

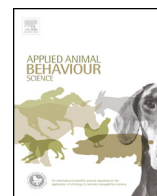


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Adopter-dog interactions at the shelter: Behavioral and contextual predictors of adoption

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ABSTRACT

Millions of unwanted pets enter animal shelters each year in the USA, but only a portion leave alive. Previous research has found that morphology and in-kennel behavior influence adoption. The current study evaluated whether any behaviors exhibited by dogs during an out-of-kennel interaction with a potential adopter predicted adoption. In addition, we evaluated whether other predictors such as the morphology of the dog, intention to adopt a dog that day, and location of the interaction influenced adoption. Finally, the study assessed correspondence between the potential adopters' answers on a questionnaire and the dogs' behavior during the interactions. The behavior of shelter dogs in out-of-kennel interactions with potential adopters was observed ($n=250$). After each interaction, visitors were given a questionnaire to indicate their reasons for adopting or not adopting that specific dog. The vast majority of shelter visitors only requested to interact with only a single dog and the average duration of interaction was 8 min. Only two behaviors: ignoring play initiation by and lying in proximity to the potential adopter, but no morphological variables, influenced adoption decisions. Dogs that were adopted spent half as much time ignoring play initiation by and twice as much time lying in proximity to the adopter than dogs that were not adopted. The probability (P) of adoption was higher in a smaller outdoor concrete area ($P=0.423$) than in both large grass area ($P=0.320$) or an indoor room ($P=0.229$). Intention to adopt a dog that day resulted in the highest probability of adoption ($P=0.586$), whereas an intention to not adopt resulted in a low probability ($P=0.102$). Dogs that were labeled as not social by non-adopters after an interaction had higher scores than average in ignoring play initiations. However, non-adopter reports did not exactly correspond with the dogs' behavior during the interactions. Our findings may be used to develop targeted training programs for shelter dogs.

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1. Introduction

Unwanted animals are surrendered to animal shelters by the millions in the USA. The American Society for the

Prevention of Cruelty to Animals (ASPCA) estimates that approximately 60% of shelter dogs are ultimately euthanized in shelters (ASPCA, 2011). Even if a dog enters a shelter which does not euthanize healthy animals, a long stay in an impoverished environment presents significant welfare concerns (Wells, 2004). Thus, one way to improve the welfare of dogs is by increasing their chances of getting out of the animal shelter – i.e., improving their adoption rates. To the best of the authors' knowledge, only

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three studies experimentally modified shelter dog's behavior in the hopes of increasing their likelihood of adoption. Luescher and Medlock (2009) found that in- and out-of-the-kennel obedience training improved dogs' chances of adoption. These authors trained a variety of different behaviors, such as walking on a head halter, sitting on cue, not jumping on people, not barking in the kennel, and staying in the front portion of the kennel. The large variety of behaviors trained prevents conclusions as to which specific behaviors influenced adopters. Protopopova et al. (2012) assessed whether training shelter dogs on a social behavior, specifically gazing into the eyes of adopters, increased adoption rates. Although the experimental manipulation did increase gazing toward experimenters, this did not significantly increase adoption rates. Herron et al. (2014) found that training several in-kennel behaviors (gazing, approaching the front of the cage, sitting or lying down in the cage, and not barking) increased several of these behaviors in shelter dogs, but did not alter their adoption rates. Unfortunately, these three studies do not provide clear conclusions on the effects of training.

The above-mentioned training interventions were based on assumptions about which behaviors are attractive to adopters; however, no previous studies have empirically evaluated which, if any, spontaneous behaviors of dogs in shelters influence adopter decisions. Wells and Hepper (1992) attempted to answer this question indirectly through the use of a choice procedure consisting of photographs of dogs that differed in one specific way. The study suggested that people prefer dogs that are labeled as "not barking" versus "barking" and "positioned in the front of the cage" versus "back of the cage." Wells and Hepper (1992) also found that when asked what determines a dog's attractiveness for adoption, participants answered that temperament is the most important factor, followed by size, sex, appearance, and age. Waller et al. (2013) found an intriguing correlation between the frequency of inner brow lifts and length of stay at the shelter. The authors suggested that this paedomorphic facial expression encouraged adoption.

