Preference assessments and structured potential adopter-dog interactions increase adoptions

Alexandra Protopopova a,⁎, 1, Maria Brandifino b, Clive D.L. Wynne c

a Department of Psychology, University of Florida, Gainesville, FL 32611, USA
b College of Veterinary Medicine, University of Florida, Gainesville, FL 32611, USA
c Department of Psychology, Arizona State University, Tempe, AZ 85281, USA

A R T I C L E   I N F O
Article history:
Received 6 April 2015
Received in revised form
23 November 2015
Accepted 28 December 2015
Available online 11 January 2016

Keywords:
Adoption
Animal shelter
Dog training
Preference assessment

A B S T R A C T
Previous research showed that lying down next to potential adopters and not ignoring their play initiatives during interactions outside of the kennel correlate with increased likelihood of adoption in shelter dogs. In the present study, we experimentally assessed whether increasing these behaviors during interactions with potential adopters influenced adoption outcomes. In Experiment 1, we validated a brief play preference assessment in order to find individual preferences for toys in shelter dogs. We found that play with specific toys in the preference assessment predicted play in more naturalistic settings ($\chi^2 = 10.50, P < 0.001, n = 20$). We then used a modification of this assessment as part of the experimental intervention. In Experiment 2, we randomly assigned dogs to the experimental structured-interaction (Group SI) and control (Group C) groups and evaluated 160 interactions between these dogs and potential adopters. The experimental intervention consisted of conducting a play preference assessment prior to the interaction and structuring the interaction once a potential adopter expressed interest in the dog. The structured interaction involved Phase 1—in which the visitor was encouraged to allow the dog to eliminate, Phase 2—in which the experimenter encouraged play with the dog’s preferred toy, and Phase 3—in which the experimenter encouraged the dog to lie down next to a potential adopter by restraining the dog with a short leash and luring into a down position with treats. A mixed-effects logistic regression model revealed that group membership, but not morphology of the dog, was predictive of adoption outcome ($\chi^2 = 3.95, P < 0.047$). Dogs in Group SI engaged in less undesirable behavior and were 2.49 times more likely to be adopted than dogs in Group C (23.3% adopted in Group C and 39.2% adopted in Group SI). A questionnaire revealed that potential adopters did not find the structured interaction intrusive. This validated intervention could be used in animal shelters to increase adoption rates in dogs.

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1. Introduction

Due to the large volume of surrendered, lost, and abandoned animals in the United States, animal shelters admit approximately 3.9 million dogs each year, with approximately a third ultimately euthanized (ASPCA, 2015). This immense overpopulation depletes shelters of resources and thus often results in only basic animal care with impoverished quality of life. Therefore, recent research has focused on understanding the variables which predict adoption, such as the dogs’ morphology and behavior (Brown et al., 2013; Clevenger and Kass, 2003; Lepper et al., 2002; Protopopova et al., 2012, 2014; Protopopova and Wynne, 2014; Siettou et al., 2014; Wells and Hepper, 1992).

Protopopova and Wynne (2014) examined which, if any, behaviors exhibited by a dog during an out-of-kennel interaction with a potential adopter predicted adoption. The correlational data showed that potential adopters were less likely to adopt dogs that ignored their play initiations, whereas dogs that showed interest in potential adopters by actively engaging in play, such as object-play with the potential adopter (e.g., tug with a rope toy, fetch with a tennis ball, etc.), or body-play (e.g., reciprocal play signals involving lunge, physical contact, bowing, hand-clapping, etc., between the potential adopter and dog) were more likely to be adopted. Dogs that lay in proximity to potential adopters also had a better chance of adoption. In addition, a smaller interaction area as opposed to a larger area, in which dogs had more opportunity to engage socially with the potential adopter, was associated with more adoptions.

http://dx.doi.org/10.1016/j.applanim.2015.12.003
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It remains to be experimentally demonstrated, however, that training behaviors or arranging conditions that produce these desirable interactive behaviors has a positive impact on adoption rates. In the present study, we aimed to develop and experimentally evaluate a program that incorporated the behavioral and contextual variables previously found to increase adoption rates in shelter dogs. We assessed a multi-component program that incorporated each of the components previously identified as correlating with the decision to adopt a dog. This multi-component approach improves the chances that an effect would be seen, which is an ethical imperative when working in shelters where dogs may stay in non-ideal environments or be euthanized if not adopted.

