THE EFFECTS OF SOCIAL TRAINING AND OTHER FACTORS ON ADOPTION SUCCESS OF SHELTER DOGS

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Abstract

The aim of the present study was to increase adoption rates of dogs housed in shelters. Previous research suggests that the public perceives friendly and sociable dogs as more adoptable. The present study hypothesized that dogs trained to gaze into potential adopters' eyes would be perceived as more attractive and would therefore have a greater likelihood of being adopted. In addition, we investigated other individual factors that may predict adoption success. For each dog in the study, we tracked outcome (adoption or euthanasia), physical characteristics, and how they were acquired by the shelter. Dogs in a group trained to gaze at people were not significantly more likely to be adopted than untrained dogs in a control group (70.7% in the training group vs. 67.8% in the control group, $P > 0.10$). However, breed type, mode of intake (how dogs were taken into the shelter), and kennel location were predictive of adoption ($P < 0.001$, $P < 0.05$. and $P < 0.05$ respectively) and size, breed type, and mode of intake were predictive of length of stay ($P < 0.05$, $P = 0.05$, and $P < 0.01$ respectively). In a second experiment, participants unaware of the dogs' outcomes (adoption or euthanasia) rated photographs of the dogs, according to attractiveness, on a scale ranging from 0 to 1. The average rating of attractiveness for the adopted and euthanized group were significantly different: 0.50 (SD = 0.08) for adopted dogs and 0.46 (SD = 0.09) for the euthanized dogs ($P < 0.05$). These findings suggest that other factors besides gazing may be more important to adopters when considering adoption of a dog.

Key words: shelter, dog, overpopulation, training, adoption

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1. Introduction

The leading preventable cause of pet death in the United States is the euthanasia of healthy animals in shelters (Griffin, 2007). Up to 10 million pet dogs are admitted to shelters and approximately a quarter of a million adoptable dogs are euthanized each year (American Society for the Prevention of Cruelty to Animals, 2011; American Veterinary Medical Association, 2007). Because of the extraordinarily large volume of homeless animals, shelters are often stretched for resources and are only able to provide basic necessities for each animal. Therefore, these animals typically live in barren, noisy environments with little to no opportunities for engaging in species-specific behaviors (see review by Wells, 2003).

The problem of pet overpopulation can be addressed from several angles. Although the sterilization of pets and the prevention of relinquishment can aid in decreasing the input of homeless pets into shelters, improving adoption success is crucial to increasing the number of pets leaving shelters and going into homes. The aim of the present study was to evaluate a training program designed to increase the adoption success of dogs housed at shelters as well as to identify which individual factors might influence adoption.

Although human interaction has been shown to be enriching for shelter dogs (Bergamasco et al., 2010; Coppola et al., 2006; Normando et al., 2009), it remains unclear whether human interaction can function to increase adoption success, which is the ultimate goal for this population. Several studies have attempted to directly alter adoption success through human interaction. Braun (2011) reported anecdotal evidence that an unsystematic volunteer training program decreased length of stay of dogs at a shelter. In addition, Luescher and Medlock (2009) reported that obedience training improved adoption success. However, this study had several notable limitations. First, the staff were aware of the assignment of the individual dogs into experimental groups, thus making it possible that the staff influenced the choices of the adopters. Second, the intervention consisted of one professional trainer training a multitude of different behaviors, which makes it difficult to replicate. Third, the study lacked a mechanism for

verifying that the trained dogs actually acquired the behaviors, thus allowing for the possibility that other factors may have contributed to the higher adoption success.

Whereas obedience seems to be important to potential adopters, sociability may play an even bigger role in adoption decisions (Sternberg, 2003). A widespread belief in the shelter community is that the sociability of a dog surpasses all other characteristics in predicting success of the dog in a new home. Therefore, many shelters employ behaviorists to evaluate dogs on a measure of sociability and some even determine the dogs' adoptability based on these measures (e.g. Sternberg, 2003). This widespread belief has some support in the literature. People perceive sociable dogs as low in aggression and high in friendliness, intelligence, and adoptability (Wright et al., 2007). For that reason, it may be beneficial to train shelter dogs to emit behaviors that are perceived as social by potential adopters in addition to, or as a substitute for, the training of obedience behaviors. In Experiment 1, we investigated whether human-directed social training can influence adoption success. Our study improved on previous methodology by keeping the shelter staff unaware of the assignment of dogs into experimental groups, teaching only one behavior, and validating that the dogs in the training group acquired the behavior.

In addition, in Experiment 1, we investigated which individual factors correlated with adoption success. Breed type (Clevenger and Kass, 2003), color (Lepper et al., 2002; Wells and Hepper, 1992), age (Clevenger and Kass, 2003; Lepper et al., 2002; Siettou et al., 2012), size (Siettou et al., 2012), and how the dog was acquired by the shelter (hereafter referred to as mode of intake) (Wells and Hepper, 1992), have been reported to influence adoption success; however, no single factor consistently predicted higher adoption. In Experiment 2, we experimentally tested whether general physical attractiveness of the shelter dogs can determine their adoption success.

