also contribute to their behavioral history, it is still significant for the noted behaviors to occur predominantly in dogs that are raised in stressful situations without socialization.

### **Health Risks**

In early puppyhood, immune protection is provided through the mother by maternal derived antibodies (MDAs). In order for puppies to create their own immunity to pathogens, their immune system must create its own antibodies. While MDAs are still present, they will react to immune challenges such as vaccinations rather than the puppy's immune system creating antibodies to the immune challenge. MDAs are commonly associated with vaccine failure when vaccination is done too early (Wilson et al., 2014).

To avoid the potential outcomes of vaccinating too early or too late, puppies receive multiple doses of certain vaccines until the puppy develops immunity. One core combination vaccine, the DAPP vaccine (Distemper, Adenovirus, Parvovirus and Parainfluenza) is one of these vaccines that is given multiple times before 16 weeks of age. **Table 2-1** shows core and other common vaccinations that are administered during the socialization period.

It is pertinent to note the importance of vaccination in young dogs. This allows their body to mount a proper immune response against potential exposure within their life through low-risk challenges modified to create antibodies to diseases. In rabies endemic regions, high rates of rabies death is seen in dogs younger than three months, presumably due to lack of vaccination in a population and individual risk due to young age (Morters et al., 2015).

**Table 2-1.** Vaccination Schedule in the Socialization Period. Adapted from American Animal Hospital Association, 2017

	Vaccine Type	Age Given
Vaccination schedule in the socialization period	DAPP (Distemper, Adenovirus, Parvovirus, Parainfluenza)	As early as 6 weeks, sequential doses given every 2-4 weeks
	Bordetella	8 weeks, booster 2-4 week after initial dose.  *High risk puppies may be administered vaccine intranasally as early as 4 weeks
	Leptospirosis	8 weeks, booster 2-4 weeks after initial.
	Canine Influenza	6-8 weeks, booster 2-4 weeks after initial dose



There may be concerns about potential infection on fragile immune systems from caretakers of young puppies during socialization. There are precautions that should be exercised that allow both socialization to outside sources (in particular, human visitors) and health to be observed. First, requiring visitors to remove shoes and wash their hands before handling puppies. This prevents potential transmission as shoes can serve as fomites for disease. Hands are used to handle and hold puppies but could also have been in contact with outside dogs. Additionally, caretakers can request that visitors have clean clothes if certain individuals in particular are often in contact with other dogs, such as those who have pet dogs or work with dogs in a professional manner.

In the aspect of socializing to other dogs, having puppies interact with healthy, vaccinated dogs already in the household is ideal. If this is not possible, finding known dogs that are healthy and have a known vaccine history would be ideal. This lessens the chances of potential disease transmission, while still allowing puppies to experience dogs other than their littermates and mother.

### **Sensitivity Periods**

An initial startle period occurs slightly in the socialization period, approximately around 8-10 weeks. This is commonly referred to as a fear period. The onset correlates with the maturation of puppies. As they become older and more independent, danger increases. This startle period allows for puppies to learn what is dangerous and how to avoid these stressors (McConnell, 2007). In their role as human companions, danger isn't the same as it would be if dogs were wild like their counterparts. A man wearing a hat isn't a direct threat to a dog's safety, but being started by one during this sensitive period, this can create that imprint on a puppy's

emotional core. Signs of an individual puppy in a sensitivity period can include an exaggerated startle response, reservation and apprehension or fear toward known or new stimuli.

Due to the timing of the first fear imprint period, simple steps can be taken to avoid potential scares. Breeders or those that foster puppies can elect to keep puppies for longer than 8 weeks, until the fear period has passed. This prevents potential fears unintentionally allowed by new puppy owners at the beginning of ownership of their puppy. The discernment to keep puppies past the usual 8-week mark of rehoming also allows for the caretaker of the litter to select what experiences the puppies encounter. Thus, this avoids anything large and drastic that could have delayed fallout when introduced to a puppy in the midst of the initial sensitivity period.