Training shelter dogs to play with potential adopters poses several challenges. Play between a dog and a human is dependent on the temperament of the dog as well as its training history (Tóth et al., 2008), and training such a complex behavior is a challenge in a shelter environment where resources are limited. A training program that requires either an expert dog trainer or a prolonged amount of time will likely not be utilized simply because of the lack of available resources. An alternative to training some predetermined play behavior in shelter dogs is to evaluate the dog’s play style preference. Previous research has found that dogs have individual preferences for play and respond to different human play signals differently (Rooney et al., 2001). In fact, previous research has found that shelter-housed dogs had preferences for different types of toys (Wells, 2004). Preference assessments have been used with animals to determine food preference (Fernandez et al., 2004; Gaalima et al., 2011) and, more recently, preference for enrichment items (Mehrkam and Dorey, 2014). Thus, instead of training shelter dogs to play, we developed an assessment of already established individual preferences of play style in dogs so that we could subsequently encourage potential adopters to use the style of play preferred by each dog. In Experiment 1, we developed and validated a brief preference assessment for shelter dogs preferred type of play. A modified version of this assessment was then used to guide potential adopter-dog interactions as part of the experimental intervention in Experiment 2. The aim of Experiment 2 was to evaluate whether using structured potential adopter-dog interactions at the shelter would increase appropriate behavior from the dogs, such as lying down in proximity to and not ignoring play initiations from potential adopters and consequently lead to a higher likelihood of adoption. All procedures in this study were conducted with the approval from the University of Florida Institutional Animal Care and Use Committee and the Institutional Review Board.

2. Experiment 1

2.1. Materials and methods

2.1.1. Animals and housing

Twenty adoptable dogs, housed at the Alachua County Animal Services (ACAS) in Gainesville, Florida, were used in this study (Table 1). ACAS is an open-admission county animal shelter functioning as both an animal control and adoption facility. Adoptable dogs consisted of seized and surrendered dogs deemed safe, healthy, and adoptable by the staff based on medical and temperament testing. Dogs were randomly selected for the study.

Dogs were singly housed in 1.0 m × 4.6 m × 2.1 m kennels with two-thirds of the kennel outdoors and one-third indoors. All of the kennels had cement floors with 1.2 m tall cement walls connected to the ceiling with a chain-link fence. The kennels contained a water bowl, food dish, and Kuranda bed (Kuranda USA, Annapolis, MD, USA) in the inside section of the kennel. Staff fed the dogs and cleaned the kennels daily before ACAS opened at 09:30. Volunteers exercised, trained, and played with the dogs approximately one to three times per week in the shelter’s outdoor play yards. Two of the play yards were used in the study. One yard was a smaller concrete outdoor fenced area that contained a small portable pool, water dish, and a bench (7.5 m × 4.3 m) and the second was a larger grassy area (10.6 m × 11.0 m) that contained a pool, several benches, toys, trees, bushes, and agility equipment (a ramp, a dog walk, and several jumps). Dogs left the shelter through adoption into a home, placement into a rescue organization, or by humane euthanasia.

2.1.2. Data collection

Each dog was given a brief play preference assessment by the experimenter to determine its preferred play style. The brief assessments were administered while the dogs were on a 1.2 m slip leash in a concrete play yard at ACAS. Each dog was presented with four toys (tennis ball, nylon squeaky toy, cotton plush toy, and a flannel rope toy) in a random order with three presentations of each. One experimenter (AP) held the leash, while a second experimenter (MB) presented each toy to the dog. The latter experimenter showed the toy to the dog by placing it in front of the dog’s face and briefly animating it with her hand while vocally calling the dog’s attention (e.g., exclaiming “What is this?”). She then threw the toy on the ground within 1 m of the dog. If the dog grabbed the toy with its mouth for at least 2 s, the experimenter offered the dog a food treat (∼2 mm in diameter hotdog piece; Classic Jumbo Jumbos Franks, Bar-S, Phoenix, AZ, USA). If the dog released the toy for a treat, the trial was deemed successful. The requirement to release the toy for a treat was included in order to ensure safety of potential adopters when implementing the play in the subsequent experiment. The proportion of times the dogs successfully interacted with the toy out of three presentations were recorded. All interactions were videotaped in order to assess inter-observer reliability.

