

CAN THE C-BARQ BE USED AS A TOOL TO CREATE BEHAVIOR PROFILES
FOR WORKING DOGS?

by

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A Thesis
Submitted in partial fulfillment
of the requirements for the degree
Master of Environmental Studies
The Evergreen State College
June 2015

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ABSTRACT

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According to some estimates, half of working dogs trained for a certain task will not graduate to active duty, which leads to a large amount of wasted resources. The Canine Behavioral Assessment and Research Questionnaire (C-BARQ) may be a useful tool in creating distinct behavior profiles for working dogs. This study compared two groups of working dogs (Detection dogs and Service dogs) and a non-working group (Companion dogs). When comparing Service dogs and Companion dogs, 100% of the 15 behavior traits were significantly different. When comparing Companion dogs and Service dogs, 64.3% of the 15 behavior traits were significantly different. Finally, when comparing Detection dogs and Companion dogs, 36% of the 15 behavior traits were significantly different. These results suggest the C-BARQ may be a beneficial tool in placing working dogs in the roles which match their temperaments and therefore provide the greatest chance for success.

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Acknowledgements

I would like to thank all the organizations that participated in my research (Conservation Canines, search and rescue, Working Dogs for Conservation, Find It Detection Dogs, Leader Dogs for the Blind, 4 Paws for Ability, the American Rottweiler Club, the German Shorthaired Pointer Club of America, and the Siberian Husky Club of America) and all the people who filled out the questionnaire. I would like to acknowledge James Serpell for his pioneering work on canine behavior, his advice and encouragement throughout my research, and his technical support. James Serpell, as well as Leader Dogs for the Blind, also provided existing C-BARQ data on service dogs, which was invaluable for my study. I would like to acknowledge Kevin Francis and the rest of The Evergreen State College faculty for their teaching and support as it has allowed me to become a better writer and scientist. Finally, I would like to thank the dogs for all the work they do for us.

Introduction

This study will explore whether working dogs display different behaviors than companion dogs, and whether significant variety exists in the type of behaviors displayed by different kinds of working dogs. In order to determine this, an online questionnaire called the Canine Behavioral Assessment and Research Questionnaire (C-BARQ) was disseminated to different American Kennel Club breed clubs and working dog groups. Members were asked to complete the 100-question survey, which was divided into fifteen different behavioral traits. The responses for each behavioral trait were compared across each of three working dog groups (Companion, Detection, and Service) to determine if enough of the behavioral traits were significantly different between each working dog group. The answers for all fifteen traits for each group is called behavioral profile.

The significance of this work expands beyond the groups chosen for this study, though it could benefit them as well. The C-BARQ has been validated in the past as a method of predicting whether service dogs will potentially be successful as active working dogs once they complete their final training. But, it has not been used to compare behavioral traits across different types of working dogs. Understanding how resources are spent on working dog selection, evaluation, training, and monitoring and being able to effectively choose the dogs for training who will ultimately have the greatest chance at success would allow for minimal waste of resources. This procedure could also eventually be used for the public in order to help dogs with potential behavior problems to receive the best type of training and activity suggestions for their temperament.

By comparing dogs who are in-training or already on active duty, hopefully behavior profiles can be distinguished in order to create a profile from which to compare all potential future working dogs. However, it is outside the scope of this study to analyze the individual success rate of a variety of canine jobs. It is also not possible to use the data available to rank how successful each dog is when performing their job.*

It is typically a relatively simple task to determine which types of dogs would be most successful in a variety of jobs. For example, service dogs are needed for support, both physical and emotional, so stability and reliability are required. They must be calm and obedient enough to be present in virtually all public places. Service dogs must also have enough awareness of their surroundings that they they can exhibit intelligent disobedience if they wish to ignore their handler in order to steer them away from potential harm. Despite the obviousness of what's required in a service dog, it can be difficult to tell if an individual dog has these qualities, particularly because many of them begin as puppies when their personalities and temperaments are still in flux. For this reason, a questionnaire like the C-BARQ can be beneficial in filtering out the dogs who have a greater chance to be successful as early as six months. An average guide dog is trained for 14-16 months (CCI.org, 2015; Guidedogs.com, 2015), costs at least \$20,000 in training and monitoring (Pawswithacause.org, 2013; Servicedogcentral.org, n.d.; Guidedogsofamerica.org, 2014) not to mention the thousands of volunteer hours that go into raising each puppy, and only about 50% of service dogs in training actually go on to become certified guide dogs for the disabled (Weiss, 2002; Weiss & Greenberg, 1997). If "career-change" dogs can be spotted earlier on, those resources can be shifted towards finding them more appropriate jobs and limiting resources that are misspent.

This thesis will begin with a literature review that covers the modern history of dog breeding and domestication before continuing onto the process of selecting and evaluating working dogs. The modern history of dog breeding and domestication begins with Belyaev's silver fox experiment in Siberia (Belyaev, 1979; Pedersen & Jeppesen, 1990; Trut et al, 2004). This story seeks to describe how plastic the canine genome can be and thus how easy it is to "create" the best type of dog for any given activity or situation. This high plasticity, however, has also led to problems in the canine gene pool due to inbreeding. In order to keep certain breeds "pure" and up to the standards of the American Kennel Club, the available gene pool for each breed is getting smaller and so certain behavioral and physiological conditions are becoming more common (Ubbink et al, 1998a; Ubbink et al, 1998b). In an attempt to keep each dog looking and acting the same as their parents, high expectations are created regarding the purchase of a purebred dog. When that purebred grows up to display undesirable behaviors, it is frequently surrendered to a shelter or rescue instead of providing support or alternative activities (Salman et al, 1998; Salman et al, 2000). This is where working dog organizations provide numerous opportunities.

The science of canine ergonomics, as coined by William Helton, has revolutionized the way working dogs are seen and what studying them can do for our understanding of human expertise and vigilance (Helton, 2009). Finally, available methodologies will be discussed including a critique of in-person evaluations versus questionnaires when used for canine behavior evaluations and ultimately a history and critique of the C-BARQ will explain why this is the chosen methodology for this study.

Once the background for this study is described, this thesis will explain the specific methodology involved obtaining the data. The results and discussion of those results will occur at the same time as it is important to keep each of the fifteen traits in order for each of the three types of working dog groups. This thesis will then finish with a summary of the primary findings and where those findings may be applicable in the future study and function of working dogs.

Historical Background

Modern Dog Domestication and Breeding

In the middle of the 20th century in Russia, Dmitry Belyaev worked on an infamous fox-farm experiment in secret that wound up leading to one of the greatest genetics revelations of his time. Under the guise of breeding a fox with a better coat, he began his behavioral experiment by only breeding the top percent of individuals according to tameness. Each generation he repeated the procedure, and after over forty generations the foxes look and behave nothing like their original predecessors. Not only have the foxes become tame enough to be kept as pets, but unexpected morphological changes occurred as well. Their tails became curly like a Siberian husky's; their coats lost their solid colors and developed patches of white; their ears became floppy. These morphological traits were not seen in the original population, but they were somehow pulled out of the fox's genome as Belyaev and his team selected for a singular behavioral traits. Belyaev's experiment along with studies conducted by other scientists have shown how plastic the canine genome is and how easy it is to manipulate, thus leading to the many kinds of dogs we have today. Change can occur more rapidly the more often

breeding occurs. Wolves typically go into estrus once a year, while domestic dogs go into estrus twice a year (Scott & Fuller, 1965). If an individual or organization had a particular behavior pattern and/or morphology in mind for their dogs, it would take a relatively short period of time to effect change in the population. Because of this high level of plasticity, our society has managed to design and create hundreds, if not thousands, of different types of dogs, all with different purposes and functions in our lives.

Dog “types” can be based on breed (a distinct genetic background) or function. Modern breeders, who tend to create new breeds or try to perfect older ones, have managed to create entirely novel breeds in several generations by combining the genomes of pre-existing breeds in seemingly predictable ways. As new breeds are created, older breeds are also changing. Historic photos of the basset hound, for instance, show a dramatically different dog than the one seen in show rings today (Elegans, 2012). Its legs have become shorter, its ears longer, and wrinkles are now more excessive. All these changes occur because of the heavy reliance on breed standards instead of functionality.

Along with morphological changes, modern dogs are also experiencing drastic changes in mental status and capabilities as well. For example, the German shepherd has experienced physical changes like the basset hound, as well as mental changes. The American line of German shepherds is more easily frightened and experiences higher rates of anxiety than the German line of German shepherds (J. Ha, personal communication, June 6, 2015). The smaller, isolated populations of dog breeds have led to breeds that have changed dramatically, and these changes are typically not in the best

interest of the dogs themselves. A push for function over form (i.e. job capabilities over morphological traits) will provide a better suited environment for dogs of all kinds.

Working Dog Breeds

The American Kennel Club (AKC) groups dogs into seven groups, one of which is the Working Group. These are dogs that were “bred” to work, which can include “guarding property, pulling sleds and performing water rescues” (AKC.org). But many individuals from the AKC Working Dog group are mainly kept as family pets. These dogs do not have the opportunities to engage in the activities in which their “breed standard” claims they should engage. Are they still working dogs if they do not actively participate in work? There is little research currently on what makes a working dog, or whether an individual dog would be successful in a particular job. This has led to many “career-changes” for working dogs who did not ultimately graduate from training to active duty, and along the way resources have been lost. The creation of a collection of behavior profiles for different breeds, jobs, and working dog organizations could provide the opportunity to limit loss of resources and funnel individual dogs towards the career in which they’d be most likely to succeed.

Working Dog Organizations

Because the definition of a working dog varies, there are a multitude of organizations that either work directly with working dogs, train working dogs, or connect

working dogs with people who need them, or do some combination of the above. The organizations chosen for this study fall under two main categories: detection or service.

Detection Dog Organizations

The detection organizations typically adopt dogs from the shelter (Castaldo, 2014) or use an individual's personal family dog as a tool to track down people (J. Wieringa, personal communication, June 6, 2015; either dead or alive) or the scat of threatened/endangered species. These dogs may or may not be purebred and typically come with a personal history that cannot be standardized across groups. The Conservation Canines work in collaboration with the University of Washington's Conservation Biology department. They adopt high energy and high prey-drive dogs from the shelter and train them to detect the scat of threatened and endangered species all over the world in a variety of terrain and conditions. The primary reward for these dogs is a ball. Find It Detection Dogs are a scat-detection organization as well and are based out of Colorado. Their dogs are also adopted from the shelter. Most dogs who perform well as scat-detection dogs do not make good family pets due to their high energy needs.

Along with scat-detection dogs, there are also cadaver and search and rescue groups included in this study. These dogs are usually owned by a family and then trained for the task of searching for individuals (either alive or dead), so they can be of virtually any breed or age, but the well-trained individuals tend to be several years old and consist of the larger breeds as they have the agility and energy to search for hours (Warren, 2013).

Service Dog Organizations

The service dog organization included is Leader Dogs for the Blind. These dogs are purebreds and consist primarily of golden retrievers, Labrador retrievers, and German shepherds, although a handful of other breeds are included as well. Each service dog in their program is obtained from either their own pool of dogs, or donated from other service dog organizations.**

The variety of ways each dog is acquired and the personal and behavioral history they each have leads to several confounding variables in determining behavioral patterns in different types of working dogs.

Working Dogs

There are many different types of working dogs including drug detection, scat detection, explosives detection, police dogs, herding dogs, livestock guardians, racing hounds, hunters, etc. (Serpell, 1995). However, most dogs fall into one of five loose categories, one of which consists of all companion dogs whose sole purpose is to simply be present in their owners' lives without being trained for any particular task. These companion dogs may have been bred to perform a certain task, but in their day-to-day life they do not have a job other than companionship. The working dogs consist of detection dogs, guardians, assistance dogs, and those bred for hard labor. Each group requires certain characteristics and therefore requires a certain selection and training process.

Detection Dogs

Detection dogs typically consist of those animals that are trained to use their heightened sense of smell (170 cm² of olfactory epithelium compared to the human's 10 cm²; Helton, 2009) to find something whether it is a missing person after an avalanche, the scat of an endangered species in the Brazilian rainforest, cocaine-filled bags hidden in a new shipment, or an explosive device around the base camp of a military operation. While the detection and discrimination thresholds in a canine mind vary between breeds and individual, they also vary between different compounds (Helton, 2009). Studying the psychophysics - "a subdiscipline of perceptual science that investigates the relationship of the physical magnitudes of environmental stimuli and their perceived psychological magnitudes or precepts" - of the canine mind's capacity to distinguish different smells is at the forefront of understanding a detection dog's ability (Helton, 2009). While the ability to smell cancer before it can be accurately diagnosed by modern medical instruments is a feat, detection dogs are not always placed in safe work environments. At this point, it is not known if dogs trained to sniff out drugs and other chemicals are actually inhaling more than was previously assumed, however, there have been news reports of drug-detection dogs ingesting toxic doses of illegal drugs (Cornwell, 2015). If this is the case, some of these chemicals may be causing unseen damage to the lungs and bodies of these working dogs.

Guardian Dogs

Compared to detection dogs, who are trained to follow one of their physical senses in a very specific way, guardian dogs have been bred to exhibit a heightened sense of anxiety (Coppinger & Coppinger, 2002). A guardian's job is to protect and this requires the ability to notice danger and alert others of its presence. The pure-bred dog population has become inbred

to the point that this relatively normal response to potentially dangerous situations is now more of a liability than a benefit. German shepherds from the European genetic line have maintained a grasp on what in their environment is actually dangerous and what can be ignored, but the American line of German shepherds in many regions has gone in the other direction (J. Ha, personal communication, June 6, 2015). Most are now in need of anti-anxiety medication to prevent them from lashing out at the wrong individual. Guardians are typically bred to complete their task and so it is difficult, if not impossible, to make a good guardian dog anything else (Coppinger & Coppinger, 2002). Herding dogs, such as the Border collie, were bred to herd and protect livestock, but their protection method has little to do with a protecting instinct like that found in most guardian dogs and more to do with a modified predatory motor pattern (Serpell, 1995). According to Spady and Ostrander (2008), predators exhibit a certain string of behaviors when hunting: eye, stalk, chase, grab-bite, kill-bite. All dogs exhibit this predatory pattern to a certain degree (pointers will eye, but rarely chase and retrievers will eye-stalk-chase-kill-bite, but rarely bite hard enough to break the skin), but the border collie has had the “eye-stalk-chase” phases bred into it so well that it wants nothing more than to herd sheep all day, always stopping just short of doing anything more than nipping at their hocks (Spady & Ostrander, 2008). However, not all working dogs have been evolutionarily adapted for the work they do.