2. Experiment 1

The first objective of Experiment 1 was to evaluate whether human-directed social training can increase adoption success in shelter dogs. Specifically, we hypothesized that dogs trained to gaze into potential adopters' eyes will be more attractive and thus more likely to be adopted. A dog's gaze into the

eyes of a human is typically perceived as a communicative and social gesture by people (e.g. Gacsi et al., 2005; Miklosi et al., 2000).

The second objective of Experiment 1 was to investigate which individual factors, such as breed type, color, age, sex, mode of intake, size, and location of the kennel correlated with adoption success.

2.2. Materials and methods

2.2.1. Animals and housing

A total of 180 dogs that were available for adoption at the Alachua County Animal Services (Gainesville, FL, USA) from the beginning of May to the end of October 2011 were used for this study. Of these dogs, 40.3% were male, age ranged approximately from 5 months to 7 years, and 38.6% were 1 year old or younger. This shelter is the only open-admission animal shelter in the county and accepts relinquished as well as stray and seized pets. All animals were held for a mandatory period of 3 days, after which the shelter staff deemed certain animals adoptable based on health and temperament. No formal temperament testing was implemented at the shelter at the time of the study. All adoptable dogs were scheduled for sterilization within their first week.

The housing for adoptable dogs included one row of adjacent pens with cement walkways in front and in back of the pens. The dogs were individually housed, with some exceptions, in 1.0 m x 4.6 m x 2.1 m pens with two-thirds of the pen outdoors, facing a grassy area and the other one-third indoors, facing other pens with dogs not yet deemed adoptable across a central corridor. The public was only allowed to view the dogs from the front outdoor walkway. All pens had cement floors and 1.2 m tall cement walls that were connected to the ceiling of the pen with a chain-link fence. Each pen contained a water dish, a food dish, and a Kuranda bed (Kuranda USA, Annapolis, MD, USA) in the inside portion of the pen. The dogs were fed and had their pens cleaned daily before 11:00 h. Shelter volunteers, when available, took the dogs out for exercise, play time, and unsystematic training to the grassy or concrete areas in front of the pens.

Each pen had a card attached to the front, which listed the dog's identification number, name, age, breed (as determined by shelter staff), mode of intake (surrendered by the owner, found as a stray, or confiscated by animal control), and sometimes a very brief description or history of the dog.

A potential adopter could request to interact with the dog, after which a volunteer or a staff member led the adopter and dog into either the grassy or the concrete area, depending on the age of the dog. If the dog was over 1 year of age, the treatment was conducted in the grassy area, whereas, if the dog was under 1 year, the treatment was conducted in the concrete area. The dog was then let off-leash, and the volunteers allowed the adopter to interact with, and give treats to the dog.

Each week, independent rescue organizations toured the shelter and selected dogs to be placed into foster homes. Every 6 weeks, a training program selected dog-friendly and non-intimidating dogs to be fostered at a prison. Adoptable dogs were marketed by the shelter on their website, several national online databases, local news channels, and through a popular online social networking site. Dogs that were perceived as hard-to-adopt by shelter volunteers, based on breed type and extended length of stay, were placed into an additional marketing program that used the same social networking site, local news channels, and printed flyers displayed in various locations in the city of Gainesville. In addition, these dogs had a lower adoption fee and came with a bag of dog food when adopted.

2.2.2. Treatments

As the dogs became available for adoption, they were randomly assigned to one of the three treatment conditions: the control group, the feeding group, or the training group. The shelter staff and volunteers were not informed about the specifics of the treatment groups or the dogs assignment to groups. The dogs in the control group did not receive any additional experiences besides the usual interactions with the shelter staff and volunteers. The dogs in the feeding and the training groups received additional 15 min of interactions between 8:00 h and 14:00 h for 6 days of the week throughout their stay at the shelter. The dogs in both of the groups were led out of their pens into a 25.6 m x 11.0 m grassy area that contained a small pool, benches, agility equipment (a ramp, a tire jump, and a long narrow bench), toys, trees, and bushes. The dogs were let off-leash and allowed to explore the area for 5 min. During this time, the