Following the initial brief preference assessment, those dogs that remained in the shelter for three weeks were administered a validity test twice per week for three weeks. Whereas the main objective of Experiment 1 was to determine whether the brief preference assessment was predictive of the dogs’ behavior in a more naturalistic setting, we included a longitudinal component in order to examine the stability of the dog’s play behavior. The validity test included a presentation of the same toys in a more naturalistic setting in order to mimic how potential adopters may interact with the dogs in an out-of-kennel interaction. The assessment began with a 2-min opportunity for the dog to explore the area and empty its bowels. Each toy was presented twice for a duration of 1 min each (a total of 8 min of play). The duration of the validity test was chosen based on previous data regarding how long an average out-of-kennel interaction lasts with a potential adopter (Protopopova and Wynne, 2014). The order of the toys was determined through a random number generator. Within the minute presentation of each toy, an experimenter asked the dog to play with it every 15 s (for a total of 4 trials per min). Multiple experimenters were used across different days for each dog to prevent the dogs becoming accustomed to a particular individual. The experimenters who assessed the dog on the brief preference assessment never participated in the validity test. The validity test was conducted off-lead in a small concrete enclosure with no other toys present. If the dog played with and released the toy for a treat, the experimenter recorded a trial as successful. The proportion of times the dogs successfully interacted with the toy out of 8 trials was recorded.

2.1.3. Data analysis

All statistical analyses were conducted using Stata SE 14 (Stata LP, College Station, TX, USA). Descriptive analyses were conducted to assess how much dogs engaged in play in general. A mixed-effects logistic regression model, with dog identity as a cluster variable, was used to assess which toys elicited most play, whether
the amount of play changed across time, and whether the brief assessments predicted play in the validity tests. Finally, reliability was assessed by comparing the live-coded data with the video data of the brief assessments. In a trial-by-trial inter-observer agreement method, the number of trials in which the observers agreed that play occurred were divided by the total number of agreements and disagreements for each dog, which resulted in a percentage.

2.2. Results

2.2.1. Descriptive statistics

A total of 20 adoptable shelter dogs participated in the study. All dogs completed the brief assessment. The average number of validity tests completed was 3.8 (Table 1).

Thirteen dogs engaged in play for some portion of the time, whereas seven dogs never played in either the brief assessment or in the validity tests. On average, dogs played in 31.7% of the trials in the brief assessment (SD = 41.0%) and 30.7% of the trials in the validity tests (SD = 36.1%).

Fig. 1 shows the dogs’ individual proportion of play during the brief assessment and the validity tests on each toy. Only dogs that played during the brief assessment or the validity tests are shown. One dog did not play in the brief assessment, and only played in one trial of the validity test; his data are not shown.

On average, in the validity tests, the plush toy was played with on 29.1% of the trials (SD = 40.2%), the rope was played with 27.0% of the trials (SD = 36.4%), the squeaky toy was played with 21.3% of the trials (SD = 32.4%), and the tennis ball was played with 21.1% of the trials (SD = 36.0%).

On average, dogs played in 28.0% of the trials in Test 1 (SD = 37.4%), 21.9% of the trials in Test 2 (SD = 35.1%), 21.0% of the trials in Test 3 (SD = 32.8%), 24.7% of the trials in Test 4 (SD = 37.4%), 24.4% of the trials in Test 5 (SD = 38.8%), and 30.2% of the trials in Test 6 (SD = 44.7%; Fig. 1).

2.2.2. Validation

To assess how predictive the brief assessments were in predicting play in the validity tests, a multi-level logistic mixed-effects regression with random slopes regression model was fit to the data, with individual dog identification (ID) as the cluster variable. The validity test number (i.e. time; 1–6) and toy type were non-significant predictors of amount of play in the validity test (time: coefficient = 0.34, P > 0.05; toy type: coefficient = 0.27, P > 0.05) and were subsequently removed as covariates. The reduced model indicated, controlling for dog identity, that play in the brief assessment was a statistically significant predictor of play in the validity tests ($\chi^2 = 10.50, P < 0.001$).

2.2.3. Reliability

All brief assessments were videotaped and coded independently by an observer, who was blind to all hypotheses of the study. The average inter-observer reliability was 95.4% (range: 58.3–100%).