Service Dogs

Assistance dogs, while usually bred for the work they do through major organizations like Guide Dogs for the Blind, are not destined to remain in their initial field of work. A successful assistance dog is chosen based on temperament at maturity. For most dogs, this is reached around one and a half or two years old (Guidedogs.com, 2015). However, most

assistance dogs are started in training at eight weeks (Guidedogs.com, 2015). For the next year or more of their lives, their environments are controlled very specifically to provide the greatest opportunity for a well-socialized, well-behaved, and low-key individual to arise at maturity, but this only happens successfully in 50% of cases (Weiss, 2002; Weiss & Greenberg, 1997). About half of all assistance dogs are made “career-change” dogs because they did not pass necessary temperament and obedience tests to become an assistance dog (Weiss, 2002; Weiss & Greenberg, 1997). While these individuals go on to other careers or to simply being wonderful pets, a tremendous amount of resources was spent on their development during those first few years to become assistance dogs. Selecting successful dogs for a certain job type is never a clear-cut science and therefore resources are wasted in the process. Understanding what working dogs do and why their work is beneficial will allow organizations to design more efficient selection and evaluation procedures.

Dogs Bred for Labor

The final group of working dogs are those that are bred for a certain type of hard labor. Breeds like greyhounds, deerhounds, and Irish wolfhounds were bred to run. The greyhound’s heart is more efficient at pumping blood due to the fact that their hearts are larger in comparison to the rest of their body than almost any other dog breed (Vines, 1987). Both breeds have physiological traits that have been deliberately selected over many generations to create the most efficient model to complete a certain task. Running isn’t the only job for a dog, though. Another breed adapted for hard labor are Newfoundlands who were bred to pull carts and retrieve people who may be drowning (Lavigne, 2014). A genetic switch has been flipped for these dogs and,

like the American German shepherds who were bred with a heightened level of environmental anxiety, have one possible task they can reasonably accomplish.

Some working dogs, such as cadaver dogs or those trained for search and rescue, are trained to find people, dead or alive. They can be defined by many categories, but the most practical distinction is in their method of searching. Tracking dogs are kept on leash, smelling the ground, and typically require an item or area specific to that individual (Jones, et al, 2004). Trailing dogs are those that can find someone either on or off leash, but must work close to the original track the person took as they “exclusively follow human scent that has drifted to the ground”. Finally, air-scenting dogs have the fewest environmental limitations (i.e. can work on or off leash, on land or over water, do not require a scent article to begin the search; Jones et al, 2004).

The wide variety of circumstances and environments that a body may be lost in, and the innumerable states it may be found in (e.g. alive, recently deceased, decayed, etc.) make training a dog complicated (Jones, et al, 2004). Whereas a dog trained to sniff out pure heroin has but one scent to learn to track, dogs trained to find people, deceased or alive, have an impossible number of variables with which to contend, including but not limited to weather, air pressure, time since death, gender of the deceased, the deceased’s last meal, etc (Jones, et al, 2004). No studies have been done previously on how a detector dog is able to track a scent (though it is suggested that they move in a grid-like pattern to catch any stray eddies of air with the appropriate odorants; Jones, et al, 2004), it is therefore difficult to know what exactly the dog is tracking, and how to specifically train them to do it.

The little that is known about scent describes a process of odorants (“low-molecular-mass organic chemicals”; Jones, et al, 2004) being attached to a dog’s mucus membranes and releasing

a cascade of action potentials to the dog's brain. Jones et al (2004) believes there are as many as one million unique scents and each person's unique odor identifiers are made up of a combination of these odorants. It is a long process to train a search dog due to these difficulties; various training articles, environments, times of the day, etc. must be used in order to generalize the dog's learning.

Beyond the physical limitations in training a dog to find an individual, there are behavioral limitations. Most search and rescue dogs work with their handler or owner as a volunteer team (J. Wieringa, personal communication, June 6, 2015). The dog goes home with them at night where it is part of their family. Jones et al (2004) describes three necessary traits for a successful search and rescue dog: hunt drive (desire to keep looking despite obstacles), prey drive (excitement about the chase), and ball drive (balls used as high reinforcement for behavior) (Jones et al, 2004). The combination of these three traits may lead to a challenging family pet. Behavior issues are arguably the most common reason for dogs being surrendered to animal shelters (Salman et al, 1998; Salman et al, 2000). This may be due to the dog's energy being channeled in inappropriate ways.

Significance of this Research

Whether people realize it or not, dogs are used to keep us safe every day. Their keen sense of smell is used by the police to track down fleeing suspects following a crime, or to find illegal drugs being transported through airports. The military uses dogs to find explosives before they detonate, and search and rescue organizations spend up to 20 hours a week training their volunteer dog-handler teams to find missing persons (J. Wieringa, personal communication, 2015). Working dogs keep us and our livelihoods safe, but little research has been done

previously that discusses the effect this work has on the dog. It is assumed that working dogs bred for a specific purpose, such as border collies herding sheep, the Great Pyrenees guarding livestock, or sled dogs pulling hundreds of pounds of cargo through freezing temperatures, are “happy” with these jobs and find a certain sense of fulfillment in completing these tasks each day. While it would be difficult to determine how satisfied a working dog is in his position, certain abnormal behaviors can be analyzed and compared to other groups (i.e. dogs used for companionship alone) to attempt to determine their stress levels. The variety of positions that use dogs may certainly provide a variety of opportunities for learning and enrichment, but they can also lead to stressful and/or dangerous work environments the dog has no control over or no way to predict.

William Helton conducted his research into vigilance and expertise, and how to relate working dogs back to people’s ability to remain vigilant and develop expertise. In *Canine Ergonomics*, Helton is a major proponent of studying working dogs for the sake of understanding work in general (2009). He suggests dogs can be used for many more roles than machines can because “machines remain unable to match the operational effectiveness of trained dogs in a number of tasks such as explosives and narcotics detection” (Helton, 2009). Perhaps, ergonomics (the study of work) does not, and should not, focus on human work. By incorporating working canines into the literature, we may be able to develop a better understanding of work in general and the kinds of work roles that must be filled by humans, dogs, and machines. According to Helton, “working dogs often act as human surrogates” and thus must, by definition, provide many of the same services and be capable of many of the same end goals as humans are (2009). However, a further point made by Helton suggests that the push to use dogs over machines relates more towards the level of autonomy we’re comfortable allowing to each (2009). A

machine with the same amount of autonomy as the average working dog would be a huge shock to society. Many dogs work daily without interacting with humans at all (e.g. livestock guardians) and so must be capable of making their own decisions to a certain degree.

In the study of ergonomics and the research into expertise, there are few human-based studies on the acquisition of proficiency as it is difficult to find willing volunteers who can participate for the lengths of time most studies require due to the time it takes to actually become an expert in a certain field. Even those participants who do agree to remain with the study for the duration may make such a decision based on their “ease of mastery, or what many call talent” (Helton, 2009). It is fortunate for these ergonomics specialists that dogs are not only willing, but plentiful participants in their studies. While dogs do not have the benefit of human language to prove the existence of declarative knowledge, it is much simpler to understand the presence of expertise or mastery with the basic distinction between declarative knowledge and reaching “the point of automaticity” (Helton, 2009). Particularly the dogs with a genetic history of certain behaviors would be willing participants in understanding the acquisition of knowledge.

Current Methodological Issues

James Serpell has been at the center of this research since the 1990's. He started by looking at how owners and their dogs interact, and how that interaction can create different behavioral traits or problems (Jago & Serpell, 1996; Serpell, 1996). In the early 2000's, he collaborated with other researchers to design a standardized survey with which dogs could be evaluated for behavioral concerns. This prototype for the C-BARQ included 40 behavioral rating scales, which were eventually adjusted to become the current version (Serpell & Hsu, 2001; Duffy et al, 2008). Once he had developed a good understanding of how dogs interact with their

handlers and owners, he pushed forward in designing a method for analyzing dogs in particular roles.

Due to the high availability of dogs in human society, there is a general understanding of the types of evaluation which provide beneficial results when working with domestic dogs. Foyer et al. (2014) determined “the experiences and behavior of the dogs during their first year of life is crucial in determining their later behavior.” This information suggests opportunities for making the working dog selection process more efficient and thus wasting fewer resources on dogs who are not ultimately going to be accepted for a certain job. The C-BARQ was Foyer et al.’s main method of assessment prior to the final temperament test at 17 months of age (2014).

Interestingly, several problem behaviors were positively correlated with success on the final temperament test: expressions of hyperactivity/restlessness, and the urge to chase shadows or light spots (Foyer et al., 2014). The authors suggest that dogs, like other altricial species (species that are born vulnerable and relatively underdeveloped and thus require extensive parental care early on in their lives), experience highly plastic development of their nervous system and so environmental factors are considered to be highly significant (Foyer et al., 2014). These crucial developmental stages include the pre- and postnatal periods commonly discussed in animal development and socialization fields, but the adolescent stage defines another valuable period of development in an individual’s life history. The C-BARQ is the most commonly used questionnaire in understanding canine behavior, according to Foyer et al. (2014). It was originally developed by Hsu and Serpell (2003) based on over 100 breeds to select dogs determined to be best suited for “guide or service work as early as at 6 months of age.”

Military Working Dogs require higher levels of assessment before officially selecting them for duty. Of the 200 dogs bred each year for military work, about 100 will be deemed

unsuitable for said work, and 20 dogs will be removed from the program for medical reasons, according to Hsu and Serpell (2003). Foyer et al (2013) found neonatal experiences to be highly significant in predicting the final success of a working dog, while Batt et al. (2010) determined success in different guide dog programs could be predicted with a combination of questionnaires and behavioral tests. Particularly for social and nonsocial fear, Svartberg found behavioral test results were potentially accurate sources of behavioral problem predictors (2005). Ultimately, it was found that daily behavioral patterns could be discerned by standardized temperament tests.

Bruder et al (2013) wanted to design an evaluation system that could be conducted by the average individual with a dog, without the need for expertly trained evaluators. They chose to focus on border collies and retrievers and started by categorizing each dog by three instruments: Dog-ADHD Rating Scale, the Dog Big Five Inventory, and 14 sub-tests that will determine impulsivity/inattention, energy/affection/neuroticism/intelligence/conscientiousness, and sociability, respectively (Bruder et al., 2013). This battery of tests Bruder et al. named FIDO led to the development of three behavioral scales: sociability, activity-impulsivity, and trainability/playfulness (2013). They found the trainability or playfulness of a given dog decreased as its inattention level rose and suggested that border collies have higher levels of trainability and/or playfulness than retrievers. The test battery appears to be an effective method of studying individual canine differences without first requiring higher levels of experimenter training.

Temesi et al (2014) aimed to design a questionnaire that, “based on relevant previous studies...[would] facilitate the standardization of measurements of fear-related behavior in dogs.” Four discrete fear-related factors were found: neuroticism, dog-directed fear, human-directed fear, and separation-related behavior. According to Temesi et al., dogs in the toy group

were more likely to show neuroticism (a trait shared with older dogs and dogs farther from their date of acquirement) and dog-directed fear (a trait shared with female dogs), while female owners reported human-directed fear more frequently (2014). Temesi et al. chose to focus on fear-related behavior as they determined it played a valuable role in the dogs' overall wellbeing (2014).

Canine Behavioral Assessment and Research Questionnaire (C-BARQ)

One of the most widely used surveys on canine behavior was developed by James Serpell, PhD. Serpell collaborates with the Center for the Interaction of Animals and Society at the University of Pennsylvania on studies that examine different uses for the C-BARQ in canine welfare and behavior with a particular focus on service and assistance dogs. He has worked with many behaviorists including Deborah Duffy and Yuying Hsu on research projects seeking to develop “standardized measures of canine behavior that can be used by any guide/assistance dog organization to predict dog performance during training” (Duffy & Serpell, 2008). Significant amounts of time and money are spent on selecting and training working dogs. When one of them is dropped from their respective programs for behavioral or medical reasons those resources are lost. The work that Serpell has done, can advance canine selection and monitoring procedures and potentially minimize the waste of valuable resources, which is particularly useful because most organizations training working dogs are non-profits groups.

Duffy and Hsu collaborated with Serpell in the first validity testing of the C-BARQ in 2008. The first batch of C-BARQ requests was disseminated by mail to 11 American Kennel Club recognized breed clubs. The top 20 most popular breeds in the country were used to select the initial sample (Duffy et al, 2008). Once the questionnaire was made available online, a

second batch of requests was sent out by way of an advertisement in the University of Pennsylvania's School of Veterinary Medicine's newsletter. Duffy et al's (2008) results found significant breed differences during this study.

Most of Serpell's work with the C-BARQ, however, has focused on a distinct group of assistance or service dog training organizations: Canine Companions for Independence, Guide Dogs for the Blind, Guiding Eyes for the Blind, Leader Dogs for the Blind, and The Seeing Eye. Starting in 2008, Serpell began using the C-BARQ on working dogs specifically (Duffy & Serpell, 2008). He has since maintained a strong and ongoing collaboration with those groups, while developing C-BARQ research farther into the realm of companion dogs as well. In 2010, Serpell used item-response theory, or modern test theory. Instead of the classical test theory which is normally used, he used one subsection of the C-BARQ on a sample of companion Labrador retrievers, golden retrievers, and German shepherd dogs and found that the questionnaire was "able to quantify stranger-directed aggression" (van den Berg et al, 2010). Several years later Serpell returned to service or guide dogs when he questioned whether the C-BARQ would be a valid method of predicting the success of service dog candidates. Each dog was evaluated by their handler once at the age of six months old and again at 1 year. The C-BARQ was able to predict the outcomes to varying degrees of each dog's training time in their respective programs, but was found to be significant overall (Duffy & Serpell, 2012). Most recently, Serpell's focus has expanded geographically; he is looking into whether the C-BARQ can be used as a valid tool in other countries such as Iran and Japan (Tamimi et al, 2015, Nagasawa et al, 2011, respectively). Given the other options available and its validity in current uses, the C-BARQ is the best questionnaire capable of answering questions regarding canine welfare as it relates to behavior at this time.