153 experimenter and assistants briefly greeted the dog if it initiated contact. At the end of the 5 min, the
154 experimenter gave the dog a choice of treats: Beggin'® Strips (Société des Produits Nestlé S.A., Vevey,
155 Switzerland), hot dogs, or Easy Cheese® (Kraft Foods Global, Glenview, IL, USA), and determined
156 which was preferred by the dog. For dogs that did not show interest in the food, toys or petting (based on
157 the dog's preference) were used during the experiment instead of the treats.
158 The dogs in the feeding group were then given a treat every 15 s for 10 min (for a total of 40 treats),
159 regardless of behavior. The experimenter said, "Come here!" and offered the treat to the dog every 15 s. If
160 the dog did not collect the treat within 5 s, the experimenter removed the treat and re-presented it 10 s
161 later. Thus, the treat became freely available to the dog every 15 s for a maximum duration of 5 s. The
162 dogs in the training group were shaped by successive approximations to gaze into the eyes of the
163 experimenter for 15 s. The experimenter waited until the dog offered a specified behavior, such as coming
164 into proximity of the experimenter, said, "Come here!", and offered a treat to the dog. If the dog was
165 already in proximity, the experimenter waited until the dog oriented towards the experimenter. After the
166 dog was reliably orienting, the experimenter waited until the dog looked up into the eyes of the
167 experimenter. The last step of the training involved the experimenter reinforcing longer and longer
168 durations of gazing into her eyes. No consequences were programmed for any other behaviors. If the dogs
169 in the training group received 40 treats, the experimenter went out of sight until the 10 min ran out, after
170 which the dog was taken back to its pen. If 10 min elapsed without the dog earning 40 treats, the
171 experimenter gave the dog the remaining treats all at once and led it back into the pen.
172 The experimenters varied daily for each dog in order to expose the dogs to as many different people
173 as possible and thus facilitate generalization of the training to an actual adopter. The experimenters were
174 three of the authors (AP, AG, and JS) and seven undergraduate students (of whom two were male).
175 The methods were systematically altered to fit the needs of certain dogs. For health reasons, dogs that
176 had undergone surgery in the past 3 days were not allowed to be in the grassy area. Instead, these dogs
177 were left on leash and the treatments were conducted in an adjacent 7.6 m x 4.3 m concrete area. If the

dogs were under 1 year of age, the treatment was conducted in the same concrete area, but off-leash. These alterations reflected the actual interaction the specific dogs would receive from a potential adopter.

All interactions with the dogs in the feeding and training conditions were videotaped with a Kodak™ PlaySport Zx3 using the WVGA mode at 30 fps (Kodak Company, Rochester, NY, USA) video camera. To improve on previous methodologies, a random sample of the dogs from the feeding and the training conditions (n = 10 in the training group and n = 9 in the feeding group) were selected for analysis in a validation procedure. A coder, blind to the hypothesis and previously trained to criterion, recorded the duration of looks at the experimenter. Due to the inherent difficulties in coding eye gaze from a distance, looking was coded when the dog oriented its head at the waist or above of the experimenter. This operational definition most likely overestimated the amount of looking of dogs in both the training and the feeding groups. A third of the videos were scored independently by an additional coder. Interobserver agreement was calculated by dividing the number of agreements by the sum of agreements and disagreements and multiplying by 100 for each 10 s time bin. The final interobserver agreement score for each video was calculated by taking the mean of all the scores for each time bin. An agreement was scored when both of the coders scored the same behavior as occurring within 1 ms.

The outcome data for the dogs was obtained on a weekly basis from the shelter records. Possible outcomes were adoption, placement into an independent rescue organization, euthanasia due to health, euthanasia due to aggression, and euthanasia due to lack of space. The outcome rescued was combined with adoption into one outcome. This was done because local rescue organizations do not euthanize their dogs and place dogs in local pet foster homes; therefore, adoption and rescue do not differ functionally. The outcome euthanized included euthanasia for all reasons mentioned above.

Additionally, the information about the dog, as listed on the kennel card, was recorded, such as age (under or over a year of age), sex (female or male), color (tan, black, brindle, black and white, black and tan, gray, and merle), breed type (Ratters, Fighting Breeds, Hounds, Working Breeds, Herding Breeds, Sporting breeds, and Lap Breeds), and mode of intake (owner surrendered – dogs given up by their owner, stray – loose dogs found by animal control officers or the public, or confiscated - dogs given up to

or seized by animal control officers). Table 1 shows the breed distributions, mode of intake, size, sex, and age of the dogs in each of the experimental conditions. The primary breed of the dog was recorded from the label on the dogs' respective cage cards as determined by shelter staff. The breeds were grouped together into seven breed types. The categories were modified from Lepper et al. (2002) to reflect the smaller sample size and to account for the somewhat unsystematic labeling of the dogs by the shelter staff. For example, Boxer mixes were assigned to the Fighting Breeds category because these dogs were not phenotypically different from other bull type breed mixes. A dog labeled by shelter staff as a Carolina Dog was included in the Hound group because it closely resembled a Hound mix. Very few, if any, dogs were pure bred, and therefore, these breed groupings represent one way to group dogs based on phenotype, behavior, and public opinion.

The size (small, approximately 0.35 m height; medium, approximately over 0.35 m and under 0.60 m in height; and large, approximately over 0.60 m in height) of the dogs and the distance of the kennel by number from the central aisle were also recorded.

A chi-square test revealed that breed type, mode of intake, size, color, sex, age, and kennel position were not distributed statistically different from a random distribution across the different experimental conditions ($P > 0.05$ for all variables).

----- INSERT TABLE 1 HERE-----

All procedures were approved by the University of Florida Institutional Animal Care and Use Committee.

2.2.4. Statistical analyses

All statistical analyses were performed using the statistical package SPSS® (International Business Machines Corp., Armonk, NY, USA).

Four dogs were excluded from the analyses due to experimental error, resulting in the total n = 176 (58 trained, 59 fed, and 59 control dogs). Descriptive statistics were used to calculate the average length of stay and outcome for all dogs.