2.3. Discussion

The brief play assessment predicted play during the validity tests well. Dogs did not decrease or increase their play across time, suggesting that the results arising from the brief assessment are likely to predict play for at least two weeks from the time of administration. Reliability of the brief assessment was high, suggesting that the assessment was easy to score. On average, no one specific toy was preferred for all dogs. However, not all shelter dogs enjoyed playing with toys, at least in the brief period of time after being taken out of the kennel. The majority of the dogs (65%) engaged in at least some play during either the brief play preference assessment or in any validity tests. On average, dogs played approximately for a third of the available trials. In summary, we showed that the brief play assessment for shelter dogs is valid and reliable, and thus, we incorporated a modified version of the assessment into Experiment 2 as part of the experimental procedure.

3. Experiment 2

Experiment 1 showed that it was possible to rapidly determine a preferred mode of play for a shelter dog. The aim of Experiment 2 was to assess whether it is possible to increase adoption rates by altering the nature of the interaction between shelter dog and potential adopter in three ways derived from a prior correlation study (Protopopova and Wynne, 2014): (1) directing the use of the smaller enclosure; (2) structuring play around a toy known to be of interest to the dog; and (3) shaping the dog to lie down next to the potential adopter when not playing.
3.1. Materials and methods

3.1.1. Animals and housing

Adoptable dogs \((n = 281)\) housed at ACAS were enrolled in the study from July through October, 2014. All housing and husbandry procedures were the same as in Experiment 1. We sampled 160 interactions between potential adopters and shelter dogs for a total of 104 individual dogs (as some dogs were viewed several times by different potential adopters).

To analyze the effects of morphology on adoption, all dogs were divided into morphologically preferred and not preferred categories as found in Protopopova et al. (2014). Morphologically preferred dogs consisted of puppies (4 months of age and under), long-coated dogs, small dogs (approximately 0.35 m and under in height), and preferred breed types (lap dogs—group containing breeds that are bred primarily for companionship, such as Chihuahuas and Pomeranians; ratters—group containing breeds that historically were bred to hunt small vermin or game, such as Rat Terriers and Jack Russell Terriers; and herders—group containing breeds that were historically bred to herd livestock, such as Border Collies and Australian Cattle Dogs). For a full description of breed types, see Protopopova et al. (2012). These dogs have been previ-
ousy found to have a shorter length of stay at the shelter than other dogs (Protopopova et al., 2014).

3.1.2. Brief play preference assessment

Dogs were recruited into the study as they became available for adoption (as determined by shelter staff). They were randomly assigned into either the control (Group C) or experimental structured interaction (Group SI) groups. Due to the large number of dogs enrolled in the study and the unpredictable selection of dogs to be taken out for interactions by potential adopters, no counterbalancing for morphological and background factors was attempted. Table 2 summarizes the morphological and background variables of the dogs, which ultimately interacted with the potential adopters in either Group C or Group SI.

Dogs in Group SI received a brief play assessment as described in Experiment 1, with some details modified. One difference was that the same experimenter held the leash of the dog as well as offered the toys and treats with the other hand. A second difference was that the order of presentation of the toys was now fixed and ranked by the cost of the toy. The tennis ball was offered first, followed by the rope toy, the squeaky toy, and the plush toy. A third difference was that the preferred item was determined by the first toy to reach a 3/3 score. For example, if the dog engaged appropriately with the tennis ball in three consecutive trials, the tennis ball was deemed acceptable and the assessment was ended. These modifications made the assessment more time efficient and cost effective in that the cheapest toy with which the dog played was always used in the structured potential adopter-dog intervention. If the dog did not engage with any toy for 3/3 trials, the first toy to score 2/3 was deemed acceptable. If the dog engaged in a maximum of 1/3 trials with any toy, no toy was deemed acceptable and the dog was determined to be not interested in toy play. Because several dogs in Experiment 1 engaged in play in only one trial and then subsequently engaged in low levels of or no play in the validity test for that toy (Fig. 1, subjects Bugsy, Spartan, Chelsea, Coco, and Derby), we did not count any toy as preferred if a dog engaged with the toy in only one trial. Thus, for every dog in Group SI, a preferred toy or “no preferred toy” was recorded.

In addition to the play preference assessment, each dog was assessed for its ability to follow a command to lay down. After conducting the play assessment, each dog in Group SI was asked to lay down with a verbal command, a hand signal, and lured with a piece of hotdog. If the dog did not show knowledge of the command, the experimenter attempted to train the dog using the food lure (place the dog into a sit, then lure the dog to the ground with a piece of hotdog). Each dog was thus trained with 10 pieces of hotdog. The experimenter recorded whether the dog lay down (at least once) or not during this assessment. This information was then used during potential adopter-dog interaction as described below.