Other Uses of the C-BARQ

Foyer et al (2014) determined “the experiences and behavior of the dogs during their first year of life is crucial in determining their later behavior”. This identifies a major area needed for research opportunities with the ultimate goal of making the working dog selection process more efficient and thus wasting fewer resources on dogs who are not ultimately going to be accepted for a certain position. The C-BARQ was Foyer et al.’s main method of assessment prior to their final temperament test at 17 months of age (2014). The authors suggest that dogs, like other altricial species, experience highly plastic development of their nervous system and so environmental factors are considered to be highly significant (Foyer et al, 2014). These crucial developmental stages include the pre- and postnatal periods commonly discussed in animal development and socialization fields, but the adolescent stage defines another valuable period of development in an individual’s life history.

Sometimes the C-BARQ may not be quite as effective as in other situations. Military and police dogs must pass more rigorous trials to become certified. Of the 200 dogs bred each year for military work, about 100 will be deemed unsuitable for said work, and 20 dogs will be removed from the program for medical reasons, according to Hsu and Serpell (2003). However, military dog behavior has not been heavily analyzed by way of the C-BARQ yet.

When compared with other methods of behavioral evaluation, including previously designed surveys and in-person evaluation methodologies, the C-BARQ qualifies as acceptable and effective. Batt et al. (2010) determined success in different guide dog programs could be predicted with a combination of questionnaires and behavioral tests. Particularly for social and nonsocial fear, Svartberg found behavioral test results were potentially accurate sources of behavioral problem predictors (2005). Being able to effectively identify and possibly predict

behavior problems and their severity early on can help facilitate getting each dog the proper and unique training adjustments, or could possibly lead to dropping him from the program entirely.

The C-BARQ has not been used as extensively as some other psychological evaluations used with people, but it has been used on both companion and working dogs and shown to be valid in a variety of geographical locations. In trying to find an effective questionnaire with the ability to be easily and rapidly disseminated, the C-BARQ is the only appropriate methodology available.

METHODS

In this study, I used the C-BARQ as a tool for creating behavior profiles for working dogs. The first part was designed to assess whether the C-BARQ would be an effective measurement for this task; the second part was designed to assess whether working dogs exhibited more of the miscellaneous (or non-functional/abnormal) behaviors than companion dogs. I contacted ten working dog organizations and breed clubs and asked their leaders to encourage participation and disseminate the log-in information to their members for the C-BARQ through my study.***

Responses for Companion Dogs included James Serpell of the University of Pennsylvania Center for the Interaction of Animals and Society (n=3224, previously gathered), the American Rottweiler Club (n=8), the German Shorthaired Pointer Club of America (n=5), and the Siberian Husky Club of America (n=15). Responses for Detection Dogs included Conservation Canines (n=6), local search and rescue clubs (n=11), Working Dogs for Conservation (n=6), and Find It Detection Dogs (n=2). My Service Dog group consisted mostly of responses from Leader Dogs for the Blind (n=6369, previously gathered), with one response from 4 Paws for Ability (n=1).

Questionnaire

The C-BARQ is made up of 101 questions divided into 15 behavior traits: stranger-directed aggression, owner-directed aggression, dog-directed aggression, familiar dog aggression, stranger-directed fear, nonsocial fear, dog-directed fear, touch sensitivity, separation-related behavior, attachment and attention-seeking behavior, trainability, chasing, excitability, energy level, and miscellaneous. Each of these behavior

traits is made up of two or more questions and each trait has been validated in previous studies. The questions included in each trait were not changed from previous studies conducted.

The answers are on a Likert scale with available responses existing on one of two scales: Never-Seldom-Sometimes-Usually-Always or 0-1-2-3-4 for scales of none-moderate-serious. (See note regarding controversy of using means with Likert scales.****) Three of the questions (found in the trainability trait category) were on a reversed scale and so those answers were reversed before statistical analysis took place.

Sample

Detection

The detection dog handlers included in this study are either part of search-and-rescue, cadaver search, or scat detection organizations. Instructions to take the questionnaire were sent to eight detection organizations; responses came from four of them. The four organizations were Working Dogs for Conservation (n=6), Find It Detection dogs (n=2), Conservation Canines (n=6), and search-and-rescue/cadaver search (n=11).

Companion

The top fifteen most popular dog breeds in the United States according to the American Kennel Club were determined and an email with instructions to take the questionnaire was sent to the contact on file on the American Kennel Club website. Members of the American Rottweiler Club (n=8), the German Shorthaired Pointer Club of America (n=5), and the Siberian Husky Club of America, Inc. (n=15) responded.

James Serpell provided a second batch of companion dogs from the C-BARQ database (n=3224) that were matched by breed type to the breeds found in the Service dog group (Labrador retriever, golden retriever, German shepherd).

Service

Five service dog organizations had a previous collaborative relationship with Serpell using the C-BARQ. (He led the team that first designed and validated the questionnaire.) Serpell provided the contact information for each of those five organizations and each was contacted requesting their participation in this study. One organization, Leader Dogs for the Blind, agreed to participate and provided the six-month and 12-month responses for dogs in their program since they began using the questionnaire (n=6369).

One respondent participated in the study from the organization 4 Paws for Ability (n=1). This organization was contacted by emailing the leader found in an internet search.

Statistical Analysis

The data was compiled into one document and summary statistics were taken to determine the size of each type of working dog group. All variables were removed except for Dog ID which was unique to each organization that participated. The eight different Dog ID's were combined depending on the type of dog they trained to make the three different job categories: Companion, Detection, and Service.

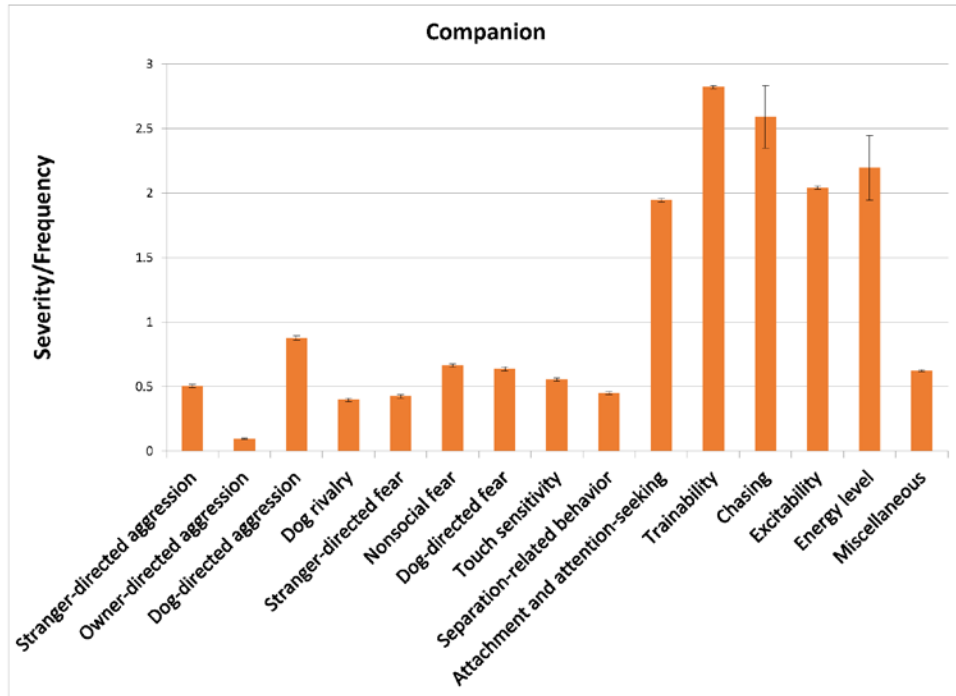
The subscale scores were determined for each trait by averaging the answers to each question in the specific category. The participants who left all answers in a specific subscale blank were removed from participation in that category. The sample size for each trait was determined by adding the number of respondents who answered 25% or more of the questions in each category. (If a participant answered fewer than 25% of the questions in a given category, they were not included in the size of the sample, but their responses were still included in the overall average for that category.)

Once the mean of each question was appropriately combined into the mean for each category, the data was put into JMP and a Tukey's HSD statistical test was run for all pairs of working dog types (Companion-Detection, Companion-Service, Service-Detection) for each of the 15 behavioral categories plus the 23 miscellaneous questions. Once size/severity/frequency relationships were determined between each pair of working dog types, patterns were manually determined for larger over-arching categories (e.g. aggression, fear, attachment, etc.) between working dog types.

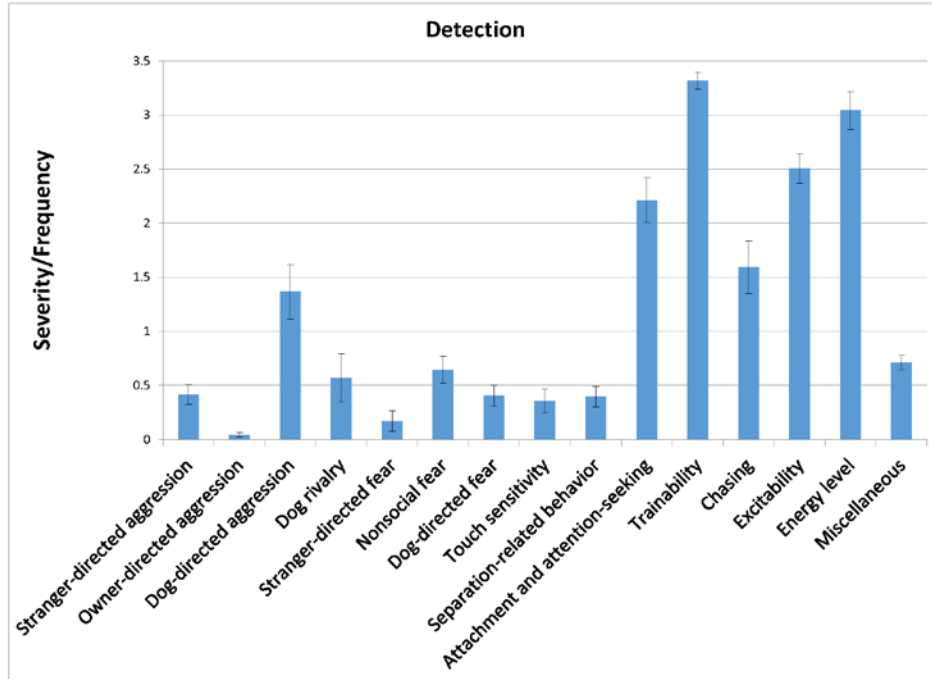
RESULTS and DISCUSSION

Summary of Results

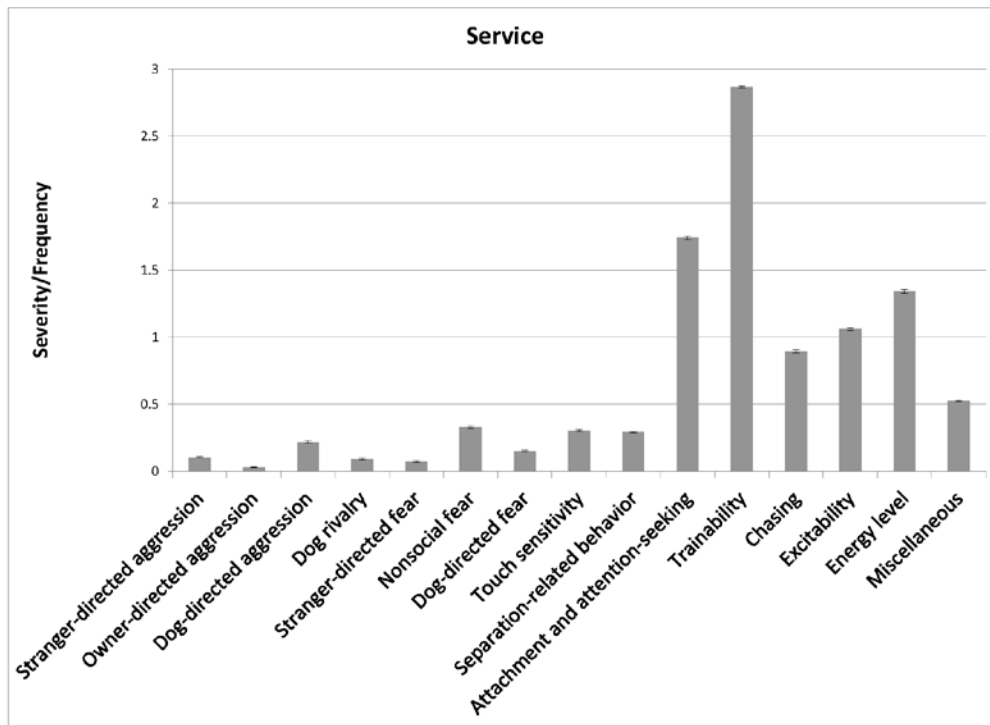
In the subsequent section, each of the 14 main behavior traits will be analyzed and discussed followed by a larger section covering the miscellaneous questions. Each behavior trait section will begin with the results of analysis followed by my interpretation of those results and the graphs associated with that section. For the miscellaneous categories, the results of analysis and the associated graphs will be covered for each of the 23 questions first, followed by a comprehensive discussion of the overall findings from that section.