To validate the effectiveness of the training procedure, we compared durations of looking at the trainer during the intervention in the training and the feeding groups. Control dogs could not be tested for looking durations because there was a need to keep those dogs in a true control group free of experimenter interaction. For a random sample of dogs in the training and feeding groups the percentage of looks over 2.5 s in duration was calculated for the 1st and the 7th day (n = 27; 15 dogs in the training group and 12 dogs in the feeding group). The percent difference of looks over 2.5 s between the conditions was analyzed using a one-tailed t-test. This method was chosen because in the training group, during the early phases of training, the delivery of reinforcement truncated glances. No such truncation occurred in the feeding group because they were not shaped with food reinforcement. Thus comparison of total durations of looking from the 1st day to the 7th in the two groups would not have been an effective measure of the effectiveness of the gaze training as the dogs in the training group started with a high frequency of short glances and progressed to longer glance durations.

All factors that might have influenced adoption were tested using logistic regression through backward elimination with criteria for inclusion set at $P < 0.25$ and for removal set at $P > 0.05$ (Mickey and Greenland, 1989). The dependent variable was outcome (adoption or euthanasia). All factors were treated as covariates. Factors included experimental condition, age, sex, color, breed type, size, mode of intake, and kennel position.

A Shapiro-Wilk test determined that length of stay data was not normally distributed (Statistic = 0.91, df = 176, $P < 0.001$). Therefore, all factors putatively contributing to length of stay were tested independently using Independent- Samples Kruskal-Wallis analysis of variance tests.

To evaluate which subgroups within the variables of interest had the most and the least adoption success as well as to evaluate how the subgroups differed in length of stay, t-tests with a Bonferroni correction for multiple comparisons was used for the variables influencing outcome and Mann-Whitney U tests with a Dunn-Bonferroni correction was used for the variables influencing length of stay.

2.3. Results

The average length of stay for all dogs was 18.0 days (range of 1 to 53 days). Of all the dogs, 41.2% were adopted into a home, 26.6% taken into an independent rescue organization, and 32.2% euthanized for various reasons; poor health (47.4%), aggression towards humans or other animals (14.0%), and space limitations (38.6%).

The mean percent change in frequency of glance durations longer than 2.5 s was -4.3 (SD = 16.3) for the feeding group and 15.2 (SD = 23.4) for the training group. A one-tail t-test revealed that this difference was statistically significant ($t = -2.4$, $df = 25$, $P = 0.01$). The interobserver agreement was 86%. However, even with the successful training, the experimental condition did not increase adoption success or decrease length of stay. In the training group, 70.7% of dogs were adopted, whereas 64.4% in the feeding group and 67.8% in the control group were adopted. The average lengths of stay in the training, feeding, and the control groups were 16.6 (SD = 11.3), 19.2 (SD = 15.1), and 18.2 days (SD = 10.4) respectively.

The final logistic regression model, with outcome as the dependent variable consisted of kennel position (Wald = 5.13, $df = 1$, $P = 0.02$), mode of intake (Wald = 4.18, $df = 1$, $P = 0.04$), and breed (Wald = 13.29, $df = 1$, $P < 0.001$) only. All other variables (age, sex, color, and size) were removed from the model in that sequence based on P values > 0.05. Post hoc tests using the Bonferroni correction revealed that Lap Breeds had more adoptions than Fighting Breeds ($P = 0.01$). Owner surrendered dogs had more adoptions than confiscated dogs ($P = 0.04$). The 10^{th} through 15^{th} kennels from the central aisle had fewer adoptions than the 1^{st} through 5^{th} ($P = 0.02$) and the 6^{th} through 10^{th} kennel positions ($P = 0.04$) (Table 2).

The Kruskal-Wallis analysis of variance tests indicated that experimental condition (Statistic = 1.28, $df = 2$, $P = 0.53$), sex (Statistic = 0.30, $df = 1$, $P = 0.59$), age (Statistic = 0.27, $df = 1$, $P = 0.61$), color (Statistic = 8.72, $df = 7$, $P = 0.27$), and kennel position (Statistic = 20.64, $df = 19$, $P = 0.36$) did not correlate with length of stay. In addition, outcome (adoption or euthanasia) did not correlate with length of stay (Statistic = 0.16, $df = 1$, $P = 0.69$). However, size (Statistic = 9.20, $df = 2$, $P = 0.01$) correlated statistically significantly with length of stay. Small dogs had shorter stays than large dogs ($z = -2.96$, $P = 0.01$). Breed type (Statistic = 12.84, $df = 6$, $P = 0.05$) was also correlated with length of stay. Ratters and

Lap Breeds stayed the shortest amount of time and Sporting and Fighting Breeds stayed the longest (a post hoc test was underpowered and did not reveal significant differences between groups). Finally, mode of intake (Statistic = 11.19, df = 2, P = 0.004) correlated with length of stay. Stray dogs stayed shorter than owner surrendered dogs (z = -2.93, P = 0.009) (Table 2).