When potential adopters are selecting a dog, in-kennel behaviors may influence further inspection of the dog, but the next set of interactions occur outside of the kennel. These out-of-kennel interactions may be very important to adopters as this is where their adoption decision may be finalized. Weiss et al. (2012) asked adopters what behaviors their adopted dog engaged in during the first meeting. Adopters reported that dogs approached and greeted, licked, jumped on, and wagged their tails during the meeting. The authors suggested that these behaviors might have influenced adopters' choices. The current study aimed to extend these findings and investigate adopter behavior and choice directly.

The first objective of this study was to examine which, if any, behaviors that a dog exhibited during an out-of-kennel interaction with a potential adopter predicted adoption. The second objective was to examine whether any other variables, such as the morphology of the dog and location of the interaction influenced adoption. We were also interested whether the reported intention to adopt a dog that day had an influence on the likelihood of adoption, as it

is possible that some portion of the visitors that enter an animal shelter simply desire to observe or play with the animals. The third objective was to evaluate agreement between reasons behind a decision to adopt as reported on questionnaires and the dogs' behavior during the interactions.

2. Materials and methods

2.1. Animals and housing

Two hundred and fifty interactions between dogs available for adoption and potential adopters were observed. This study used a total of 151 dogs, which were housed at the Alachua County Animal Services (ACAS; Gainesville, FL, USA) from May to October 2013 and 154 separate potential adoptive individuals or families. ACAS is an open-admission county animal shelter, which functions both as animal control and adoption facility. Adoptable dogs comprised seized and surrendered dogs which were determined to be safe and healthy by staff.

Dogs were housed in rows of adjacent kennels with cement walkways at front and back. Dogs were housed singly or in pairs in 1.0 m width \times 4.6 m length \times 2.1 m height kennels with two-thirds of the pen outdoors and the rest indoors. The dogs could be viewed by the public from the outside walkway. All kennels had cement floors and 1.2 m tall cement walls that were connected to the ceiling of the kennel with a chain-link fence. Each kennel contained a water dish, a food dish, and a Kuranda bed (Kuranda USA, Annapolis, MD, USA) in the inside portion of the kennel. Staff fed the dogs and cleaned kennels daily before 9:30 h. Volunteers at the shelter exercised, trained, and played with the dogs approximately one to three times per week on the shelter premises.

A cage card was attached to each kennel that noted the dog's name, identification number, age, breed (as determined by shelter staff), mode of intake (surrendered by the owner, found as a stray, or confiscated by animal control), and, infrequently, a few words on the history of the dog.

Independent rescue organizations frequently visited the shelter and selected dogs to enter into their programs. Dogs were marketed by the shelter staff and volunteers on their website, several national online databases, local news channels, and through a popular online social networking site. The standard adoption fee was \$30 but was waived for 2 of the 6 months of this study.

2.2. Data collection

An experimenter (AP or a research assistant) waited for a potential adopter to select a dog from the row of adoptable dogs and escorted the adopter, dog, and any shelter volunteers or staff (who were unaffiliated with the study) to an out-of-kennel interaction area, as per the usual protocol of the shelter. There were three possible interaction areas: a 25.6 m \times 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; an adjacent 7.6 m \times 4.3 m concrete area with a small pool, chairs, and toys; or an indoor room (9.1 m \times 7.3 m) with couches, a rug,

Table 1
Ethogram of out-of-kennel interactions between the shelter dog and potential adopter.