Graph 1. Severity or frequency of the 15 behavior traits (including miscellaneous) of the C-BARQ for Companion dogs. On the scale of severity, 0 = no moderate signs up to 4 = serious signs (e.g. no visible signs of aggression up to serious signs of aggression, including tendency to snap, bite, or attempt to bite). On the scale of frequency, 0 = never, 1 = seldom, 2 = sometimes, 3 = usually, and 4 = always.



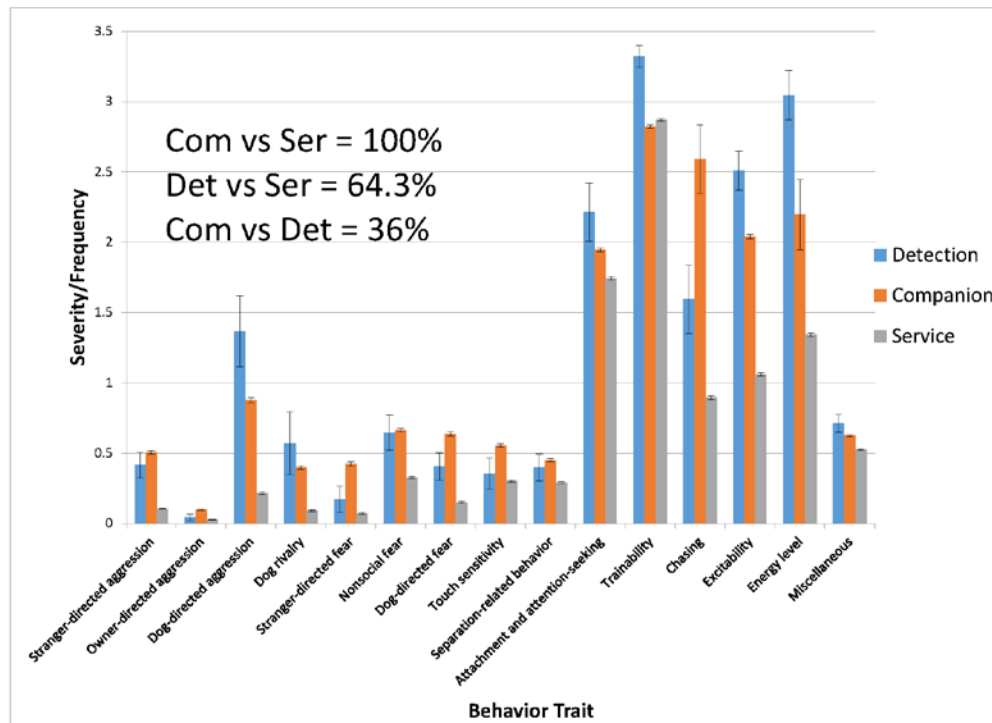
Graph 2. Severity or frequency of the 15 behavior traits (including miscellaneous) of the C-BARQ for Detection dogs. On the scale of severity, 0 = no moderate signs up to 4 = serious signs (e.g. no visible signs of aggression up to serious signs of aggression, including tendency to snap, bite, or attempt to bite). On the scale of frequency, 0 = never, 1 = seldom, 2 = sometimes, 3 = usually, and 4 = always.



Graph 3. Severity or frequency of the 15 behavior traits (including miscellaneous) of the C-BARQ for Service dogs. On the scale of severity, 0 = no moderate signs up to 4 = serious signs (e.g. no visible signs of aggression up to serious signs of aggression, including tendency to snap, bite, or attempt to bite). On the scale of frequency, 0 = never, 1 = seldom, 2 = sometimes, 3 = usually, and 4 = always.

Table 1. Average response scores and sample sizes for three different working canine jobs for each of 15 behavioral traits as determined by the C-BARQ.

Behavioral Traits	Detection	Det n#	Companion	Com n#	Service	Ser n#
Stranger Agg	0.42	19	0.51	3218	0.10	2818
Owner Agg	0.04	22	0.10	3233	0.03	2844
Dog Agg	1.37	22	0.88	3109	0.22	2780
Dog Rivalry	0.57	17	0.40	2749	0.09	2444
Dog fear	0.40	20	0.64	3114	0.15	2823
Chasing	1.59	21	2.59	21	0.90	2644
Stranger Fear	0.17	20	0.42	3193	0.07	2839
Nonsocial Fear	0.65	21	0.66	3169	0.33	2812
Touch Sensitivity	0.36	22	0.55	3160	0.30	2817
Excitability	2.51	20	2.04	3200	1.06	2811
Separation	0.40	21	0.45	3200	0.29	2840
Attachment	2.21	19	1.95	3206	1.74	2840
Trainability	3.32	24	2.82	3240	2.87	2841
Energy	3.04	22	2.20	22	1.34	2840
Miscellaneous	0.71	21	0.62	3209	0.52	2842



Graph 4. Severity or frequency of the 15 behavior traits (including miscellaneous) of the C-BARQ for Detection dogs, Companion dogs, and Service dogs. When comparing Companion dogs vs Service dogs, 100% of the 15 behavior traits examined were significantly different. When comparing Detection dogs vs Service dogs, 64.3% of the 15 behavior traits examined were significantly different. When comparing Companion dogs vs Detection dogs, 36% of the 15 behavior traits examined were significantly different. On the scale of severity, 0 = no moderate signs up to 4 = serious signs (e.g. no visible signs of aggression up to serious signs of aggression, including tendency to snap, bite, or attempt to bite). On the scale of frequency, 0 = never, 1 = seldom, 2 = sometimes, 3 = usually, and 4 = always.

Table 2. Average response scores with sample sizes for three different working canine jobs for 23 miscellaneous behaviors as determined by the C-BARQ.

Behavioral Traits	Detection	Det n#	Companion	Com n#	Service	Ser n#
Misc 77	0.5	20	1.38	21	1.29	2526
Misc 78	1.09	22	1.11	3041	0.46	2549
Misc 79	0.77	22	0.77	3077	0.22	2794
Misc 80	0.73	22	0.73	3165	0.75	2825
Misc 81	0.14	22	0.14	3203	1.04	2839
Misc 82	0.65	20	0.65	3190	0.33	2828
Misc 83	0.3	20	0.3	3199	0.57	2840
Misc 84	0.11	19	0.11	3191	0.45	2834
Misc 85	1.32	22	1.32	3126	0.28	2843
Misc 86	0	19	0	3199	1.23	2842
Misc 87	0	22	0	3200	0.05	2835
Misc 88	0.09	22	0.09	3205	0.07	2843
Misc 89	0.09	22	0.09	3193	0.05	2843
Misc 90	0.55	22	0.55	3187	0.05	2842
Misc 91	2.95	22	2.95	3209	0.62	2841
Misc 92	3.05	22	3.05	22	2.06	2841
Misc 94	0.14	22	0.14	3151	0.19	2834
Misc 95	0.27	22	0.27	3156	0.1	2834
Misc 96	0.1	21	0.1	3195	0.75	2841
Misc 97	1.68	22	1.68	3127	0.16	2823
Misc 98	0.45	22	0.45	3208	0.32	2843
Misc 99	0.68	22	0.68	3207	0.42	2843
Misc 100	0.29	21	0.29	3208	0.65	2843

Stranger-Directed Aggression (comprised of 10 questions)

“Dog shows threatening or aggressive responses to strangers approaching or invading the dog’s or the owner’s personal space, territory, or home range.” (cbarq.com)

RESULTS

Service dogs (n=2818) present significantly lower rates of stranger-directed aggression than both Companion dogs (n=3218; $p<0.0001$) and Detection dogs (n=19; $p=0.014$). Companion dogs and Detection dogs are not significantly different from each other ($p=0.695$).

DISCUSSION

Due to the fact that service dogs are socialized to a variety of people as early as possible during development, it is not surprising to find that Service dogs have lower rates of stranger-directed aggression than Detection or Companion dogs. It is also not surprising to find no distinction in stranger-directed aggression when comparing Detection and Companion dogs as most of the detection dogs included in this study were previously companion dogs. The lack of a significant difference between these two groups is possibly due to the lack of specificity of where each dog in the two groups was acquired. Detection dogs included in this study were either family pets trained to be search-and-rescue or cadaver dogs, or they were acquired from shelters and other working dog organizations and trained to sniff the scat of a variety of endangered species. The companion dogs have even more variability in when and where they were obtained (e.g. breeder, shelter, friend, online, organization, etc.) and that variable was not taken into consideration in determining the outcome of this study. The variability in when and where these dogs were obtained by their handlers or family members could have a

significant effect on their temperament and performance as adults. It is important to keep in mind as well that the dogs who were acquired from a shelter or rescue group were most likely relinquished for a specific reason due to behavioral problems of the dog; these possible behavioral challenges would also affect whether specific dogs were chosen for specific jobs and whether or not they would be successful.

Owner-Directed Aggression (comprised of 8 questions)

“Dog shows threatening or aggressive responses to the owner or other members of the household when challenged, manhandled, stared at, stepped over, or when approached while in possession of food or objects.” (cbarq.com)

RESULTS

Detection dogs (n=22) are not significantly different from either Companion dogs (n=3233; p=0.528) or Service dogs (n=2844; p=0.949). Companion dogs present significantly higher rates of owner-directed aggression than Service dogs (p<0.0001).

DISCUSSION

While Detection dogs did not have significantly higher or lower rates of owner-directed aggression when compared with Companion dogs, Companion dogs were significantly higher than Service dogs in this area. Companion dogs tend to have less training overall than working dogs simply due to the fact that they must undergo frequent instruction to make sure they stay up to date on their job tasks, though the type of specific training may vary and therefore the types of prominent behaviors observed by a handler may vary as well. For example, a dog trained in Schutzhund (aggression/protection) may have undergone more training time than the average family retriever, but the retriever

would still most likely display more acceptable behavior for a family setting. Detection dog training tends to focus on channeling a dog's motivation and energy into appropriate outlets while service dog training focuses on creating well-behaved dog who is capable of being around people in a variety of situations. Owner-directed aggression is not ideal for any of the three working dog groups included in this study, however, service dogs who display aggression towards their owners or handlers will definitively be removed from the program and, therefore, service dogs who are farther along in their training or have graduated to active duty are understandably found to be much less aggressive towards their owners or handlers than other types of dogs.

Dog-Directed Aggression (comprised of 4 questions)

“Dog shows threatening or aggressive responses when approached directly by unfamiliar dogs.” (cbarq.com)

RESULTS

All three pairs of working dogs are distinctly different from each other. Detection dogs (n=22) present the highest rates of dog-directed aggression ($p < 0.0001$ when compared with Service dogs; $p < 0.0001$ when compared with Companion dogs, n=3109). Service dogs (n=2780) have the lowest rates of dog-directed aggression ($p < 0.0001$ when compared with Detection dogs; $p < 0.0001$ when compared with Companion dogs).

DISCUSSION

Service dogs displayed the lowest rates of dog-directed aggression, which is understandable given the amount of socialization and training they receive to acclimate them to a variety of situations. Companion dogs showed higher rates of dog-directed aggression than service dogs did, which is also understandable as companion dogs typically do not undergo such a methodical and comprehensive process of training and socialization as service dogs of all types do. It is less understandable why Detection dogs displayed the highest levels of dog-directed aggression. It may be due to where most detection dogs are acquired (i.e. shelters, rescue groups) and the high-stress nature of being kenneled in such environments. The fact that detection dogs have typically been relinquished to shelters due to complaints by previous owners may also play a part. More research is needed to understand the reason for this distinction between types of working dogs and companion dogs.

Familiar Dog Aggression (comprised of 4 questions)

“Dog shows aggressive or threatening responses to other familiar dogs in the same household.” (cbarq.com)

RESULTS

Detection dogs (n=17) show significantly higher rates of familiar dog aggression than Service dogs (n=2444; p=0.0004), and Service dogs show significantly lower familiar dog aggression than Companion dogs (n=2749; p<0.0001). Detection dogs do not have significantly different rates of familiar dog aggression when compared with Companion dogs (p=0.356).

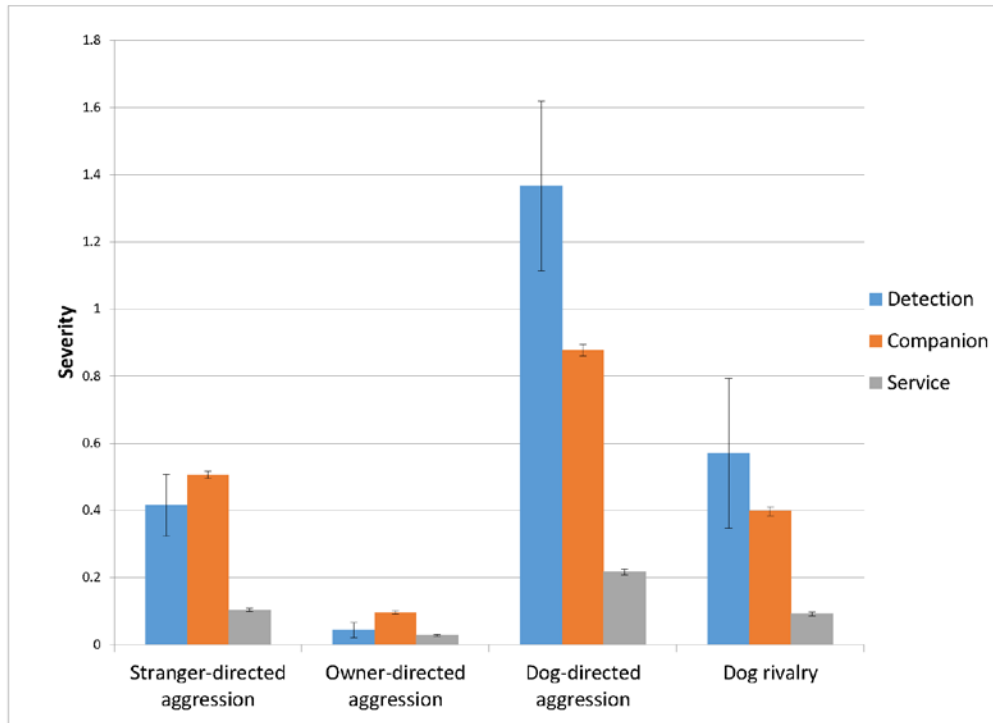
DISCUSSION

Similar to the rates of dog-directed aggression, Detection dogs showed the highest rates of familiar dog aggression when compared with service dogs. However, there was no significant difference in the rate of familiar dog aggression between Detection dogs and Companion dogs, which may be due again to the huge variability in where detection and companion dogs are obtained, but does not incorporate the fact that dog-directed aggression in general was distinct. More research is needed to understand the differences between familiar dog aggression and general dog-directed aggression, particular as they pertain to the temperament and performance of working dogs.