-----INSERT TABLE 2 HERE-----

3. Experiment 2

Through correlational analysis, Experiment 1 indicated that a dog's morphology and background are important in predicting adoption. Experiment 2 aimed to test experimentally whether morphology, or overall physical appearance, determines adoption success. Our prediction was that people would rate photographs of dogs that were adopted as more attractive than photographs of dogs that were euthanized, even if they were not informed as to the animal's outcome.

3.1. Methods

Thirty participants who walked into the Alachua County Animal Services for the purpose of adopting an animal or searching for a lost pet were recruited to participate in the survey. Participants were asked if they would participate in a research study by completing a brief survey about their opinions on shelter dogs. Each participant was asked to sign an informed consent form, led to a desk with a computer, and asked to complete the survey. No further directions were given.

The survey showed 81 images of dogs in a random sequence (46 images of adopted and 35 of euthanized dogs). These images were screen captures taken from videos in Experiment 1. The criteria for selection of images were that the dog was fully visible in profile, that no human appeared in the image, and that the image was of similar size and quality to the others. The experimenter who selected the images for the study was not aware of the outcomes for the dogs, thereby resulting in unequal numbers of images for each outcome. Under each image, three questions were displayed: "Is the dog attractive?", "How much do you care about the dog?", and "Is the dog pleasant?" Each participant was asked to answer each question under each image using a Visual Analog Scale (ranging from "very" to "not at all") (Bradley and Lang, 1994). The first question targeted the variable of interest, the subjective measure of

attractiveness, whereas the next two questions targeted the well-established variables of intensity and valence in human judgment. Intensity measures the strength of emotion to a particular object (e.g. a gun is high in intensity whereas an umbrella is low intensity) and valence measures the pleasantness of a particular object (e.g. a baby is high in valence whereas a cemetery is low in valence) (Bradley and Lang, 1994). These two variables are necessary in order to place the novel variable in the context of known variables. The variable of attractiveness was hypothesized to be high in both intensity and valence. The participants were not told which dogs belonged to which outcome group. The participants were allowed to leave at any time but incomplete data were excluded from analysis. All procedures were approved by the University of Florida Institutional Review Board.

3.1.1. Statistical analyses

Data were normalized to correct for individual differences in the range of the scale used [normalized value = (original value - minimum)/ range] (Lykken et al., 1966). Several people went through the whole survey without changing any of the scales for any image, presumably from indifference to the study or from inexperience with using computers (several individuals had trouble using the computer mouse). Therefore, interquartile ranges (IQR) for each participant were calculated and participants that had an IQR after standardization < 0.2 were excluded from further analysis in order to exclude data from participants who did not engage with the scale, resulting in n = 20.

Differences in the mean ratings between dogs adopted and those euthanized were tested using a one-tailed t-test, as our hypothesis was that adopted dogs would have higher attractiveness scores than euthanized dogs.

3.2. Results

Participants reported that the dogs in the adopted group were more attractive than dogs in the euthanized group ($t(75) = 1.84$, $P = 0.04$). The average ratings for the adopted and euthanized groups were 0.50 (SD = 0.08) and 0.46 (SD = 0.09) respectively.

The three variables of interest (attractiveness, intensity, and valence) were analyzed using Pearson's correlation in order to determine the novel variable's association with the known variables. As

hypothesized, there was a positive correlation between the attractiveness variable and the valence variable (pleasantness) ($r^2 = 0.81$, $P < 0.0001$) and between the attractiveness variable and the intensity variable (care) ($r^2 = 0.68$, $P < 0.0001$).

4. Discussion

Although our experimental manipulation in Experiment 1 did increase gazing towards experimenters in the dogs in the training group, this was not enough to increase adoption success by a statistically significant margin. Additionally, taking shelter dogs out of their kennels and giving them treats daily did not increase their adoption success. A post hoc analysis revealed that the data in Experiment 1 had only 26% power to detect a significant difference ($\alpha = 0.05$) between the proportion of adoptions in the training group and the control group. Two hundred and sixty-seven subjects would have been needed in each condition (for a total of 801 dogs) to reach 80% power. This analysis emphasizes that the treatment effect is very small even if present, thus limiting the utility of this intervention as an efficient and cost-effective means of improving adoption success.

This study uncovered several variables that influenced adoption success and lengths of stay, but these were morphological and background factors. Breed type and mode of intake correlated with adoption success and length of stay. Fighting Breeds had the lowest adoption success, while Lap Breeds had the highest. Sporting and Fighting Breeds had the longest length of stay, whereas Ratters and Lap Breeds had the shortest. These findings correspond with those of Clevenger and Kass (2003) and Posage et al. (1998), who also found that toy breeds had the highest adoption success. Confiscated and stray dogs had less adoption success than dogs relinquished by their owners; however, stray and confiscated dogs had shorter lengths of stay than those relinquished by their owners. These findings reinforce survey reports that people prefer dogs that were surrendered by their owner (Wells and Hepper, 1992). Size correlated positively with length of stay. These findings support the reports by Posage et al. (1998) and Siettou et al. (2012), who found that small size predicted high adoption success. Furthermore, these results suggest that adopters may be more influenced by morphological traits and the history of the dogs than by their behaviors.