From birth until 16 weeks of age, puppies undergo through major changes and maturation. They evolve from defenseless newborns that rely solely on maternal care, to small dogs that are interacting with their world. Because of their learning plasticity during the neonatal and socialization phases, introduction to handling and socialization is very important. It is best to find a happy medium in regard to stressors and stimuli, overwhelming a puppy can have the opposite effect than intended if a situation is too stressful for them.

### **Chapter 3- Adolescence: Juvenile through Adult Development**

The third developmental stage of young dogs is referred to as the juvenile period. This period begins after the socialization stage, which ends around 14-16 weeks. The end of the juvenile period is commonly considered to be around one year of age, whereupon many dogs are sexually mature and referred to as adults (Battaglia, 2009 and Howell et al., 2015). However, with regard to breed, maturity rates in terms of behavior can differ drastically. A large breed dog can be considered an adult in that it is sexually mature and able to reproduce, but still exhibits puppy-like behaviors and be developmentally behind other small dog breeds of the same age.

While the previous developmental period is dubbed “the socialization period” due to being the primary learning period for socialization to various stimuli and experiences, it is still important for dogs to receive remedial socialization throughout the juvenile phase. Exposure only in the socialization period and abstaining from subsequent exposure for a large period of time in the juvenile period can invoke fear responses in canines (Dietz et al., 2018). Conversely, constant exposure for wolf cubs throughout socialization and juvenile periods have been shown to result in fearlessness toward humans in adulthood, even when kept away from human interactions from up to 18-22 months (Woolpy and Ginsburg, 1967).

Socialization during the socialization period is the foundation, while socialization during the juvenile period is reinforcement of this foundation. One way for owners of juvenile dogs to accomplish this secondary socialization is by attending training classes. Often, facilities have classes geared specifically for puppies to experience a variety of stimuli that will be encountered in a dog’s lifetime. These stimuli include individuals with unique traits, visual experiences, auditory experiences and interactions with other dogs. Puppies that attend puppy classes exhibit less fear responses than their counterparts that do not attend puppy classes (Cutler, 2017). Rates

of noise phobias, such as storm and firework reactions, occur significantly less in puppies that attend training classes than puppies that do not (Kurachi, 2019). Additionally, dogs who do not attend puppy classes are 2.6 times more likely to develop aggression than those who do attend puppy classes (González-Martínez et al., 2019).

### **Health Risks**

One frequent concern for new owners of puppies is the balance between socialization and protecting their new addition from zoonotic diseases. Some animal professionals warn of keeping puppies away from potential exposure to diseases, such as canine parvovirus (CPV) and distemper through quarantine until core puppy vaccinations have been completed. However, this vaccination schedule ties in right to the end of the socialization period and beginning of the juvenile period. Therefore, dog owners now have a conundrum.

One option that is often presented is to keep their puppy at home until the puppy series of vaccinations are completed, which would include foregoing puppy classes. This limits additional socialization during the prime developmental periods. The other option would be to take their puppy out to socialize but risk the possibility of contracting a potentially deadly disease. **Table 3-1** illustrates vaccinations that can be given to puppies in the juvenile period. There are some similarities to **Table 2-1**, but individual cases might result in vaccination later than the earliest age noted. While these vaccines may be given earlier, they are still noted in the table to account for those that do not receive the initial dose or booster until the juvenile period. Additionally, Rabies is not one administered at an early age such as the others noted.

**Table 3-1.** Vaccination Schedule in the Socialization Period. Adapted from American Animal Hospital Association, 2017.

	<b>Vaccine Type</b>	<b>Age Given</b>
Vaccination schedule in the juvenile period	DAPP (Distemper, Adenovirus, Parvovirus, Parainfluenza)	16 weeks, additional dose at 18 weeks for dogs in high risk environments
	Rabies	16 weeks
	Bordetella	As early as 8 weeks, booster 2-4 week after initial dose
	Leptospirosis	As early as 8-9 weeks, booster 2-4 weeks after initial dose
	Canine Influenza	As early as 6-8 weeks, booster 2-4 weeks after initial dose

The Stepita et al. (2013) study looked into the occurrence of CPV in puppies who did or did not attend socialization classes prior to 20 weeks of age. While CPV is transmissible to canines of any age, dogs under 6 months of age are at an increased risk (Stepita et al., 2013). The concern increases tenfold for puppies under 16 weeks of age, as they have not finished the vaccination series and their immune systems are still vulnerable to infection. This timeframe includes the initial DHPP vaccination and boosters.