Patterns of Aggression Across Dog Breeds

Canine aggression is difficult to measure whether they are working or companion dogs. Typically that information is determined from “bite statistics, behavior clinic caseloads, and experts’ opinions” (Duffy et al, 2008), which can be fairly inaccurate because bites from large dogs are reported more often and cause more damage than bites from small dogs. However, small dogs (i.e. chihuahuas and dachshunds) scored higher in aggression towards humans and other dogs, while other breeds were specific to either human-directed or dog-directed aggression. Among the eight breeds included in the final analysis of this study, six are commonly used as working dogs. These six breeds include English springer spaniel (hunting), golden retriever (hunting, service), Labrador retriever (hunting, service), Rottweiler (protection), Shetland sheepdog (herding), and Siberian husky (sledding). Not surprisingly, golden retrievers and Labrador retrievers showed some of the lowest rates of aggression towards humans and dogs, and thus are a good choice for service dogs. It was also interesting to note that Labrador retrievers showed

higher rates of owner-directed aggression in field-bred dogs compared to those bred for showing. This suggests that aggression is not bred into Labrador retrievers used as service or hunting dogs.



Graph 5. Average severity of the four types of aggression included in the C-BARQ (stranger-directed aggression, owner-direction aggression, dog-directed aggression, and dog rivalry) for Detection dogs, Companion dogs, and Service dogs. On the scale of severity, 0 = no moderate signs up to 4 = serious signs (e.g. no visible signs of aggression up to serious signs of aggression, including tendency to snap, bite, or attempt to bite).

Dog-Directed Fear (comprised of 4 questions)

“Dog shows fearful or wary responses when approached directly by unfamiliar dogs.”
(cbarq.com)

RESULTS

Detection dogs (n=20) do not show significantly different rates of dog-directed fear when compared with either Service dogs (n=2823; p=0.152) or Companion dogs (n=3114; p=0.208). However, Companion dogs show significantly higher rates of dog-directed fear when compared with Service dogs (p<0.0001).

DISCUSSION

Companion dogs show the highest rates of dog-directed fear, which could be due to a lack of socialization and/or training for companion dogs compared to working dogs of all kinds. While companion dogs are difficult, if not impossible, to define exclusively and exhaustively, companion dogs may spend the majority of their time at home with the same dogs indicating a possible lack of specific socialization with unfamiliar dogs either in the home or away from it. Additional research is suggested in the area of what defines a working dog as compared to a companion dog and how traits like fear play a role in this distinction.

Stranger-Directed Fear (comprised of 4 questions)

“Dog shows fearful or wary responses when approached directly by strangers.”
(cbarq.com)

RESULTS

Companion dogs (n=3193) show significantly higher rates of stranger-directed fear than Service dogs (n=2839; $p < 0.0001$). Detection dogs (n=20) do not show significantly different rates of stranger-directed fear when compared with either Companion dogs ($p = 0.13$) or Service dogs ($p = 0.731$).

DISCUSSION

Service dogs show the lowest rates of stranger-directed fear of all three types of working dogs, which is understandable due to their comprehensive early socialization and training. It is a little difficult to determine where detection dogs fall on the spectrum of stranger-directed fear as those results were not significant. Perhaps breed type or where each detection dog was acquired could account for this lack of significance; more research is needed in this area. Companion dogs show higher rates of stranger-directed fear than service dogs, which is most likely due to the differences in type or presence of training and socialization during important development periods in each dog's life.

Nonsocial Fear (comprised of 6 questions)

“Dog shows fearful or wary responses to sudden or loud noises (e.g. thunder), traffic, and unfamiliar objects and situations.” (cbarq.com)

RESULTS

Service dogs (n=2812) show significantly lower rates of nonsocial fear when compared with both Companion dogs (n=3169; $p < 0.0001$) and Detection dogs (n=21; $p = 0.025$). Companion dogs and Detection dogs do not show significantly different rates of nonsocial fear ($p = 0.988$).

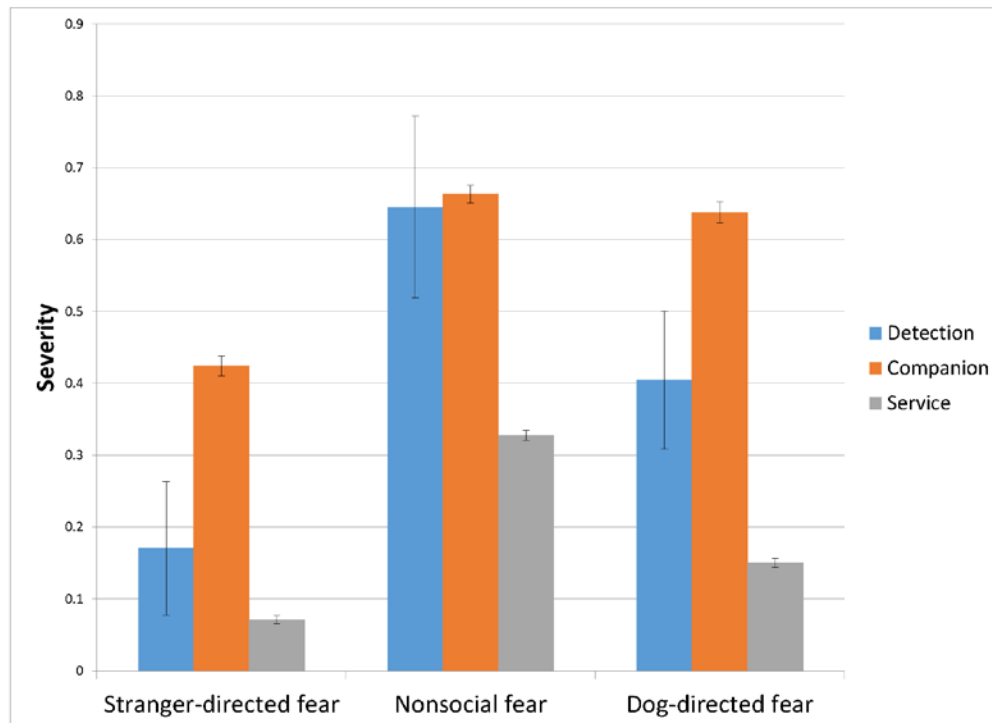
DISCUSSION

While Detection dogs do not show significantly different rates of nonsocial fear when compared with Companion dogs or Service dogs, Service dogs in general display less instances of nonsocial fear. This is most likely due to their comprehensive and standardized program of socialization during early development. Additional research is necessary to determine if the behavioral traits common in Service dogs compared to other working dogs are due to heredity, or training and early socialization.

Patterns of Fear Across Dog Breeds

Svartberg conducted a study to determine how working dog performance compared to how each dog was rated on a scale of shyness to boldness (Svartberg, K. (2001). Shyness-boldness was found to predict performance in working dogs. Each dog was evaluated between 12 and 18 months old using five different personality factors: playfulness, curiosity/fearlessness, chase-proneness, and sociability (aggressiveness was evaluated for but was not included in the final shyness-boldness dimension). Not

surprisingly, each owner's previous experience increased their dog's success rate, so in order to remove that confounding variable, only inexperienced owners' responses were included in the final results. When looking at dogs with inexperienced owners, the bolder the dog the more successful they were in their job performance. This suggests that shyer breeds would perform lower than individuals of bolder breeds. The caveat with this study regards how the author defined working dogs. He clearly chose two breeds (German shepherds and Belgian tervurens) whose average job is protection and agility. Though he varied the types of trials the tested dogs participated in (e.g. tracking, searching, delivering messages, handler protection), he ultimately chose the same type of activity and so his results probably showed only that boldness was a significantly helpful trait in dog whose main jobs are agility and protection.



Graph 6. Average severity of the three types of fear included in the C-BARQ (stranger-directed fear, nonsocial fear, and dog-directed fear) for Detection dogs, Companion dogs, and Service dogs. On the scale of severity, 0 = no moderate signs up to 4 = serious signs (e.g. no visible signs of fear up to extreme fear, including tendency to cower, retreat, or hide).

Touch Sensitivity (comprised of 4 questions)

“Dog shows fearful or wary responses to potentially painful or uncomfortable procedures, including bathing, grooming, nail-clipping, and veterinary examinations.”
(cbarq.com)

RESULTS

Companion dogs (n=3160) show significantly higher rates of touch sensitivity than Service dogs (n=2817; $p < 0.0001$). Detection dogs (n=22) do not show significantly different levels of touch sensitivity when compared with Companion dogs ($p = 0.203$) or Service dogs ($p = 0.885$).

DISCUSSION

Service dogs and Detection dogs do not appear to experience different levels of touch sensitivity, but Companion dogs experience significantly more than Service dogs. While more research is needed, this elevated rate/severity of touch sensitivity among companion dogs could result from a lack of socialization and interaction with people during valuable socialization phases. However, if this were the case, the same pattern would most likely be seen in detection dogs as well because they tend to either be companion dogs in their “down time” or they were previously companion dogs before being surrendered to an animal shelter and then adopted by a detection dog organization.

Separation-Related Behavior (comprised of 8 questions)

“Dog vocalizes and/or is destructive when separated from the owner, often accompanied or preceded by behavioral and autonomic signs of anxiety including restlessness, loss of appetite, trembling, and excessive salivation.” (cbarq.com)

RESULTS

Companion dogs (n=3200) show a significantly higher rate of separation-related behavior when compared with Service dogs (n=2840; $p<0.0001$). Detection dogs (n=21) do not show significantly different rates of separation-related behavior when compared with either Companion dogs ($p=0.868$) or Service dogs ($p=0.553$).

DISCUSSION

Companion dogs have the highest rates of separation-related behavior, which is understandable considering the fact that most of them do not experience the same amount of interaction and companionship during the day. Future research should look into what the exact cause of this relationship is between different working dog groups. Service dogs also understandably experience the lowest rates of this behavior most likely because they spend so little time on their own as their whole job is to be companions to their owners/handlers.

Attachment and Attention-Seeking Behavior (comprised of 6 questions)

“Dog maintains close proximity to the owner or other members of the household, solicits affection or attention, and displays agitation when the owner gives attention to third parties.” (cbarq.com)

RESULTS

Detection dogs (n=19) show significantly higher rates of attachment and attention-seeking behaviors when compared with Service dogs (n=2840; p=0.013) and Companion dogs (n=3206; p<0.0001). Detection and Companion dogs do not show significantly different rates of attachment and attention-seeking behavior when compared with each other (p=0.242).

DISCUSSION

While Service dogs and Companion dogs show lower rates of attachment and attention-seeking behavior, it is surprising that Detection dogs show the highest rates. As a working dog, it is assumed that detection dogs spend more time interacting with their handlers and their environment than companion dogs and therefore would not need to show attachment and attention-seeking behaviors as frequently. This could be due to the living conditions of many scat-detection dogs who stay in kennels with other detection dogs instead of being treated as family pets in their “off time”. The difference in attachment and attention-seeking behavior could also be due to any number of factors and the exact reason is difficult to know without further research. Future research should focus on what these behaviors are actually signifying in order to understand why the frequency and severity may differ between types of working dogs.

Trainability (comprised of 8 questions)

“Dog shows a willingness to attend to the owner and obey simple commands. Dog is not easily distracted, tends to be a fast learner, responds positively to correction, and will fetch or retrieve objects.” (cbarq.com)

RESULTS

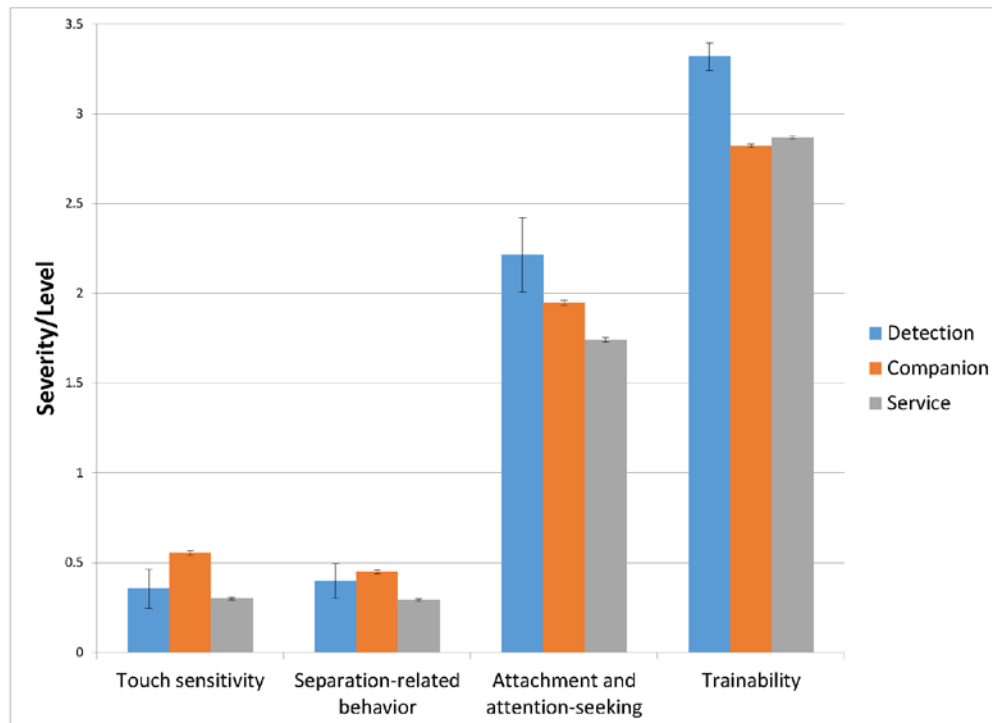
All three pairs of working dogs show significantly different levels of trainability.