Behavior	Operational definition
Proximity	Stays within an arm's reach of person (~1 m) for >2 s
Accepting Petting	Dog does not walk away when person touches or strokes dog
Rejecting Petting	Dog walks or darts away when person reaches for dog
Human Toy Play	Dog engages with toy that is held by person or runs toward the toy when it is thrown and brings back to person
Ignoring Play Initiation	Dog walks away or otherwise ignores initiation of play by person (through toy or body)
Independent Toy Play	Dog engages with toy away from the person
Human Play	Dog engages with playing person by play bowing, barking, light mouthing, jumping. No toy involved
Attending To Person	Dog is facing person, looking in direction of the person. Proximity is not necessary
Accepting Food	Dog ingests food when given or thrown by person
Rejecting Food	Dog ignores food when given or thrown by person
Obedying Command	Dog complies with a command (i.e. sit, down, shake, get off, stop it, give, come here, etc.)
Disobeying Command	Dog does not comply with command
Leaning On/Sitting On Person	Dog is in physical contact with person by either leaning on the person or placing a body part on the person
Licking Person	Dog places tongue on person
Lie In Proximity	Dog is lying down within an arm's reach (~1 m)
Sit In Proximity	Dog is sitting within an arm's reach (~1 m)
Mouthing Person	Dog places teeth on person regardless of force
Jump On Person	Dog places both front feet on person simultaneously and somewhat forcefully
Covering	Dog's head is lowered, tail tucked or lowered, and back is arched
Exploration	Dog is walking or standing while sniffing the ground or air, but not the person
Lie Not In Proximity Of Person	Dog is lying down away from the person (>1 m away)
Running	Dog is galloping (3-gait movement)
Fence Running	Dog is trotting or galloping along the fence line of the enclosure
Eliminating	Dog eliminates
Barking	Dog emits a bark
Whining	Dog emits a whine
Initiating Contact	Dog enters into proximity and accepts physical contact without being called by the person
On-Leash Pulling	Leash is tight and person is visibly pulled by dog
Aggression	Dog forcefully lunges and barks at the person or growls at the person while not engaging in play
Interaction with Volunteer	Dog attends to, physically contacts, or otherwise interacts with volunteers that are assisting the potential adopter

a table, and toys. Compared to the other areas, the grassy area was significantly more enriched; it was larger, contained more items in the area and many more surfaces that may have contained left-over odors from other dogs. The interaction area was determined by the volunteer or staff member who was escorting the potential adopter and dog. Generally, the volunteers and staff preferred the outdoor grass area. If the dog had not yet completed the vaccination protocol, was recently spayed or neutered, or was under 1 year of age, the interaction occurred in the concrete or indoor area.

The experimenter asked the potential adopter for permission to videotape the dog for a study during the interaction. If the adopter agreed, the experimenter began recording. If the adopter disagreed, the experimenter did not videotape the session (one potential adopter disagreed and was removed from the study). The interactions were videotaped with a Kodak™ PlaySport Zx5 video camera using the WVGA mode at 30 fps (Kodak Company, Rochester, NY, USA). During the interaction, the experimenter did not interact with the dog or the adopter and remained as far as possible from both the dog and adopter. The experimenter answered any questions about the dog briefly, taking care to not make any remarks regarding the dog's behavior, looks, or adoptability. The video recording ended when the potential adopter indicated his/her decision whether or not to adopt the dog. In order to obtain demographic information on shelter visitors and provide more insight into the adoption process, after the interaction, the potential adopters were led to a desk and asked to fill out a brief questionnaire (Appendix I, Supplementary

data). The questionnaire data were descriptive in nature and not included in the logistic model to predict adoption likelihood. The questionnaire asked about the gender and age of the adopter, the number of people in the family, the number of children in the family, the presence of other pets in the home, the intended purpose of the dog under consideration, and whether the adopter came in intending to adopt any dog that day. Finally, the questionnaire asked the adopter to select a reason for adopting or not adopting the particular dog by circling one or more of the following: "behavior", "looks", "right/wrong age", and "right/wrong breed". If the potential adopter circled "behavior", the adopter was then also asked to describe the behaviors that were attractive or unattractive. After the interaction, the experimenter noted the breed, sex, age, coat length, size, color, mode of intake (stray, owner-surrender, or confiscated), the area where the interaction occurred (grass, concrete, or indoor), and whether or not the dog was adopted. If the adopter expressed interest to interact with more than one dog, the adopter was asked to complete a separate questionnaire for each dog immediately after each interaction.