No assessments were conducted for dogs in Group C.

3.1.3. Structured potential adopter-dog interactions

An experimenter waited at the animal shelter for a potential adopter to indicate that they were interested in taking a dog of their interest out of the kennel. At this point, the experimenter requested informed consent to participate in the study and to allow video recording of the interaction. The informed consent consisted of explaining to the potential adopter that the study aims to understand the behavior of dogs in the shelter and did not describe any hypotheses or methods of the study. Upon consent, the experimenter took the dog out of the kennel. If the dog was in Group C, the experimenter led the potential adopter to a large outdoor grass area, removed the leash from the dog, and stood passively next to the entrance. If the dog in Group C was less than 4 months old, the dog and the potential adopter were led into the small concrete area as per the requirements of the shelter in order to prevent disease spread among small puppies. In such a situation, a box of toys, which was usually located in the grass area, was taken to the small concrete area. If asked, the experimenter would provide information about the dog (sex, age, breed, how long the dog had been at the shelter, shelter adoption procedures, etc.), but took care not to provide any information about the behavior of the dog.

If the dog was in Group SI, the potential adopter was led to a smaller outdoor concrete enclosure and the structured interaction consisting of three phases began. Only the dog’s preferred toy was present in this location. In the first phase, the experimenter asked the potential adopter to wait until the dog had emptied its bowels before beginning interacting with it. The following script was used for this purpose, “[Dog’s name] hasn’t had a chance to go potty today, would you mind if we let [dog’s name] potty first?” This phase was included to allow the dog to acclimate to the area and empty bowels if needed. The phase ended after either 2 min or the potential adopter began reaching for the dog.

As soon as the first phase ended, Phase 2 began in which the experimenter took out the dog’s preferred toy as determined by the brief play assessment. The experimenter indicated to the potential adopter that the toy was the dog’s favorite and that the dog liked to play with it. The experimenter then modeled appropriate play by showing the toy to the dog and tossing it away from the dog. As the dog grabbed the toy, the experimenter explained to the potential adopter that the dog likes to bring the toy back and exchange it for a treat while at the same time giving the dog a treat and picking the toy up. The experimenter then gave the toy and treats to the potential adopter and said, “Now you try!” If the dog did not have a preferred toy, as determined by the modified preference assessment, the same procedure was repeated but with tossing a treat instead of the toy. The script was slightly altered (i.e., “This dog really likes to find treats”, followed by tossing the treat away from the dog). The second phase continued until either the dog

Table 2
Summary of the morphological and background variables of the dogs used in Experiment 2.

<table>
<thead>
<tr>
<th>Breed Type</th>
<th>Control</th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percentage</td>
</tr>
<tr>
<td>Puppy (&lt;4 months of age)*</td>
<td>11</td>
<td>12.8%</td>
</tr>
<tr>
<td>Male</td>
<td>48</td>
<td>55.8%</td>
</tr>
<tr>
<td>Long coat*</td>
<td>2</td>
<td>2.3%</td>
</tr>
<tr>
<td>Ratter*</td>
<td>6</td>
<td>7.0%</td>
</tr>
<tr>
<td>Herding*</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Lap*</td>
<td>3</td>
<td>3.5%</td>
</tr>
<tr>
<td>Fighting</td>
<td>32</td>
<td>37.2%</td>
</tr>
<tr>
<td>Sporting</td>
<td>29</td>
<td>33.7%</td>
</tr>
<tr>
<td>Working</td>
<td>4</td>
<td>4.7%</td>
</tr>
<tr>
<td>Hound</td>
<td>12</td>
<td>14.0%</td>
</tr>
</tbody>
</table>

*Variables that comprise the morphologically preferred group (long coat, small size, or ratter, herding, or lap dog).
Table 3

<table>
<thead>
<tr>
<th>Behaviors</th>
<th>Operational definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignoring play initiation</td>
<td>Dog walks away or otherwise ignores initiation of play by person (through toy or body)</td>
</tr>
<tr>
<td>Human toy play</td>
<td>Dog engages with toy that is held by person (or thrown treat) or runs toward the toy when it is thrown and brings back to person (or eats the treat)</td>
</tr>
<tr>
<td>Human play</td>
<td>Dog engages with playing person by play bowing, barking, light mouthing, and jumping.</td>
</tr>
<tr>
<td>Independent toy play</td>
<td>No toy or thrown treat involved</td>
</tr>
<tr>
<td>Lie in proximity</td>
<td>Dog is lying down within an arm's reach of potential adopter (~1 m)</td>
</tr>
<tr>
<td>Proximity</td>
<td>Stays within an arm's reach of potential adopter (~1 m) for more than 2 s</td>
</tr>
</tbody>
</table>

stopped engaging with the toy or treat or the potential adopter began attempting to pet the dog.