Detection dogs (n=24) present the highest level of trainability ($p < 0.0001$ when compared with Service dogs, n=2841; $p < 0.0001$ when compared with Companion dogs).

Companion dogs (n=3240) have the lowest rates of trainability ($p < 0.0001$ when compared with Detection dogs; $p = 0.0007$ when compared with Service dogs).

DISCUSSION

The fact that Detection dogs show the highest levels of trainability suggests a breed-related cause because of the high levels of intelligent and highly motivated dogs in detection-related jobs compared to the choice for using retrievers as service dogs, which are known for their friendly nature over other traits (Burrows et al, 2008). Companion dogs have the lowest rates of trainability and this is most likely due to the lack of training most companion dogs receive compared to other working dogs.



Graph 7. Average severity or level of four behavior traits included in the C-BARQ (touch sensitivity, separation-related behavior, attachment and attention-seeking behavior, and trainability) for Detection dogs, Companion dogs, and Service dogs. On the scale of severity, 0 = no moderate signs up to 4 = serious signs (e.g. no visible signs of aggression up to serious signs of aggression, including tendency to snap, bite, or attempt to bite).

Chasing (comprised of 4 questions)

“Dog chases cats, birds, and/or other small animals, given the opportunity.” (cbarq.com)

RESULTS

All three pairs of working dogs are distinctly different from each other.

Companion dogs (n=21) present the highest rates of chasing ($p < 0.0001$ when compared with Service dogs; $p < 0.0001$ when compared with Companion dogs). Service dogs (n=2644) have the lowest rates of chasing ($p < 0.0001$ when compared with Detection dogs, n=21; $p < 0.0001$ when compared with Companion dogs).

DISCUSSION

The fact that Service dogs displayed the lowest rates of chasing is not surprising, however, Companion dogs displaying the highest rates of chasing is an unexpected finding. Detection dogs are typically found to have - and usually are chosen because - they have higher energy levels and are typically made up of high-energy breeds with high prey drives (Conservationbiology.uw.edu, 2015). Further research is needed to examine the distinction between chasing, energy level, and motivations for detection dogs as most detection dogs are trained using balls or other toys as primary reinforcers for the completion of their given task.

Excitability (comprised of 6 questions)

“Dog displays strong reaction to potentially exciting or arousing events, such as going for walks or car trips, doorbells, arrival of visitors, and the owner arriving home; has difficulty calming down after such events.” (cbarq.com)

RESULTS

All three pairs of working dogs show distinctly different rates of excitability from each other. Detection dogs (n=20) present the highest rates of excitability ($p < 0.0001$ when compared with Service dogs; $p = 0.01$ when compared with Companion dogs). Service dogs (n=2811) have the lowest rates of excitability ($p < 0.0001$ when compared with Detection dogs; $p < 0.0001$ when compared with Companion dogs).

DISCUSSION

Detection dogs showed the highest levels of excitability, which makes sense given that excitability is a requirement to be a successful detection dog for those that sniff out scat or missing people. Service dogs have the lowest rates of excitability, which is probably due to a combination of breed choice (retrievers typically used as service dogs are not high energy compared to other breeds), constant activity (service dogs move around frequently and so do not have the opportunity to develop pent up energy), and socialization (service dogs interact with a wide variety of situations on a daily basis and so do not develop an increased excitement level for particular situations).

Energy Level (comprised of 2 questions)

“Dog is energetic, “always on the go”, and/or playful.” (cbarq.com)

RESULTS

All three pairs of working dogs show significantly different energy levels.

Detection dogs (n=22) present the highest energy level ($p < 0.0001$ when compared with Service dogs, $n=2840$; $p=0.0002$ when compared with Companion dogs). Companion dogs (n=22) have the lowest energy level ($p=0.0002$ when compared with Detection dogs; $p < 0.0001$ when compared with Service dogs).

DISCUSSION

Just as Detection dogs showed the highest rates of trainability and excitability, they also show the highest rates of increased energy levels. This is most likely again due to the specific breeds used in this field as well as the types of dogs who are most likely to succeed. High energy levels are needed for dogs who are expected to run around for hours every day under their own volition. Also understandable, is the fact that service dogs have the lowest energy levels. Again, this is most likely due to the fact that they move around with their handlers/owners constantly throughout the day and are being exercised very regularly.

Miscellaneous Summary of Results (comprised of 23 questions)

The miscellaneous category is comprised of 23 questions that relate to potentially abnormal behaviors (e.g. chasing shadows, excessive licking, mounting inappropriate objects, etc.) and the frequency of those behaviors. Understanding the rates/frequencies

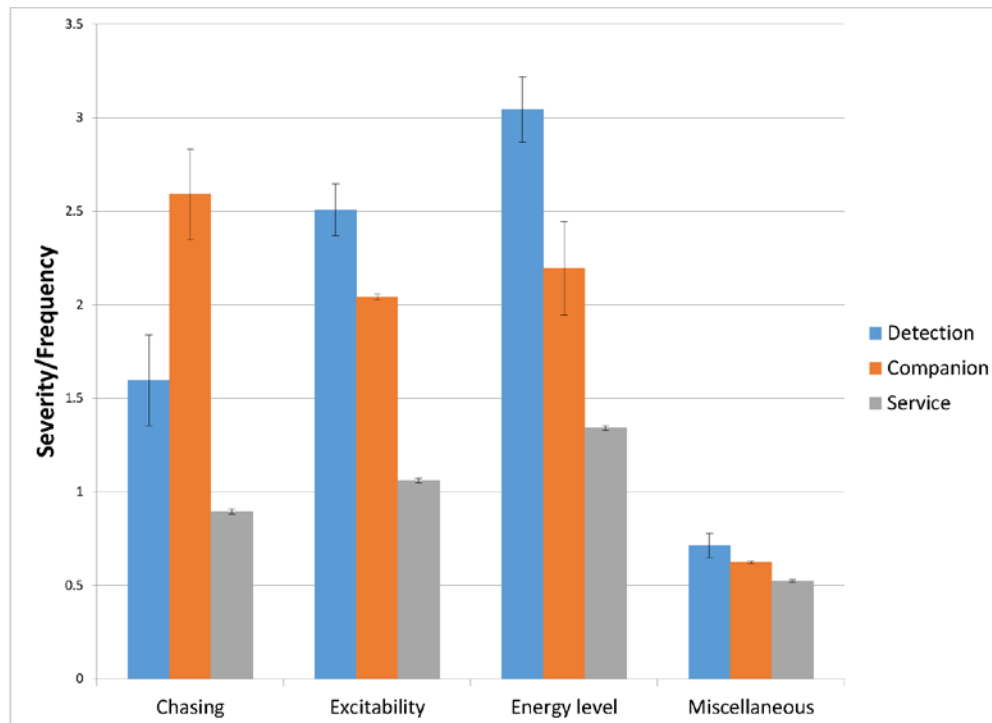
of these abnormal, or non-functional, behaviors as they relate to different types of working dogs can help us create circumstances that will make the dogs more successful in the long run.

RESULTS

Service dogs (n=2842) show significantly greater rates of miscellaneous (or abnormal) behaviors when compared with both Companion dogs (n=3209; $p<0.0001$) and Detection dogs (n=21; $p=0.037$). Detection dogs do not show significantly different rates of miscellaneous (or abnormal) behaviors when compared with Companion dogs ($p=0.471$).

DISCUSSION

Detection dogs and Companion dogs showed fewer miscellaneous behaviors than service dogs. The exact concerns regarding these behaviors (i.e. whether they are abnormal or not) depends on what each individual owner/handler considers to be a problem behavior. However, the behaviors listed here are generally considered to be un-functional behaviors with no purpose except perhaps an instinctual response (e.g. chasing small animals) or a psychological response (e.g. chasing their tails). This makes it difficult to determine whether an increase in these behaviors is actually a concern or not.



Graph 8. Average severity or level of four behavior traits included in the C-BARQ (chasing, excitability, energy level, and miscellaneous) for Detection dogs, Companion dogs, and Service dogs. On the scale of severity, 0 = no moderate signs up to 4 = serious signs (e.g. no visible signs of aggression up to serious signs of aggression, including tendency to snap, bite, or attempt to bite). On the scale of frequency, 0 = never, 1 = seldom, 2 = sometimes, 3 = usually, and 4 = always.

77. Chases Squirrels, Rabbits, etc.

Companion dogs (n=21) show the greatest rates of chasing squirrels, rabbits, etc. These rates are significantly higher than Detection dogs (n=20; p=0.047). Detection dogs show the lowest rates of chasing squirrels, rabbits, etc. These rates are significantly lower than Service dogs (n=2526; p=0.009). Companion dogs and Service dogs do not show significant differences in rates of chasing squirrels, rabbits, etc.

78. Escapes from Home or Yard

Companion dogs (n=3041) do not show significantly different rates of escaping when compared with Detection dogs (n=22; p=0.995). Service dogs (n=2549) show significantly lower rates of escaping when compared with Companion dogs (p<0.0001) and Detection dogs (p=0.016).

79. Rolls in Droppings

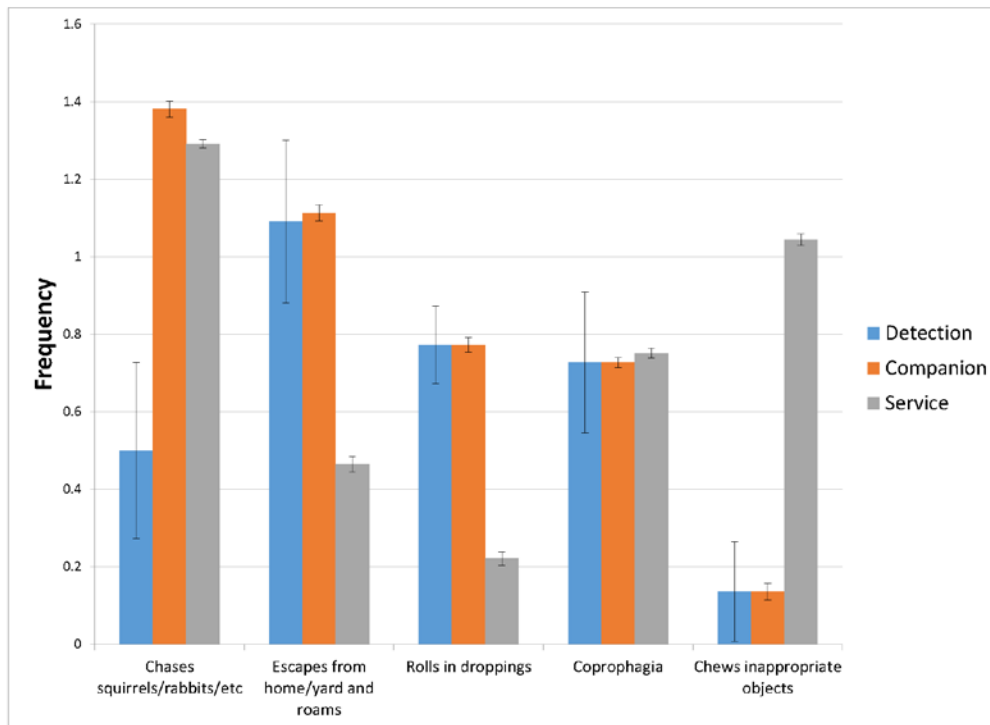
Companion dogs (n=3077) show significantly higher rates of rolling in droppings when compared with Detection dogs (n=22; p=0.498). Service dogs (n=2794) show significantly lower rates of rolling in droppings when compared with Companion dogs (p<0.0001) or Detection dogs (p=0.017).

80. Coprophagia

Companion dogs (n=3165) show the highest rates of coprophagia when compared with Service dogs (n=2825; $p < 0.0001$). Detection dogs (n=22) do not show significantly different rates of coprophagia when compared with Companion dogs ($p = 0.638$) or Service dogs ($p = 0.995$).

81. Chews Inappropriate Objects

Service dogs (n=2839) show the highest rates of chewing inappropriate objects when compared with Detection dogs (n=22; $p < 0.0001$) and Companion dogs (n=3203; $p < 0.0001$). Detection dogs show the lowest rates of chewing inappropriate objects when compared with Companion dogs ($p = 0.0013$).



Graph 9. Average frequency of five miscellaneous behavior traits included in the C-BARQ (chases squirrels/rabbits/etc., escapes from home/yard and roams, rolls in droppings, coprophagia, and chews inappropriate objects) for Detection dogs, Companion dogs, and Service dogs. On the scale of frequency, 0 = never, 1 = seldom, 2 = sometimes, 3 = usually, and 4 = always.

82. Mounts Inappropriate Objects

Detection dogs (n=20) show no significantly different rates of mounting inappropriate objects when compared with Service dogs (n=2828; p=0.117) or Companion dogs (n=3190; p=0.09). There is also no significant difference in the rate of mounting inappropriate objects between Service dogs and Companion dogs (p=0.568).

83. Begg for Food

Companion dogs (n=3199) show significantly higher rates of begging for food when compared with both Detection dogs (n=20; p=0.0003) and Service dogs (n=2840; p<0.0001), while Service and Detection dogs show no significant difference in rate of begging for food when compared with each other (p=0.495).