Behaviors of the dog were coded on an ethogram (Table 1) from the video recordings by research assistants, who had been trained to criterion (minimum 90% interobserver agreement on four practice videos). Behaviors were coded with a partial interval recording method using 5 s time bins. The proportion of bins in which a behavior occurred was calculated for each interaction. Twenty-five percent of videos (62/250) were coded by two coders independently to calculate interobserver reliability.

An agreement was scored when two observers agreed on an occurrence or nonoccurrence of a behavior in each time bin.

Information about the dog, as listed on the kennel card, was also recorded, including color (tan, black, brindle, black and white, black and tan, gray, and merle), coat length (short or long), mode of intake (owner surrendered, stray, confiscated, or recently returned to the shelter), and size (small – approximately 0.35 m; medium – approximately over 0.35 m and under 0.60 m; large – approximately over 0.60 m in height at the withers). The sex of the dog (male or female) was recorded from the kennel card; some dogs were not yet sterilized, but would be before leaving with an adopter. The age of the dogs were recorded from the estimates provided by shelter veterinarians. We based our age categories on the work of [Clevenger and Kass \(2003\)](#), who used two categories, split around first birthday, but subdivided their “juvenile” category (dogs less than 1 year of age) into “puppy” – dogs up to 4 months, and “juvenile” – between 5 and 11 months since in our own experience at the research facility, visitors and staff clearly discriminated between young juveniles and older juveniles. Five months was chosen as a cutoff because it reflected staff and visitor perception of the month at which there was evident maturation from a younger puppy to an older juvenile. 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 or morphological types (Ratters, Fighting Breeds, Hounds, Working Breeds, Herding Breeds, Sporting breeds, and Lap Breeds) as described in [Protopopova et al. \(2012\)](#). 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.

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

2.3. Statistical analysis

All statistical analyses were performed using the statistical package SPSS® (International Business Machines Corp., Armonk, NY, USA). Proportions of each behavior were calculated for each interaction. Behaviors that occurred in less than 5% of interactions (<12 of the 250 interactions) and/or had a low interobserver agreement were removed from analysis. The interactions were divided into two groups: culminating in an adoption or non-adoption.

Descriptive statistics were used to quantify demographic information of potential adopters as reported through the surveys. The frequency of reporting that “looks,” “breed,” “age,” or “behavior” was important in the decision to adopt or not adopt, based on the questionnaire responses, was calculated. In addition, we calculated the frequency of the words used to describe the behavior of the dog after the interaction and to justify their decision.

All morphological and behavioral variables that might have influenced adoption, along with the dog identity as predictors (as some dogs interacted with several potential adopters), were entered into a logistic regression model through Wald backward elimination with criteria

for inclusion set at $P < 0.25$ and for removal set at $P > 0.05$. The dependent variable was outcome (adoption or non-adoption). All behavioral variables, size, coat length, sex, and age were treated as covariates, and individual dogs, breed, color, and intake type were treated as categorical predictors. Thus, the final model contained 29 behavioral and eight morphological variables of the dogs and the dogs themselves as predictors. Questionnaire data were not included in the model.

Chi-square analyses were used to evaluate whether the interaction area or prior intention to adopt or not adopt influenced adoption decisions.

To evaluate whether the subsamples of dogs labeled as “too active” or “not social” were different from the overall population of non-adopted dogs, a multivariate General Linear Model was fitted to two dependent variables (lie in proximity and ignore play initiation) and two independent variables (dogs that were labeled “too active” and dogs that were labeled “not social”). These two independent variables were chosen because they were the highest frequency descriptors of non-adoption. The two dependent variables were chosen as they predicted the likelihood of adoption.

3. Results

Out of 250 sampled interactions, 88 resulted in adoption (35.2%). Aggression never occurred in any interactions and was therefore removed from further analysis. All other behaviors occurred in more than 5% of interactions and were retained in the analysis.