The third phase began with the experimenter placing a 1.2 m slip leash on the dog and inviting the potential adopter to join the experimenter on a bench. If the dog was able to follow the command to lie down during the brief assessment, the experimenter asked the dog to lie down and continued to give treats to the dog for maintaining the down position. If the dog was not able to lie down during the assessment, the experimenter continued to give treats to the dog for sitting and continued to attempt to lure the dog into a down position. At the same time, the experimenter provided treats to the potential adopter to feed to the dog. The experimenter answered any questions the potential adopter had about the dog, but took care not to draw attention to any behaviors, similarly to interactions with dogs in Group C.

Infrequently, the procedure deviated slightly. If a potential adopter indicated that she wanted to play after Phase 3, the dog was taken off-leash and the preferred toy was provided. One potential adopter brought her own toy to an interaction and, in several instances, the potential adopters asked to take the dogs off-leash in Phase 3 while not wanting to play. These interactions were retained in the analysis in order to capture all variation that may occur with this intervention.

The interactions with dogs in both Group SI and Group C ended after the potential adopter indicated that they were done looking at the dog. At this point, a questionnaire was provided to the potential adopter and an outcome (adoption or non-adoption) was recorded.

Ninety-six percent of all interactions were video recorded to verify that dogs engaged in less inappropriate behavior in Group SI than in Group C. Six behaviors that involved various play behaviors, lying down, and proximity, were recorded using a partial-interval method, in which the occurrence or non-occurrence of the behaviors was scored in 5-s bins from the videos (Table 3). Approximately half of the videos (54%) were coded by additional observers to assess inter-observer agreement. In an interval-by-interval inter-observer agreement method, an agreement was scored when the two observers agreed on the occurrence of a behavior in each 5 s interval. The agreements were divided by the total number of intervals to calculate a proportion, which was multiplied by 100 to derive the percentage agreement for each video.

3.1.4. Questionnaire

Because of the potentially intrusive nature of the experimental intervention, a questionnaire was provided to gauge the comfort level of shelter visitors with the procedure (Appendix A). The questionnaire consisted of six questions that assessed how comfortable the potential adopter was interacting with the dog and the experimenter, if the visitor felt restricted in interacting with the dog, if the experimenter was intrusive or annoying, and if the visitor felt that he or she was able to evaluate the dog as needed.

The visitors were given a questionnaire and an envelope in which to place the questionnaire upon completion. This was done to allow the visitors to remain anonymous.

3.1.5. Data analysis

All statistical analyses were conducted using Stata SE 14 (Stata LP, College Station, TX, USA). A logistic regression model with outcome and morphology of the dog, as well as dog ID as a random effect was used to assess the effect of group membership on adoption outcome for the full sample (n = 160). Data from video recordings of the interactions (n = 154) were used to further assess the effect of intervention on the dog’s behavior. A multivariate generalized linear regression model was used to assess the effect of group membership on the six behaviors (Table 3) and length of interaction.

A multivariate general linear regression model was used to assess the differences in responding on a questionnaire in the different groups.

3.2. Results

3.2.1. Descriptive statistics

Out of a total of 281 dogs recruited in the study (n = 144 in Group C and n = 137 in Group SI), 38% out of the dogs in Group SI interacted with a toy (20% ball, 8% plush toy, 7% rope, and 3% squeaky toy). The remaining 62% of dogs in Group SI did not interact with any toys, as indicated by play on one or no trials in the brief play assessment. Only 16.5% of all dogs in Group SI were able to follow the down command during the brief assessment. One hundred and sixty interactions between potential adopters and shelter dogs were observed (n = 86 in Group C and n = 74 in Group SI; Table 4). In the sub-sample of dogs with which potential adopters interacted, 25 dogs (32.4%) in Group SI interacted with a toy. The remaining dogs preferred not to interact with any of the provided toys. Seventeen dogs (23.0%) in Group SI were able to follow a command to lie down during the brief assessment.