84. Steals Food

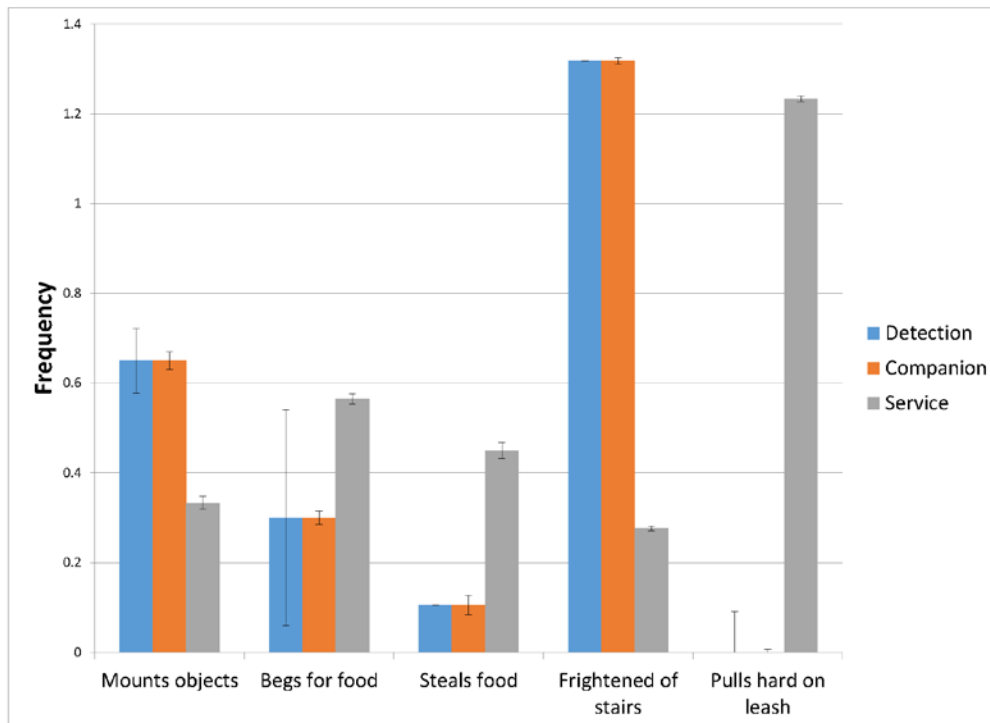
Companion dogs (n=3191) show significantly higher rates of stealing food when compared with both Detection dogs (n=19; p=0.003) and Service dogs (n=2834; p<0.0001). Service dogs do not show significantly different rates of stealing food when compared with Detection dogs (p=0.273).

85. Frightened of Stairs

Detection dogs (n=22) show the highest rates of being frightened of stairs when compared with Service dogs (n=2843; $p<0.0001$) and with Companion dogs (n=3126; $p<0.0001$). Service dogs showed the lowest rates of being frightened of stairs when compared with Detection dogs ($p<0.0001$) and Companion dogs ($p<0.0001$).

86. Pulls Hard on Leash

Detection dogs (n=19) were not included in the analysis for this trait because 0 of 19 participants responded to this question. Service dogs (n=2842) had a significantly lower rate of pulling on the leash when compared with Companion dogs (n=3199; $p<0.0001$).



Graph 10. Average frequency of five miscellaneous behavior traits included in the C-BARQ (mounts objects, begs for food, steals food, frightened of stairs, and pulls hard on leash) for Detection dogs, Companion dogs, and Service dogs. On the scale of frequency, 0 = never, 1 = seldom, 2 = sometimes, 3 = usually, and 4 = always.

87. Urinates Against Objects at Home

Detection dogs (n=22) were not included in the analysis for this trait because 0 of 19 participants responded to this question. Companion dogs (n=3200) showed significantly higher rates of urinating against objects at home when compared with Service dogs (n=2835; $p < 0.0001$).

88. Urinates when Approached, Handled, etc.

Companion dogs (n=3205) show the highest rates of urinating when approached or handled when compared with Service dogs (n=2843; $p = 0.0014$), but no significant difference when compared with Detection dogs (n=22). The rates among Detection dogs of urinating when approached or handled is not significantly different when compared with Service dogs ($p = 0.974$) or Companion dogs ($p = 0.978$).

89. Urinates when Left Alone

Companion dogs (n=3193) show the highest rates of urinating when left alone when compared with Service dogs (n=2843; $p < 0.0001$), but not when compared with Detection dogs (n=22; $p = 0.788$). Detection dogs show no significant difference in their rate of urinating when left alone when compared with Service dogs.

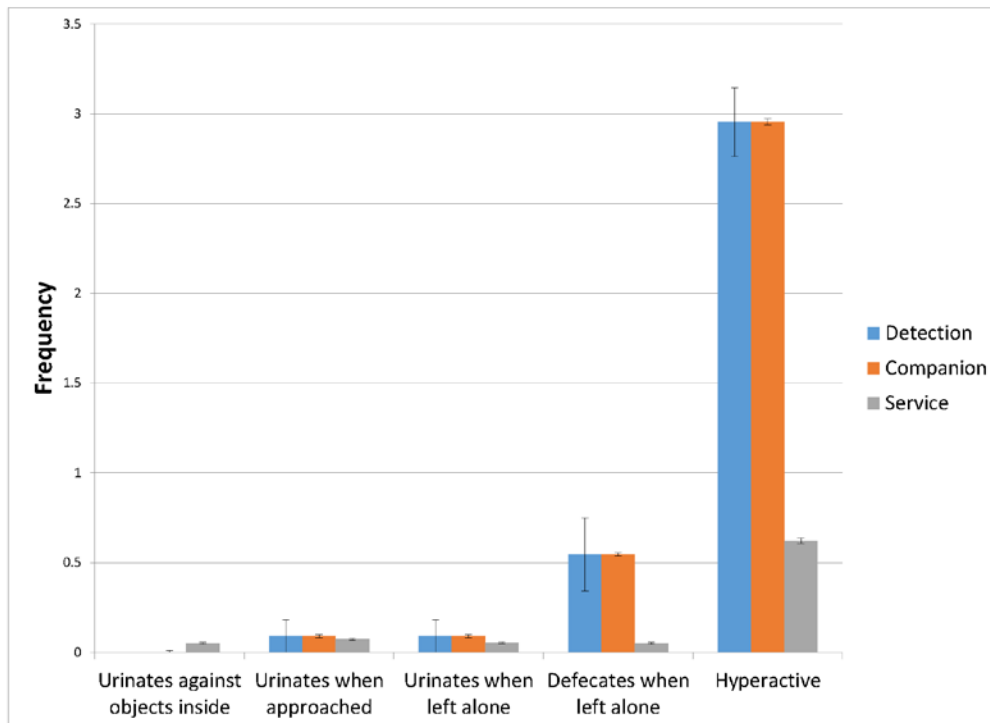
90. Defecates when Left Alone

Detection dogs (n=22) had the highest rates of defecating when left alone when compared with Service dogs (n=2842; $p<0.0001$) and with Companion dogs (n=3187; $p<0.0001$).

Service dogs showed the lowest rates of defecating when left alone when compared with Detection dogs ($p<0.0001$) and Companion dogs ($p<0.0001$).

91. Hyperactivity

Detection dogs (n=22) and Companion dogs (n=3209) showed almost identical frequencies of hyperactivity. Service dogs (n=2841), however, showed significantly lower rates of hyperactivity ($p<0.0001$) than either of the other two groups.



Graph 11. Average frequency of five miscellaneous behavior traits included in the C-BARQ (urinates against objects inside, urinates when approached, urinates when left alone, defecates when left alone, and hyperactivity) for Detection dogs, Companion dogs, and Service dogs. On the scale of frequency, 0 = never, 1 = seldom, 2 = sometimes, 3 = usually, and 4 = always.

92. Playful/Boisterous

Detection dogs (n=22) and Companion dogs (n=22) showed similar frequencies of playful/boisterous behavior. However, Service dogs (n=2841) showed significantly lower rates of playful/boisterous behavior ($p<0.0001$) than either of the other two groups.

94. Stares Intently at Nothing Visible

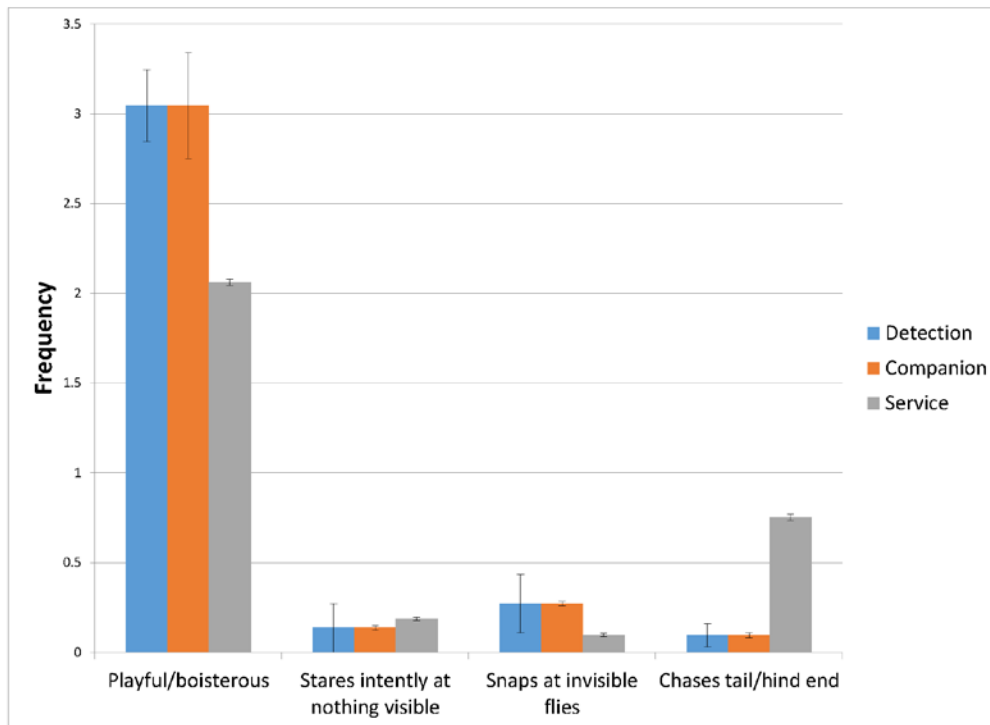
Detection dogs (n=22) have the lowest rates of staring intently at nothing visible, but the rates are not significantly different from Companion dogs (n=3151; $p=0.171$) or from Service dogs (n=2834; $p=0.931$). Companion dogs show the highest rates of staring intently at nothing visible when compared with Service dogs ($p<0.0001$).

95. Snaps at Invisible Flies

Service dogs (n=2834) show the lowest rates of snapping at invisible flies when compared with Companion dogs (n=3156; $p<0.0001$), but no significant difference when compared with Detection dogs (n=22). Detection dogs show no significant difference in rate of snapping at invisible flies when compared with either Service dogs ($p=0.299$) or Companion dogs ($p=0.918$).

96. Chases Tail/Hind End

Service dogs (n=2841) show significantly higher rates of chasing their tail or hind end when compared with either Companion dogs (n=3195; $p < 0.0001$) or with Detection dogs (n=21; $p = 0.001$). Companion dogs show no significant difference in the rate of chasing their tail or hind end when compared with Detection dogs ($p = 0.228$).



Graph 12. Average frequency of four miscellaneous behavior traits included in the C-BARQ (playful/boisterous, stares intently at nothing visible, snaps at invisible flies, and chases tail/hind end) for Detection dogs, Companion dogs, and Service dogs. On the scale of frequency, 0 = never, 1 = seldom, 2 = sometimes, 3 = usually, and 4 = always.

97. Chases Shadows

Detection dogs (n=22) show the highest rates of chasing shadows when compared with Service dogs (n=2823; $p<0.0001$) or with Companion dogs (n=3127; $p<0.0001$). Service dogs show the lowest rates of chasing shadows when compared with Detection dogs ($p<0.0001$) or with Companion dogs ($p<0.0001$).

98. Barks Excessively

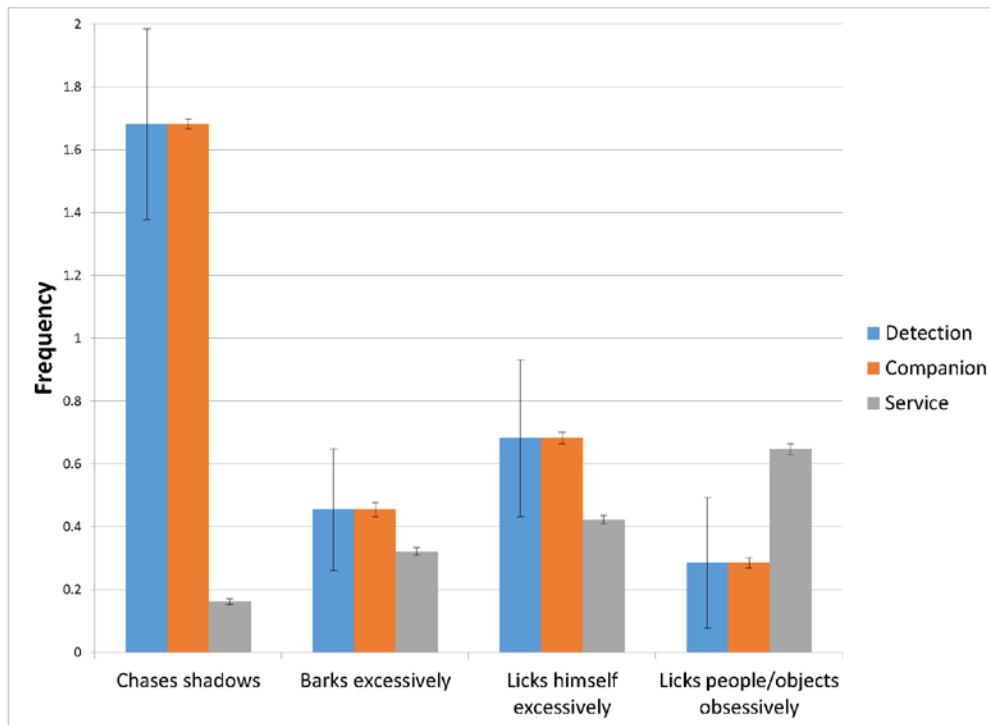
Companion dogs (n=3208) show the highest rates of excessive barking when compared with Detection dogs (n=22; $p=0.009$) or with Service dogs (n=2843; $p<0.0001$). Service dogs show the lowest rates of excessive barking when compared with Companion dogs ($p<0.0001$), but show no significant statistical difference in rate of excessive barking when compared with Detection dogs ($p=0.813$).