In order to test the hypothesis that adopter choice depends on physical appearance, a follow-up experiment was conducted to test whether potential adopters would rate adopted dogs higher in physical attractiveness than dogs that were euthanized. Participants gave higher attractiveness scores to dogs that were adopted than to dogs that were euthanized. Results from this experiment suggest that potential adopters are sensitive to the morphological characteristics of the dogs and are influenced by these characteristics in the decision to adopt a dog from the shelter. These results correspond with the survey findings that adopters report physical appearance as important when choosing to adopt an animal (Weiss et al., 2012). Results from Experiment 2 must be interpreted with caution, however, because of the large number of participants who did not engage with the rating scales. It is possible that, by omitting individuals who did not engage with the scale, we increased the likelihood of finding group differences. A larger sample size might be required to verify these findings.

Age, sex, and color did not correlate with length of stay and did not influence adoption success. Previous research has suggested that the lighter-colored dogs are preferred over darker-colored dogs (Lepper et al., 2002; Posage et al., 1998; Wells and Hepper, 1992). However, this was not consistent with our data. We found red dogs had similar adoption success as brindle or black dogs. These findings suggest that instead of being attracted to a specific color, adopters may prefer dogs with unique coloration, which occur less frequently in the studied region. For example, in mid-Florida, the quintessential "Florida dog" is a tan colored, medium-sized, short-haired dog. This highlights the need to study adopter preferences across different regions and manifests the danger of universally recommending exclusion of certain colored dogs from being offered for adoption.

Breed type and mode of intake were the only factors that influenced adoption success. Interestingly, Sporting Breeds had a much higher adoption success than Fighting Breeds. Previous research has suggested that even trained shelter professionals are unlikely to accurately characterize a dog based solely on its phenotype (Olson et al., 2012), suggesting that the difference in adoption success may be partly due to public perceptions of the different breed types and not to actual preferences in morphology. Public perceptions as to what makes a dog a good pet may also play a role in why dogs that were surrendered by

384 the owner were more likely to be adopted than dogs that were found or seized by animal control. This is
385 consistent with the finding that adopters spend on average only 20 to 70 s evaluating a dog before making
386 a decision (Wells and Hepper, 2001). However, future research should evaluate the behavioral differences
387 in dogs of various modes of intake.

388 Our data suggest that the 11^{th} to 15^{th} kennel positions from the central aisle had lower adoption rates
389 than the other positions. There were no detectable differences in these kennels aside from their distance
390 from the entrance. This phenomenon may be specific to the current shelter, but suggests that kennel
391 position may be a factor worthy of further investigation.

392 In the present study, similarly to the Luescher and Medlock (2009) study, an increase in adoption
393 success was not reflected in decreased length of stay. Length of stay and adoption rate are necessarily
394 related: dogs cannot be adopted unless they are in residence. However, the different outcomes likely have
395 at least partially different controlling variables. So long as a dog is available for adoption, adoption rates
396 are entirely determined by the actions of adopters. Length of stay, on the other hand, is determined by the
397 actions of both adopters and shelter staff. Because the shelter staff make the euthanasia decisions, they
398 can elect to keep an attractive dog for longer. But adopters also influence length of stay. They may select
399 attractive dogs, thereby preventing them from having longer stays. The actions of rescue groups also
400 influence length of stay, but not adoption rates. In this way, length of stay and adoption success become
401 differentiated outcomes because of the complex interaction between the actions of adopters and shelter
402 staff. These results highlight the need for future studies to explicitly account for all of the different
403 human populations involved in the fate of dogs at shelters (e.g. adopters, rescuers, and staff) in order to
404 achieve readily usable results.

405 The results from this study and the past literature suggest that, whereas training and human
406 interaction may function as enrichment interventions, these interventions are unlikely to produce cost-
407 efficient increases in adoption rates. The intervention proposed by Luescher and Medlock (2009) would
408 cost at least $4.30/ dog/ day (based on the amount needed to pay a professional animal trainer for 20 min,
409 US Bureau of Labor Statistics, 2011). The intervention that we explored in this study would cost

approximately $1.80/ dog / day (the amount to pay a worker the federal minimum wage for 15 min, US Bureau of Labor Statistics, 2011). Because animal shelters are often understaffed and financially strained, funding additional in-shelter programs may result in the cutting of funds to other necessary shelter operations. Therefore, future studies should include a cost-benefit analysis to ensure that the proposed intervention is financially viable as well as adequately effective.

A limitation of the present study was that the dogs were already deemed adoptable by the shelter staff. A training intervention might be more effective with dogs that have not yet been deemed adoptable, as these dogs may present a more behaviorally diverse population. However, the relevance of training dogs that have not been deemed adoptable is questionable. These dogs may include an unhealthy and/or dangerous population for which euthanasia may be the more humane outcome.