In the study, researchers contacted 21 veterinary clinics and 24 dog trainers. The study population totaled 1,012 puppies, whose vaccination status, status of socialization classes before 20 weeks of age, and any instance of CPV diagnoses were recorded. Of the 48 puppies who did attend training classes, none were diagnosed with CPV. Puppies that did not attend training

classes had 14 cases out of a subpopulation of 876 animals. The remaining 88 puppies did not have a known puppy class status, and one of these individuals was diagnosed with CPV.

Based on the results of this study (Stepita et al., 2013), attending puppy class did not increase the likelihood of CPV contraction. Likewise, not attending puppy class did not decrease the risk of CPV. While CPV is still a concern for puppies under 6 months of age, the potential of reducing the likelihood of fear-based behaviors in adulthood is not something that should be brushed aside. It is pertinent for owners to be aware and carefully choose where their puppy is allowed to visit. Facilities that offer training should implement a cleaning regiment to reduce potential transmission and require appropriate vaccination status for the individual's age for participation in classes. Additionally, one factor this study could not track was every location an owner took their puppy. This would be important information to include, since CPV is not limited to training facilities or even specified dog areas.

Simple modifications that allow a puppy to safely go into new environments can address the concerns from both sides of this problem. Avoiding high traffic dog areas, such as a dog park, is important. These areas also do not require vaccinations of the individuals that utilize this space, increasing the risk of potential disease transmission. Only allowing contact with known dogs with current vaccinations is another important discretion to minimize CPV risk while still allowing puppies to experience new stimuli and create social bonds during these important developmental periods.

### **Second Sensitivity Period**

The choice for breeders and fosters to keep puppies past 8 weeks of age to avoid potential sensitivity period fallout works well for the initial fear development period, but the second fear period becomes difficult to navigate. While most breeds will stay within the two-week window

for the first sensitivity period, the second one is usually seen upon sexual maturity. Because of the different developmental rates amongst breeds, this could range from 6 months of age through 14 months. Small breed dogs will likely encounter a second sensitivity period before large breed counterparts of the same age due to reaching sexual maturity sooner.

No matter the source from where an owner has obtained a puppy from, dealing with the second sensitivity period is something owners of any dog that is a juvenile will have to endure. While each individual dog has their own unique experiences and responses during this time, it is pertinent for owners to remember that any adverse experiences have a higher impact on fear imprinting during a sensitivity period.

Continuing socialization can help owners navigate juvenile sensitivity periods. Reinforcement of socialization to potentially triggering stimuli before a sensitivity period can allow owners to learn how to create positive associations that lessen the potential fallout in a fear period. Additionally, taking the responsibility of socializing one's pet dog requires owners to proactively make choices for socialization experiences, such as enrolling in puppy classes. Utilizing resources such as professional dog trainers can allow owners to learn about challenges including fear periods and how to handle them for appropriate training during this developmental stage.

## **Chapter 4- Adulthood**

Previous sections of this report have focused on socialization during puppy and adolescent ages by owners. While these ages benefit the most to appropriate training due to the plasticity of puppies in these age groups, focus on those ages alone excludes a subpopulation of dog owners. Some owners may acquire an adult dog, where socialization in primary developmental periods may either be unknown or nonexistent. Often a source for these cases is adoption from shelter or a rescue organization but can also be attributed to rehoming situations between individuals without the intervention of a rescue organization, or potentially adopting an unclaimed dog that has been found.

In such circumstances, the owner is faced with both helping a dog adjust to a new living situation, and potentially dealing with fear-based behaviors due to partial or complete absence of socialization and handling during developmental periods.