The interobserver agreement ranged from 88% (for “Exploration”) to 100% (for “Rejecting Food”, “Mouthing Person”, “Whining”, and “Barking”). All other behaviors had average interobserver agreement above 90%. No behaviors were removed from analysis due to low interobserver agreement.

3.1. Shelter visitor demographics

Two people did not complete the questionnaire, resulting in 248 completed questionnaires. The majority of potential adopters were female (57.6%). The largest percentage (37.2%) were less than 25 years of age, 23.2% were between 26 and 35, 15.6% were between 36 and 45, 14.4% were between 46 and 55, 4.8% were between 56 and 65, and 4.0% were older than 66 years of age. Of the shelter visitors, 14% lived alone, 31% lived with one other person, and the rest (54%) lived with more than two people. A small majority did not have any children in the home (53.6%). The small majority potential adopters already had other pets in the home (57.6%).

About half of shelter visitors reported not having an intention to adopt a dog during that visit (47.2%). One hundred and fifty-five different people or families interacted with the dogs during the study. Almost two-thirds of potential adopters interacted with only one dog (64.5%), 21.9% interacted with only two dogs, 6.5% interacted with three dogs, 3.2% interacted with four dogs, 2.6% interacted with five dogs, and 0.6% interacted with six and seven dogs each.

Table 2

The number and percent of people indicating the following variables as important in choosing to adopt or not adopt a dog. The sub-categories (behavior and other) show frequencies of descriptive words provided on the free-response questions.

	Number of people	Percent of people
Reason for adoption		
Looks	56	63.6
Age	50	56.8
Breed	44	50.0
Behavior	72	81.8
Playful/energetic/active	27	42.2
Calm/mellow	22	34.4
Friendly	20	31.3
Attentive/responsive/people oriented/listens well	11	17.2
Affectionate/sweet/kind/nice	10	15.6
Cat/dog/child friendly	8	12.5
Submissive	3	4.7
Likes water	1	1.6
Did not bark	1	1.6
Reason for non-adoption		
Looks	4	2.5
Age	7	4.3
Breed	9	5.6
Behavior	59	36.4
Aloof/inattentive/did not interact/uninterested/not social/independent	22	42.3
Hyper/too active/too energetic/rambunctious	14	27.0
Scared/timid/skittish	5	9.6
No interest in toys or play	4	7.7
Did not listen	4	7.7
Not potty trained/marked	3	5.8
Can climb fence/jumps fences/tries to escape	3	5.8
Unfriendly	2	3.8
Calm/not energetic enough	2	3.8
Submissive	2	3.8
Too puppyish	1	1.9
Aggressive with other dogs	1	1.9
Biting	1	1.9
Chewing	1	1.9
Other	53	32.1
Still looking/will come back/not ready	31	59.6
Have to bring other family members or resident dog	11	21.2
Breed restriction/do not want a pit bull	4	7.7
Money/cost	2	3.8
Chose another dog	1	1.9
Want smaller dog	1	1.9
Grieving over loss of a dog	1	1.9

3.2. Reported reasons for adopting or not adopting

Of 88 interactions that resulted in an adoption, 82 questionnaires contained a rationale for adoption. Table 2 lists the given reasons and the frequency of descriptive words used by adopters to explain their decision in adopting that specific dog. Of 162 interactions that resulted in no adoption, only 70 contained a rationale for choosing not to adopt. Table 2 also lists the reasons for not adopting and the frequency of descriptive words used by visitors to explain why they did not adopt that particular dog.

3.3. Shelter dog demographics

One hundred and fifty-one different dogs were taken out of their kennels by potential adopters during the study. Most dogs were taken out only once (61.6%), 22.5% of dogs were taken out twice, 10.6% were taken out three times, 2.0% dogs were taken out four times, 2.0% dogs were taken out five times, 0.7% of dogs were taken out six times, and 0.7% of dogs were taken out seven times.