An additional limitation of the study was that the generalization of the trained response was not assessed. Therefore, the lack of increased adoptions in the training group may due to the trained behavior not generalizing to potential adopters. Future studies need to address this limitation by directly assessing the trained response in situations with real potential adopters.

A potential confound in the present study was that some dogs that were perceived as less adoptable by the shelter volunteers were marketed more intensely than others. By placing dogs randomly into experimental conditions, we hoped to minimize the effect this differential marketing had on the present study.

Training shelter dogs may still be beneficial for reasons other than increasing adoption success. For example, human interaction and exercise may increase the welfare of the dogs during their stay at the shelter (e.g. Bergamasco et al., 2010; Coppola et al., 2006). In addition, training may reduce the re-relinquishment of dogs post adoption. Future research should continue to look at the positive effects of human interaction on shelter dogs.

5. Conclusions

Training shelter dogs to look into the eyes of adopters did not increase adoption success. Adopters were likely most influenced by variables that were readily observable in a few seconds, such as the

436 overall look of the dog and the information that was written on the cage card. This information may be
437 used by shelters to maximize adoptions and prioritize resources. For example, instead of implementing a
438 training program, shelters may elect to enhance the physical appeal of the dogs. In addition, these results
439 may be used to select dogs based on their morphology to be placed for adoption in order to increase
440 adoption success by providing dogs that match adopter preferences. This study also highlights the need
441 for future studies to account for all of the human populations that may influence the dogs' outcomes in
442 addition to conducting a cost-benefit analysis on the interventions to ensure financial viability.
443

References

The American Society for the Prevention of Cruelty to Animals. Pet statistics, 2011. Available at: http://www.aspca.org/about-us/faq/pet-statistics.aspx. Accessed Jan 3, 2011.

American Veterinary Medical Association, 2007. U. S. pet ownership and demographics sourcebook. Available at: http://www.avma.org/reference/marketstats/ownership.asp. Accessed Jan 3, 2012.

Bergamasco, L., Osella, M.C., Savarino, P., Larosa, G., Ozella, L., Manassero, M., Badino, P., Odore, R., Barbero, R., Re, G., 2010. Heart rate variability and saliva cortisol assessment in shelter dog: Human-animal interaction effects. Appl. Anim. Behav. Sci. 125, 56-68.

Bradley, M.M, Lang, P.J., 1994. Measuring emotion: The self-assessment manikin and the semantic differential. J. Behav. Ther. Exp. Psy. 25, 49-59.

Braun, G., 2011. Taking a shelter dog for walks as an important step in the resocialization process. J. Vet. Behav. 6, 100.

Clevenger, J., Kass, P.H., 2003. Determinants of adoption and euthanasia of shelter dogs spayed or neutered in the University of California veterinary student surgery program compared to other shelter dogs. J. Vet. Med. Educ. 30, 372-378.

Coppola, C.L., Grandin, T.R., Enns, M.R., 2006. Human interaction and cortisol: Can human contact reduce stress for shelter dogs? Physiol. Behav. 87, 537-541.

Gacsi, M., Gyori, B., Miklosi, A., Viranyi, Z., Kubinyi, E., Topal, J., Csanyi, V., 2005. Species- specific differences and similarities in the behavior of hand-raised dog and wolf pups in social situations with humans. Dev. Psychobiol. 47, 111-122.

Griffin, B., 2007. No more homeless pets. Maddie's Shelter Medicine Program at Cornell. Available at: http://www.sheltermedicine.vet.cornell.edu/spayNeuter/noHomeless.htm. Accessed Jan 3, 2011.

Lepper, M., Kass, P.H., Hart, L.A., 2002. Prediction of adoption versus euthanasia among dogs and cats in a California animal shelter. Appl. Anim. Welfare Sci. 5, 29–42.

Luescher, A.U., Medlock, R.T., 2009. The effects of training and environmental alterations on the adoption success of shelter dogs. Appl. Anim. Behav. Sci. 117, 63-68.

Lykken, D.T., Rose, R., Luther, B., Maley, M., 1966. Correcting psychophysiological measures for individual differences in range. Psychol. Bull. 66, 481-484.

Mickey, R.M., Greenland, S. 1989. The impact of confounder selection criteria on effect estimation. Am. J. Epidemiol. 129, 125-137.

Miklosi, A., Polgardi, R., Topal, J., Csanyi, V., 2000. Intentional behavior in dog-human communication: An experimental analysis of "showing" behavior in the dog. Anim. Cogn. 3, 159-166.

National Council on Pet Population Study and Policy. The shelter statistics survey, 1994-97. Available at: http://www.petpopulation.org/statsurvey.html. Accessed Jan 3, 2011.

Normando, S., Corain, L., Saladoretti, M., Meers, L., Valsecchi, P., 2009. Effects of an Enhanced Human Interaction Program on shelter dogs' behaviour analysed using a novel nonparametric test. Appl. Anim. Behav. Sci. 116, 211-219.

Olson, K.R., Levy, J.K., Norby, B. 2012. Incorrect breed identification costs dogs their lives. Maddie's Shelter Medicine Program at University of Florida. Available at: http://www.maddiesfund.org/Resource_Library/Incorrect_Breed_Identification.html. Accessed March 1, 2012.