### **Common Behavioral Problems**

The prevalent reason for surrendering or rehoming a dog is behavior or temperament issues (Bollen and Horowitz, 2008). Often these temperament problems are described as aggression. Aggression is described as an intent by an organism to injure or inflict noxious stimulation towards another organism (Moyer, 1968). Aggression is a complex behavior, and it varies by individual. In canines, some aggression can be genetic (Bollen and Horowitz, 2008). Other varieties can include maternal aggression, same sex aggression or fear aggression (Moyer, 1968).

Both genetic predisposition and environmental factors contribute to the likelihood and development of aggression. It is through both an individual's genome and life experiences that the propensity for aggression is determined (Bollen and Horowitz, 2008). Predisposition to



impulsivity can lead into the occurrences of aggression, whereas impulsive individuals are more likely to show signs of aggression than those less impulsive and able to control outward behaviors (Mitcham, 2015). Therefore, the potential of exhibiting aggressive behaviors is possible in any dog, the severity of each case is individually based.

Individual behaviors often associated with aggression, such as snarling and growling, are utilized in communication often (Bollen and Horowitz, 2008). Aggregation of these behaviors outside of normal dog-to-dog communication or to inappropriate levels constitute aggression as a behavioral issue. There is the potential of owners misunderstanding communication behaviors to be a true aggression behavior problem. It is important in cases of potential aggression that owners consult a professional dog trainer or behaviorist who can confirm aggression and set up an intervention plan. Relying on oneself to be able to accurately determine aggression can be inaccurate and result in worsening behavior problems.

### **Socialization Exercises**

This section will primarily focus on exercises performed in shelters for dogs that have been surrendered for adoption. This is not to say that other cases mentioned in the previous section would not affect dogs in such situations. There might be an increased rate of success in those cases that are not in a kennel environment, which can often lead to increased anxiety. Studies have been focused on shelter dogs rather than rehomes due to prevalence in society as well as accessibility for researchers.

Not all shelters and rescue organizations are the same. Some might have more access to resources, funding and donations than others. A big city shelter will differ in resources available than one in a small country town. As such, some shelters have been branching out to hire staff or volunteers that work with the dogs through social contact or providing enrichment. Studies have

shown that having human interaction through petting for 15 minutes can decrease heart rate and attention-seeking behaviors in shelter dogs (McGowan et al., 2018). While salivary cortisol levels did not have a significant decrease in this study, dogs exhibited more relaxation behaviors at the end of 15 minutes than prior to the petting session. Including human contact can serve as a socialization exercise by exposing the dog to different people rather than the same select few. These petting sessions would allow for positive correlations with humans to be learned by dogs, so long as the petting is not forced upon those dogs that are fearful. In such events, petting while the dog is over threshold and exhibiting fearfulness can have the opposite effect.

Enrichment, such as toys, and training through operant conditioning can also have positive effects on anxieties and fear in a shelter environment. Based on the Herron et al. (2014) study, dogs that were given access to food-based enrichment, such as the popular Kong toy, and were also rewarded for ideal behaviors such as eye contact, being quiet, and sitting, had lower rates of exhibiting undesirable behaviors (such as jumping) and higher rates of desirable behaviors that had been rewarded than those that did not receive enrichment and training. In the same study, there was no significant difference in fearfulness between the study group and the control group, but both populations showed a decrease in fearfulness between day 0 and day 3. It was suggested by these authors that simple exposure to researchers passing by the kennels and standing in front of them created an association for individual dogs, even without direct reinforcement through food rewards. This affirms that exposure to different people can be beneficial to dogs and result in a decrease of fear-based behaviors.

The effects of socialization past the socialization and juvenile period have not been shown to have the profound effect that early socialization in those stages have. This is not to suggest that socialization in adulthood has no worth, but rather the effects of not socializing to

various stimuli at a young age have already contributed heavily to adult behavior to where socialization at a later age will not serve as a reversal. That being said, owners can continue to work on fear-based behaviors through socialization in order to desensitize their dogs to various stressors. By learning to ignore or do alternative behaviors in place of reacting fearfully, dogs can be taught more peaceful affects rather than those of anxiety and distress. This does not mean that a dog afraid of umbrellas will learn to love umbrellas unconditionally, but owners can work through desensitization techniques learned from a trainer or dog training class, so that the simple sight of an umbrella will no longer result in distress for the dog.