The majority of dogs were male (56.4%) and adults (60.0%). Only 9.6% were puppies and 30.4% were juveniles. Most dogs were medium sized (64.8%), 30% were small, and 5.2% were large. The largest color category was red (48.8%), white followed next (12.8%), followed by brindle (10.0%), black (8%), black and tan (6.8%), black and white (6.4%), merle (3.2%), tricolor (3.2%), and the smallest category was gray (0.8%). The majority of dogs had a short coat (77.2%). The two most frequent breed types were fighting (32.8%) and sporting (26.4%), followed by hounds (16.4%), herding (9.6%), working (8.4%), toy (3.6%), and ratters (2.8%). The majority of dogs were strays (64.4%), 28.0% were owner surrendered, 4.4% were confiscated, and 3.2% were recent returns.

Most of the interactions happened in the smaller enclosed outdoor concrete area (56.8%), followed by the adjacent large grass area (33.2%), and the indoor room (10.0%). The average duration of an interaction was 7.9 min (range: 1.0–40.7 min). There was no difference in the duration between interactions ending with an adoption and non-adoption (mean ± SD, 8.7 ± 7.5 min, and 7.5 ± 5.3 min, respectively; Mann–Whitney *U* statistic = 1.0, *df* = 1, *P* > 0.1).

3.4. Predictors of adoption

3.4.1. Morphological and behavioral predictors

A test of the full logistic regression model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between interactions that resulted in adoption and non adoption (chi-square = 13.16, *df* = 2, *P* < 0.001). Prediction success overall was at 67.2% (97.5% for non-adoption and 11.4% for adoption). The Wald criterion demonstrated that only ignoring play initiation by the potential adopter and lying in proximity to the potential adopter made a significant contribution to prediction (Table 3). The odds ratio indicated that dogs that lay in proximity were 14.47 times more likely to be adopted than those that did not, after accounting for the only other behavior remaining in the model (ignoring play initiation). The odds ratio for ignoring play initiation was less than 0.001, indicating that that behavior was associated with very low odds of being adopted, after controlling for the other significant behavior (laying in proximity).

Dogs that were not adopted ignored play initiations by the potential adopter twice as much (mean proportion ± SD, 0.040 ± 0.057) than adopted dogs (mean proportion ± SD, 0.020 ± 0.036), and lay in proximity to the potential adopter half as much (mean proportion ± SD, 0.030 ± 0.086) as adopted dogs (mean proportion ± SD,

Table 3

Output of the logistic regression conducted to predict an adoption outcome after an interaction using behavioral (29) and morphological (8) variables of the dogs and dog identity as predictors. The coefficient (*B*), standard error (SE), Wald statistic (Wald), degrees of freedom (df), *P*-value (*P*), odds ratio (OR), and the confidence interval (C.I.) for each variable is shown below in consecutive order.

	B	S.E.	Wald	df	P	OR	95% C.I. for OR	
							Lower	Upper
Ignore play initiation	−9.14	3.76	5.91	1	0.015	<0.001	<0.001	0.17
Lie in proximity	2.67	1.29	4.27	1	0.039	14.47	1.15	182.69
Constant	−0.47	0.17	7.28	1	0.007	0.63		

0.060 ± 0.131). There was no correlation between ignoring play and lying in proximity ($\rho = -0.08$, $P > 0.1$).

3.4.2. Other predictors

The area where interaction took place significantly influenced adoption decisions. Interactions in the smaller concrete area resulted a probability of adoption of 0.423, whereas interactions in the indoor room resulted in a probability of 0.320, and interactions in the large enriched grass area resulted in a probability of 0.229 (chi-square = 9.37, $df = 2$, $P < 0.01$).

Stated intention to adopt or not adopt influenced adoption decisions of shelter visitors. The interactions of potential adopters, who reported not intending to adopt a dog that day, resulted in a probability of adoption of 0.102; whereas, interactions of potential adopters, who reported an intention to adopt a dog that day, resulted in a probability of 0.586 (chi-square = 62.99, $df = 1$, $P < 0.001$).