Patroneck, G.J., Glickman, L.T., 2004. Development of a model for estimating the size and dynamics of the pet dog population. Anthrozoos 7, 25-42.

Posage, J.M., Bartlett, P.C., Thomas, D.K. 1998. Determining factors for successful adoption of dogs from an animal shelter. J. Am. Vet. Med. Assoc. 213, 478-482.

Siettou, C., Fraser, I.M., Fraser, R.W., 2012. A retrospective cohort study on investigating factors that influence 'consumer' choice when adopting a shelter dog. Unpublished paper presented at the 86th Annual Conference of Agricultural Economics Society, Warwick, UK.

Sternberg, S., 2003. Successful dog adoptions. Wiley Publishing Inc., Indianapolis, IN, pp. 82-85.

U.S. Bureau of Labor Statistics, 2011. Occupational Employment Statistics. Available at: http://www.bls.gov/oes/current/oes_nat.htm#39-0000. Accessed at Jan 13, 2012.

Weiss, E., Miller, K., Mohan-Gibbons, H., Vela C., 2012. Why did you choose this pet?: Adopter and pet selection preferences in five animal shelters in the United States. Animals 2, 144-159.

Wells, D.L., 2003. A review of environmental enrichment for kenneled dogs, Canis familiaris. Appl. Anim. Behav. Sci. 85, 307-317.

Wells, D.L., Hepper, P.G., 1992. The behaviour of dogs in a rescue shelter. Anim. Welfare 1, 171– 186.

Wells, D.L., Hepper, P.G., 2001. The behavior of visitors towards dogs housed in an animal rescue shelter. Anthrozoos 14, 12-18.

Wright, C.J., Smith, A., Daniel, K., Adkins, K., 2007. Dog breed type stereotype and exposure to negative behavior: effects on perceptions of adoptability. Appl. Anim. Welfare Sci. 10, 255-265.

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Table 1.

The number of dogs in each experimental condition organized by breed type, mode of intake, size, sex, and age.

Individual Factor		Number in Training Group	Number in Feeding Group	Number in Control Group
Breed Type				
Ratters	Cairn Terrier	1	0	0
	Fox Terrier	1	1	0
	Jack Russell Terrier	1	0	1
	Basenji	0	0	1
	Dachshund	1	0	0
	Rat Terrier	0	0	1
Fighting Breeds	American Pit Bull Terrier	16	18	13
	Bulldog	2	1	1
	Sharpei	1	0	1
	Boxer	2	0	0
Hounds	Basset Hound	1	1	1
	Beagle	2	1	2
	Catahoula Hog Dog	1	1	0
	Coonhound	2	3	2
	Plotthound	0	0	2
	Treeing Walker Hound	0	1	0
	Whippet	0	0	1
	Rhodesian Ridgeback	0	1	1
	Carolina Dog	0	0	1
Working Breeds	German Shepherd Dog	4	6	5
	Rottweiler	0	1	0
	Mastiff	0	0	1
	Husky	0	0	1
	Anatolian Shepherd	0	1	1
Herding Breeds	Border Collie	0	0	1
	Corgi	0	1	0
	Australian Shepherd	0	1	1
	Australian Heeler	0	0	1

Sporting Breeds	Golden Retriever	1	1	0
	Labrador Retriever	19	13	14
	Pointer	2	1	1
Lap Dogs	Maltese	0	0	1
	Miniature Poodle	0	1	0
	Chihuahua	1	3	2
	Boston Terrier	0	1	0
	Pug	0	0	1
	Pomeranian	0	1	1
Mode of Intake				
	Owner Surrendered	14	7	6
	Stray	38	48	50
	Confiscated	6	4	3
Size				
	Small	11	12	15
	Medium	43	41	39
	Large	4	6	5
Sex				
	Female	42	32	31
	Male	16	27	28
Age				
	Young	24	27	17
	Adult	34	32	42

Table 2.

The percent of dogs adopted and the length of stay of dogs at the shelter by breed type, mode of intake, kennel position, and size.

		Percent Adopted	Length of Stay	
			Median	*IQR*
Breed Type	Fighting Breeds	49.1	19.0	17.0
	Hounds	58.3	18.5	10.8
	Working Breeds	70.0	16.5	14.0
	Sporting Breeds	78.8	21.5	19.0
	Herding Breeds	80.0	15.0	7.0
	Ratters	87.5	8.5	6.8
	Lap Breeds	100.0	9.0	11.5
Mode of Intake	Confiscated	38.5	26.0	8.0
	Stray	68.4	15.5	17.0
	Owner Surrendered	77.8	27.0	20.0
Kennel Position	1 - 5	73.8	16.0	18.0
	6 - 10	73.2	19.5	17.3
	11 - 15	45.7	18.0	17.5
	16 - 20	70.0	15.5	17.8
Size	Small	84.2	13.0	20.0
	Medium	61.8	18.0	17.0
	Large	73.3	26.0	11.5