99. Licks Him/Herself Excessively

Companion dogs (n=3207) show the highest rates of licking themselves excessively when compared with Service dogs (n=2843; $p<0.0001$), but not when compared with Detection dogs ($p=1$). Detection dogs showed no significant difference in rate of licking themselves excessively when compared with Service dogs ($p=0.35$).

100. Licks People/Objects Excessively

Detection dogs (n=21) have the lowest rate of licking people or objects excessively when compared with either Service dogs (n= 2843; p=0.169) or with Companion dogs (n=3208; p=0.384). Service dogs have the highest rate of licking people or objects excessively when compared with Companion dogs (p=0.0001).



Graph 13. Average frequency of four miscellaneous behavior traits included in the C-BARQ (chases shadows, barks excessively, licks himself excessively, and licks people/objects obsessively) for Detection dogs, Companion dogs, and Service dogs. On the scale of frequency, 0 = never, 1 = seldom, 2 = sometimes, 3 = usually, and 4 = always.

Miscellaneous Discussion

Overall, Detection dogs and Companion dogs showed similar, and at times almost identical, responses to the 23 miscellaneous behaviors. The one behavior in which they differed was the fact that Detection dogs seemed to chase squirrels/rabbits/etc. significantly less than the other two groups. This is surprising given that the Detection dogs that were included in the study (those involved in scat- and people-detection) are typically required to have high prey drive. It would be interesting to delve into this finding with future research to determine the reason behind it. Service dogs tended to have the most significantly different results from the other two groups. They tended to show lower rates of escaping, rolling in droppings, mounting objects, fear of stairs, defecating when left alone, hyperactivity, playful/boisterous behavior, and chasing shadows. These findings agree with the rest of the findings in this study as well as previous research; the Service dog group tended to be better behaved and more socially balanced than other groups most likely because they experienced more socialization during prime developmental periods. However, Service dogs did show higher frequencies of chewing inappropriate items, begging for/stealing food, chasing their tail, and licking people/objects obsessively. The first two of these four behaviors (chewing and begging/stealing) are common behaviors seen in dogs who were bred to use their mouths, such as retrievers, which were bred to help hunters by bringing back what was caught from the brush. The last two of these four behaviors are more surprising. Chasing their tail and licking people/objects obsessively can be indicative of obsessive compulsive conditions in dogs (Overall & Dunham, 2002). OCD would be a surprising finding in service dogs considering the amount of training, socialization, and care taken when breeding.

CONCLUSION

There are so many variables that affect the temperament of an individual dog. Genetic histories, prenatal and neonatal developmental environments, as well as any socialization or training (or lack thereof) from before birth onward will help determine a dog's ultimate temperament. It is for this reason that selecting and evaluating individual dogs for particular working roles becomes incredibly difficult, and to do so with any level of accuracy may be altogether impossible. However, it is highly encouraging that the C-BARQ has been previously used to predict how successful service dogs in training will be once they graduate to active duty, or if they will graduate at all. If the C-BARQ can be used to accurately predict success rates for one type of working dog, it is suggested that it can also be used to determine which type of job an individual dog might be most successful at completing. The results of this study further indicate that the C-BARQ can be a successful tool in completing this task.

Overall, each working dog group displayed a significantly different behavior profile compared to the other two. Trainability was the highest behavior trait for all three groups and owner-directed aggression was the lowest. Aggression and fear were relatively low for all three groups as well, though Detection dogs appeared to have the greatest variety in the four types of aggression; Detection dogs showed the highest levels of dog-directed and familiar-dog aggression (dog rivalry), but moderate levels of stranger-directed and owner-directed aggression compared to the other two groups. Because detection dogs complete such a variety of tasks this finding is not surprising (e.g. detecting cancer or allergens requires a different set of skills and a different temperament than detecting missing people after a natural disaster). It is also not surprising that

Detection dogs displayed the highest levels of dog-directed aggression specifically because these dogs may not be required to work with or even in the area of other dogs. Detection dogs tend to require good rapport with their handlers over virtually any other individual, whether human, canine, or other species.

Service dogs understandably displayed the lowest levels of all traits except for trainability, which was only higher than Companion dogs but not Detection dogs. This is most likely due to the large amount of socialization and training that goes into preparing a service dog for active duty. It is also probably related to the highly structured nature of service dog organizations that will provide unique training to young dogs who are struggling to complete the program and move onto active duty. Service dogs also tend to be bred from a specific gene pool that has been tested over many generations to contain the best-behaved individuals. Also unsurprising was the finding that service dogs displayed the lowest levels of excitability and energy. This may be due to the constant movement required for a dog who follows his handler everywhere they go, but is probably also due to the large amount of socialization mentioned earlier.

The Companion dog group had a huge amount of variety simply due to the fact that the questionnaire was disseminated to this group based on word of mouth as well as through the leaders of several American Kennel Club breed groups. It is even more encouraging that even though a large amount of variety exists, the group as a whole was still significantly different from the other two groups.

There were two main findings that were unexpected: frequency of miscellaneous behaviors and severity of fear. Prior to the start of this study, it was predicted that when compared with Companion dogs, all working dogs would display fewer miscellaneous

behaviors, which included behaviors such as excessive barking, inappropriate urination/defecation, mounting people or objects, chasing shadows, etc. due to the simple fact that working dogs have less downtime in which to become bored or destructive. However, Companion dogs did not show the highest frequency of these miscellaneous behaviors; Detection dogs displayed higher frequencies than Companion dogs. This is most likely due to the fact that detection dogs can remain successful at their jobs even if they are excessive barkers or become hyper-focused on a ball (this trait is even used as reinforcement as many detection dogs will work for hours with only a ball or tug toy as motivation). The second unexpected finding (higher levels of fear) is most likely due to the lack of socialization provided to companion dogs when compared with a variety of working dogs (such as service dogs), while also putting these less socialized individuals in many potentially problematic situations (unlike detection dogs who tend to spend their time working or training).

Though there are many variables involved in doing a study of this size (and each of those variables may not be accounted for at this point), the primary limitation in analyzing these results is determining whether the behaviors led to the job or the job led to the behaviors. Service dogs are selected at or before birth as well as monitored up until about eighteen months old to determine if they could be successful enough to attempt the time and financial effort of training them to be active service dogs. The dogs' developmental environment and hereditary background affect the type of behavior they display. In this situation, it is most likely that the job (or environmental circumstances) led to the behaviors. However, detection dogs are an example of the opposite. Detection dogs are either family dogs with unknown histories or they were adopted from shelters,

also with unknown histories. The cause of their behavioral discrepancies can be hard or impossible to determine. However, most detection dogs are chosen for a specific job because they display behaviors that suggest they would be good at that job. Those who are adopted from shelters were surrendered most likely due to behavior concerns (i.e. excitability, high energy levels, becoming easily bored). These concerns, while making them unsuitable for the average family, typically make them wonderful detection dogs. Therefore, detection dogs are chosen for a job based on the behaviors they display.

Further research is required before using the C-BARQ as the primary tool in the selection and evaluation of working dogs, however the results of this study suggest it would be highly beneficial to do so. Additional studies are also needed to possibly compare different types of working dogs beyond the general categories of detection and service. This suggested research should focus on how the C-BARQ can be incorporated into already existing methods of evaluation for working dogs so as to validate its functionality and usefulness at first, but to also allow changes to occur as soon as possible. Working dogs are incredibly valuable and being able to streamline the process of selecting and training them will allow more of them to graduate to active duty and continue doing the jobs we rely on them to do.

References

1. Belyaev, D. (1979). The Wilhemine E. Key 1978 Invitational Lecture. Destabilizing selection as a factor in domestication. *Journal of Heredity*, 70, 301-8.
2. Burrows, K., Adams, C., & Millman, S. (2008). Factors affecting behavior and welfare of service dogs for children with autism spectrum disorder. *Journal of Applied Animal Welfare Science*, 11, 42-62.
3. Castaldo, N. (2014). "Sniffer Dogs: How Dogs (and Their Noses) Save the World". Harcourt Publishing Company. New York City, New York.
4. CCI.org. (2015). Canine Companions for Independence. Retrieved June 6, 2015 from http://www.cci.org/site/c.cdKGIRNqEmG/b.4011115/k.65BA/Training_assistance_dogs.htm
5. Conservationbiology.uw.edu. (2015). Conservation Canines. Retrieved June 7, 2015 from <http://conservationbiology.uw.edu/conservation-canines/>
6. Coppinger, R. & Coppinger L. (2002). "Dogs: A New Understanding of Canine Origin, Behavior and Evolution." University of Chicago Press. Chicago, Illinois.
7. Cornwell, C. (2015). Barney, the Tacoma K-9, remembered as a 'phenomenal dog'. *The Seattle Times*. Retrieved June 7, 2015 from <http://www.seattletimes.com/seattle-news/crime/narcotics-dog-hospitalized-after-ingesting-meth/>
8. Duffy, D., Hsu, Y., & Serpell, J. (2008). Breed differences in canine aggression. *Applied Animal Behavior Science*, article in press.
9. Elegans, C. (2012). "100 Years of Breed 'Improvement'". Retrieved June 6, 2015 from <https://dogbehaviorscience.wordpress.com/2012/09/29/100-years-of-breed-improvement/>
10. Guidedogs.com. (2015). Guide Dogs for the Blind. Retrieved June 6, 2015 from http://www.guidedogs.com/site/PageServer?pagename=about_overview_faq
11. Guidedogsofamerica.org. (2014). Guide Dogs of America. Retrieved June 6, 2015 from <http://www.guidedogsofamerica.org/1/mission/>
12. Helton, W. (2009). "Canine Ergonomics: The Science of Working Dogs". Taylor and Francis Group, LLC. Boca Raton, Florida.
13. Lavigne, G. (2014). *The Draft Dog, past and present*. Guillaume de Lavigne/Lulu.com.
14. Overall, K. & Dunham, A. (2002). Clinical features and outcome in dogs and cats with obsessive-compulsive disorder: 126 cases (1989-2000). *Journal of the American Veterinary Medical Association*, 221, 1445-1452.
15. Pawswithacause.org. (2013). Paws with a Cause. Retrieved June 6, 2015 from <https://www.pawswithacause.org/i-want-a-dog/dogs-for-autism>

16. Pedersen, V. & Jeppesen, L. (1990). Effects of early handling on later behavior and stress responses in the silver fox (*Vulpes vulpes*). *Applied Animal Behavior Science*, 26, 383-393.
17. Salman, M., Hutchison, J., Ruch-Gallie, R., Kogan, L., New, Jr., J., Kass, P., & Scarlett, J. (2000). Behavioral reasons for relinquishment of dogs and cats to 12 shelters. *Journal of Applied Animal Welfare Science*, 3, 2.
18. Salman, M., New, Jr., J., Scarlett, J., Kass, P., Ruch-Gallie, R., & Hetts, S. (1998). Human and animal factors related to relinquishment of dogs and cats in 12 selected animal shelters in the United States. *Journal of Applied Animal Welfare Science*, 1, 3.
19. Scott, J. & Fuller, J. (1965). *Genetics and the Social Behavior of the Dog*. University of Chicago Press. Chicago, IL.
20. Serpell, J. (1995). "The Domestic Dog: Its Evolution, Behavior and Interactions with People". Cambridge University Press. Cambridge, UK.
21. Servicedogcentral.org. (n.d.). Service Dog Central. Retrieved June 6, 2015 from <<http://servicedogcentral.org/content/faq/60>>
22. Trut, L., Plyusnina, I., & Oskina, I. (2004). An experiment on fox domestication and debatable issues of evolution of the dog. *Russian Journal of Genetics*, 40, 644-655.
23. Ubbink, G., van de Broek, J., Hazewinkel, H., & Rothuizen, J. (1998a). Cluster analysis of the genetic heterogeneity and disease distributions in purebred dog populations. *The Veterinary Record*, 142, 209-213.
24. Ubbink, G., van de Broek, J., Hazewinkel, H., & Rothuizen, J. (1998b). Risk estimates for dichotomous genetic disease traits based on a cohort study of relatedness in purebred dog populations. *The Veterinary Record*, 142, 328-331.
25. Vines, G. (1987). "Science goes to the dogs." *NewScientist*, 1584, 44-48.
26. Warren, C. (2013). "What the Dog Knows: Scent, Science, and the Amazing Ways Dogs Perceive the World". Touchstone. New York City, New York.
27. Weiss, E. (2002). Selecting shelter dogs for service dog training. *Journal of Applied Animal Welfare Science*, 5, 1.
28. Weiss, E. & Greenberg, G. (1997). Service dog selection tests: Effectiveness for dogs from animal shelters. *Applied Animal Behavior Science*, 53, 297-308.

Notes

* (Pg. 2) For the sake of this study, all dogs who have graduated from training to active duty are considered to be successful at their job. If, at any point, they are removed from a program, they would no longer be considered successful, though dogs are frequently “career-changed” from one job to another where they will be more successful (which usually occurs before they are graduated to active duty).

** (Pg. 8) There was another service dog organization included in this study called 4 Paws for Ability, but there was only one response. The answers for that dog were included in the analysis.

*** (Pg. 21) Data contributed to this study by James Serpell and Leader Dogs for the Blind was previously gathered from past research. The rest of the data was provided at the time this study was conducted.

**** (Pg. 22) According to one school of thought, it is inappropriate to take the mean of responses from a Likert scale because the ordinal arrangement means the possible answers are subjective (i.e. “strongly agree” vs “agree”) and possibly not comparable between questions (i.e. ranking how much you like mashed potatoes alongside how much you like animals). However, if approached cautiously, this method can be used appropriately with questions that have been previously correlated with each other (as has been done with the C-BARQ).