A total of 104 individual dogs interacted with potential adopters during the study. The average number of interactions per dog was 1.54 (range: 1–7). Group C contained 23 dogs (26.7%) that were morphologically preferred whereas Group SI contained 35 (47.3%). A total of 30.6% of interactions resulted in an adoption.

3.2.2. Predictors of adoption

Adoptions were lower in Group C (23.3%) than in Group SI (39.2%). Morphology of the dogs was not found to be a predictor of adoption (coefficient = −0.28, P > 0.05) and was therefore removed from the model. The reduced mixed-effects logistic regression model indicated that, controlling for dog ID, group membership predicted adoption outcome (χ² = 3.95, P = 0.047). An odds ratio indicated that dogs in Group SI were 2.49 times more likely to be adopted.

Adoptions were higher for morphologically preferred dogs (37.9%, n = 58) than not preferred dogs (26.5%, n = 102), but this difference did not reach statistical significance (χ² = 2.29, P > 0.05) and, as mentioned above, was not a predictor of adoption.

Because the puppies in both groups were treated slightly differently (i.e., they were always taken out into the smaller enclosure), a separate confirmatory analysis was conducted with the puppies removed. With the removal of the puppies (Group C: n = 11; Group SI: n = 9) the data remained statistically significant (chi square test; χ² = 4.96, P = 0.026).
3.2.3. Video data

Inter-observer reliability was 95.1% (range, 85.0–98.9%). On average, interactions lasted 7.92 min (Group C: mean = 8.30 min, SD = 10.46 min, n = 82; Group SI: mean = 7.49 min, SD = 3.95 min, n = 72).

Shapiro-Wilk test for normality showed that the six behavioral variables and the length of interaction were not normally distributed (all P < 0.0001) and thus were log-transformed for further analysis. A multivariate general linear regression model was statistically significant (F[7,146] = 14.5, P < 0.0001). However, human toy play, human play, and length of interaction were not statistically significant predictors (P > 0.05) and were therefore removed from the model. The reduced model was constructed with the remaining variables (F[4,149] = 25.2, P < 0.0001; Table 4). Dogs in Group C engaged in play initiations by potential adopters more (mean = 0.03, SD = 0.06) than dogs in Group SI (mean = 0.01, SD = 0.02). Dogs in Group C engaged in individual play away from the potential adopter more (mean = 0.09, SD = 0.19) than dogs in Group SI (mean = 0.02, SD = 0.06). Dogs in Group C lay in proximity to the potential adopter less (mean = 0.02, SD = 0.04) than dogs in Group SI (mean = 0.09, SD = 0.18). Fig. 2 shows the proportion of time spent ignoring play initiations, individual toy play, and lying in proximity across the two groups. Fig. 3 shows that dogs in Group C spent less time in proximity in general (mean = 0.41, SD = 0.23) than dogs in Group SI (mean = 0.76, SD = 0.21).

3.2.4. Questionnaire

One hundred forty one questionnaires (88.1%) were collected after the interactions (Group C: n = 79, 91.9%; Group SI: n = 62, 83.8%). Out of all of the questionnaires, 22 potential adopters left comments, out of which only three were negative. One negative comment after an interaction with a dog in Group C was about the dog (“Dog didn't want to interact, he's not one for my farm”) and two comments were about the interaction itself, one after an interaction with a dog in Group C and one after an interaction with a dog in Group SI respectively (“She's a very nice person, but I just needed one on one interaction” and “Interaction with toys and a place to run would have been nice”). Some missing questionnaires resulted from experimenter error in indicating to which group the dogs, with which the potential adopter interacted, belonged (n = 8). The remaining omissions occurred when the potential adopter either refused to participate or left the premises before the experimenter was able to administer the questionnaire.

Group membership was not predictive of answers on any questions (F[6,133] = 1.67, P > 0.05). To verify no differences in any questions, a less stringent analysis was conducted using multiple independent samples t-tests, which confirmed that no questions differed by group membership (all P-values > 0.05).