## **Chapter 5- Conclusions and Future Directions**

### **Education**

If one were to ask a group of dog owners, trainers and veterinarians if socialization was important, the majority would likely agree that socialization is important for dogs. However, agreement upon what socialization exactly is would be varied. In recent years, specific socialization programs, such as Dr. Gayle Watkins' Avidog program (American Kennel Club, 2019) or Jane Killion's Puppy Culture (Puppy Culture, 2020), have rapidly gained popularity amongst the dog breeding community. While some may be familiar with programs such as these, others may not be. Popularization of these programs amongst frequently used sources by those researching into owning a dog would be beneficial into educating those who may not know the importance of socialization. Sources such as these can educate owners as to why they should be interested in acquiring a socialized dog, as well as how to identify beneficial sources of socialization in terms of the source of the dog and training opportunities once they acquire ownership. Availability of resources should be considered, since internet availability and dog trainers can be scarce in rural areas. Therefore, widely available resources that are a necessity for dog ownership should be taken into account. For example, dog food is a must-have for any dog owner; therefore, it is widely available compared to other niche resources. Education and funding through pet food companies can lend a hand in relaying the information about socialization. In turn, improving the relationship between dogs and humans would maintain or increase ownership rates, which would result in more demand and sales for dog food companies.

### **Research**

There are several topics in which further research and elaboration could be beneficial. Throughout this report, one common theme is the discretion that the age ranges for

developmental periods will vary amongst breed. In general, there are some common trends, such as larger breeds mature at a slower rate physically and mentally than smaller breeds. Studies conducted in interbreed differences have focused on prevalent behaviors exhibited between breeds and breed groups (Mehrkam and Wynne, 2014). Work has also been completed to find intrabreed differences amongst individuals, such as the propensity for impulsivity (Mitcham, 2015). These focus more on adult behavior profiles and behaviors exhibited rather than developmental stages in regards to socialization. Additionally, most behavioral breed difference studies focus on a select few breeds that are most popular and commonly owned, such as Golden Retrievers, Labrador Retrievers and German Shepherds (Mehrkam and Wynne, 2014). Popularity does lend into prevalence of certain breeds; however, there is a large variety of breeds that are owned within households. Research into specifics of breeds would be beneficial for bridging that knowledge gap in regard to developmental stage timespans, as well as supplying dog owners' knowledge of how to best socialize their canine companion. Additionally, designer mixed breeds have surged in popularity. While traits of these mixed breeds are more varied than their purebred counterparts, they should also be included in research so that those who choose to own these individuals can make educated decisions in regard to proper socialization and related timeframes.

There are also gaps in what makes a good socialization class. Some may consider a free-for-all puppy play group to be adequate socialization without realizing that socialization encompasses more life experiences than playing with other puppies. Research into what components of puppy socialization classes result in decreased rates of fear-based behaviors could potentially allow for more scientifically backed class curriculum to become prevalent in training classes that are offered to dog owners. This would apply not only to trainers who are creating

these classes, but also to owners. What owners believe to be socialization and how they pick puppy classes (topics covered, training methods utilized, socialization definition, cost, etc.) should also be investigated from the perspective of the owner as well as the professional dog trainer. Trainers that offer proper socialization opportunities at classes should be able to properly market to owners that are searching for a puppy class to register with but may not know exactly what components of a class they should be looking for.

### **Final Thoughts**

Socialization is an important component of raising a well-adjusted companion animal. However, it is only one part that contributes to adult behavior. Ethical breeding where maternal care and selection of temperamentally sound parents is another portion that contributes to the addition of behaviorally sound companions. Further research and education are a requirement for all stakeholders involved in dog rearing. Not only should breeders, owners, trainers and veterinarians recognize the importance of socialization of young canines, it should be carefully practiced for the benefit of both humans and dogs.

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