3.5. Sensitivity of non-adopter descriptions

A multivariate General Linear Model found that being labeled “too active” did not predict a dog’s tendency either to ignore play or lie in proximity ($F(1) = 0.102$, $P > 0.1$ and $F(1) = 2.73$, $P > 0.1$, respectively). Dogs that were labeled as “too active” ($n = 13$) had an average proportion of ignoring play of 0.02 (SD = 0.02) and had an average proportion of lying in proximity of 0.08 (SD = 0.19). Dogs that were not labeled as “too active” ($n = 143$) had an average proportion of ignoring play of 0.03 (SD = 0.04) and had an average proportion of lying in proximity of 0.03 (SD = 0.08). However, dogs labeled “not social” were more likely to ignore play, but not less likely to lie in proximity ($F(1) = 38.6$, $P < 0.001$ and $F(1) = 2.09$, $P > 0.1$, respectively). Dogs that were labeled as “not social” ($n = 25$) had an average proportion of ignoring play of 0.09 (SD = 0.09) and had an average proportion of lying in proximity of 0.006 (SD = 0.01). Dogs that were not labeled as “not social” ($n = 131$) had an average proportion of ignoring play of 0.03 (SD = 0.04) and had an average proportion of lying in proximity of 0.03 (SD = 0.08).

4. Discussion

More than one-third of all interactions sampled during the 6 months of this study resulted in an adoption. The most typical shelter visitor that requested to interact with a dog was female, under 25 years of age, lived in a household with more than two people and had other pets. About half of the potential adopters did not have children in the home. Many shelter visitors did not intend to take a dog home that day.

Close to 47% of people who requested to interact with a dog reported not having an intention to adopt that day.

An interesting finding was that the average duration of interactions was quite short – only 8 min. This corresponds to previous research that found that adopters only spend 20–70 s evaluating a dog in the kennel (Wells and Hepper, 2001).

One surprising finding was that the vast majority of potential adopters only took out a single dog. About one-fifth of adopters interacted with two dogs and only about a tenth of potential adopters interacted with more than two dogs. This finding suggests that adopters are selecting dogs based on their in-kennel presentation and only take the dog out to confirm their choice. This corresponds to our finding that our model based on behavioral variables was only able to predict failure, but not success, of adoption. In addition, while morphology has been well established to influence adoption (e.g. Protopopova et al., 2012), no morphological variables, such as breed, age, size, sex, intake type, coat length, or coat color influenced adoption decisions during an out-of-kennel interaction. Our results suggest that adopters make a decision to adopt prior to interacting with a dog, but this decision can be reversed based on the dog’s behavior outside of the kennel.

Only two behaviors predicted the likelihood of adoption during an interaction with a potential adopter: ignoring play initiation by and lying down in proximity to the potential adopter. Dogs that lay down in proximity to adopters were approximately 14 times more likely to be adopted and ignoring play initiation was associated with a very low likelihood of adoption. Previous authors have suggested that sociability is a desirable trait in shelter dogs (Sternberg, 2003) and many researchers in the field of comparative cognition attribute the success of domestic dogs in human societies to their evolved social cognitive abilities (e.g. Hare et al., 2002). Protopopova et al. (2012) did not find that training a sociable behavior increased adoption rates significantly but this may have been due to a poor choice of sociable behavior – gazing. In the present study, adopted dogs did not attend more to potential adopters. It is possible that training a different social behavior, such as lying down in proximity to the adopter, would have increased adoption rates. Future research should experimentally investigate the ability of the two behavioral variables (lying down and ignoring play initiation) to influence adoption.

The derived model based on the two behavioral variables was much more accurate in predicting non-adoption than adoption. These results suggest that adopters were more sensitive to undesirable than to desirable behaviors.

Most adopters justified their reasons for adopting a dog in the questionnaire. The majority of people reported that the behavior and the overall look of the dog was a reason for adoption. Previous survey research has reported similar findings. Wells and Hepper (1992) found that people reported temperament as the most important variable in adoption, but Weiss et al. (2012) found that adopters reported that appearance was the single most important reason for adoption. We found in the present study that adopters reported playfulness/activity as the most important behavioral reason for adopting. This was followed by calmness and friendliness. Interestingly, only about half of the people in this study reported that age and breed were reasons for adoption; however, a growing body of research suggests that breed and age are important correlates of adoption (e.g. Normando et al., 2006; Protopopova et al., 2012; Brown et al., 2013). This discrepancy may reflect the limitations of questionnaire data in identifying the specific variables that are influencing adoption decisions.

To the best of our knowledge, no previous research has asked people to report on why they did not adopt a particular dog after an interaction. We found that shelter visitors reported behavior as the main reason for not adopting. Specifically, the two most common responses were that the dog was not attentive and too active. The most common “other” reason for not adopting was that the adopter was still looking or did not feel ready to adopt. The second most common “other” reason was needing to bring family members, including any resident dogs, to meet the new dog.

We found that more adoption happened in the smaller outdoor concrete area than in either the large grass area or an indoor room. All puppies were required to be shown in either the concrete area or the indoor room; however, age alone could not have been responsible for these results, as age was not a predictor of adoption in our study. It is possible that a larger grass area permitted dogs to engage in unattractive behaviors more easily (e.g. the dogs spent more time in exploratory behavior away from the potential adopter); however, both the outdoor concrete area and the indoor area were large enough to permit the dog to freely move away from the adopter. Future research should experimentally investigate the effects of the space in which pre-adoption interaction occurs on dog's outcomes.

The most accurate predictor of adoption was intention to take a dog home that day. Interactions with shelter visitors, who reported the intention to adopt a dog that day, resulted in 58.6% adoptions. It is noteworthy that, while this represents the majority of interactions, there were still many people who left the shelter without a dog even though they stated they were ready to adopt. About half of all visitors did not intend to adopt a dog that day. It is possible that some of the visitors never intended to adopt a dog, but were simply visiting the shelter for entertainment; however, even though the majority of people who did not intend to adopt did not adopt, one tenth of their interactions still resulted in an adoption. It is therefore possible that with targeted interventions shelters would be able to convince visitors to adopt an animal even when they did not intend to adopt. However, precautions would have to be made to avoid heightened return rates based on impulsive

adoption decisions. A possible alternative explanation of the high predictive value of the intention to adopt a dog is the possibility that the adopters, after deciding to adopt, indicated retrospectively that they were ready to take the dog home. This confound could be avoided in future studies by assessing intention to adopt prior to any interactions.

Our results suggest that visitors were somewhat able to report on the behaviors they were sensitive to during an interaction. Dogs that were labeled as not social by non-adopters also had higher scores than average in ignoring play initiations. However, adopter reports did not completely match the dogs' behavior during the interactions. Non-adopters listed hyperactivity as a main deterrent to adoption; however, no active behaviors predicted non-adoption. This was perhaps due to a large number of adopters who specifically reported that activity was a main reason for adoption. Our findings suggest that sole reliance on survey data may not reveal a complete picture of the adoption process. Future research should continue to utilize observational and experimental methods to investigate adoption in animal shelters.

One limitation of the current study was that we aggregated data across different people. Our sample size was too small to investigate the influence of demographic variables on behavioral selection of dogs. It is possible that adopters with small children will select dogs based on different criteria than single adopters. Similarly, age, socioeconomic, and other variables may influence choice. Future research should investigate whether it may be possible to match dogs to the right owners based on demographic information. It is also important to note that the current study assessed preferences only in a single geographical location. It would be beneficial to replicate the current study in a variety of different locations in order to assess if the reported trends appear universal or are specific to location type (such as in urban versus rural shelters, small versus large cities, etc.).

5. Conclusion

Our results suggest that adopters make a decision to adopt prior to interacting with a dog, but this decision can be reversed based on the dog's behavior during a brief (8 min) interaction outside of the kennel. As long as the dog spends time lying in proximity to and not ignoring play initiation by the adopter, the likelihood of adoption is high. Our results suggest that a smaller interaction area and a desire to adopt a shelter dog that day are predictive of adoption. However, a proportion of visitors left without adopting a dog even when they intended to, which implies that this portion of the population may be amenable to targeted programs designed to improve shelter dog adoption.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.applanim.2014.04.007>.

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