4. Discussion

The aim of the sequence of studies was to evaluate the utility of structuring potential adopter-dog interactions at the shelter to increase appropriate behavior and subsequently adoption rates of the dogs. Using structured potential adopter-dog interactions more than doubled the likelihood of adoptions compared to allowing potential adopters to interact freely with dogs. The higher likelihood of adoption of dogs in Group SI was likely due to the dogs spending more time lying down next to potential adopters and less time ignoring their play initiations. These behaviors have previously been found to predict adoption likelihood (Protopopova and Wynne, 2014). Dogs in Group SI also spent more time in proximity to and less time playing independently away from the potential adopter. These findings suggest that using structured interactions to guide potential adopter-dog interactions at the shelter does improve behavior of the dogs and results in higher adoptions.

The duration of interaction was not different in Group SI compared to Group C, suggesting that structuring interactions does not

![Fig. 2. Mean (±SD) proportion of time spent engaging in behavior of dogs in Group C and Group SI.](image-url)

Table 4

A multivariate regression model with four log-transformed behavioral variables as predictors. Coefficients, standard errors, t statistics, p-values, and 95% confidence intervals are shown for each independent variable.

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>P-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignoring play initiation</td>
<td>−0.016</td>
<td>0.006</td>
<td>−2.42</td>
<td>0.017</td>
<td>−0.028, −0.003</td>
</tr>
<tr>
<td>Independent toy play</td>
<td>−0.059</td>
<td>0.018</td>
<td>−3.21</td>
<td>0.002</td>
<td>−0.095, −0.023</td>
</tr>
<tr>
<td>Lie in proximity</td>
<td>0.058</td>
<td>0.016</td>
<td>3.55</td>
<td>0.001</td>
<td>0.026, 0.09</td>
</tr>
<tr>
<td>Proximity</td>
<td>0.229</td>
<td>0.024</td>
<td>9.45</td>
<td>&lt;0.001</td>
<td>0.181, 0.276</td>
</tr>
</tbody>
</table>
change the time potential adopters interacted with the dog. Therefore, utilizing this intervention when showing dogs to potential adopters does not take more time away from staff and volunteers than standard protocols. Also, visitors did not perceive the intervention as more intrusive or restricting than the more passive standard procedure. These findings taken together suggest that the intervention is acceptable by potential adopters and is just as time-efficient as the standard procedure in many shelters.

In accordance with previous data (Protopopova and Wynne, 2014), morphology was not found to be a predictor of adoption likelihood during out-of-kennel interactions. Growing evidence suggests that adopters select dogs primarily based on morphology when observing them in their kennels (Herron et al., 2014), but then confirm their decision based on behavior during their interaction with the dog outside of the kennel (Protopopova and Wynne, 2014).

Furthermore, our data from Experiment 1 add to the growing literature of the utility of preference assessments in animals. Previous research was restricted to animals at the zoo: cotton-top tamarins (Fernandez et al., 2004), African elephants and giant pandas (Gaalema et al., 2011), and Galapagos tortoises (Mehrkan and Dorey, 2014). We have extended the utility of preference assessments to domesticated species by showing that a brief play preference assessment to evaluate preferred toys in shelter dogs predicted play in more naturalistic settings.

An interesting finding was that whereas play is an important behavior for potential adopters, only a minority of dogs at the shelter preferred to play with toys. These findings are in agreement with previous research that showed that fewer than a third of the dogs played with toys while kenneled at an animal shelter (Pullen et al., 2010; Wells and Hepper, 2000), and that shelter dogs did not engage in object-play for a prolonged period of time (Wells, 2004). One solution may be to avoid toys with those dogs and, instead, focus the attention of a potential adopters on alternative forms of play. For the current intervention, we used tossing treats as an alternative interaction. However, other approaches deserve assessment, such as body play and food puzzle games. Also, a more labor-intensive program to train shelter dogs to play with toys, such as a game of fetch, may be worth attempting. Because only a minority of shelter dogs play with toys, subsequent studies can also investigate the underlying lack of motivation to play.

One limitation in Experiment 2 was that the experimenter was not blind to the dogs’ group membership. It was difficult to design a procedure which would allow the experimenter to remain blind to the conditions. It is possible that the experimenter unconsciously biased the potential adopters to adopt more dogs in Group SI. However, a recent study that contained a portion of the intervention in which the experimenters were not blind to the conditions, did not result in altered behavior from shelter visitors (Protopopova and Wynne, submitted).

A second limitation was that potential adopters could have taken out more than one dog during their visit, thus exposing the same person to dogs in both groups. Although data on the number of dogs with which each visitor interacted were not collected during the present study, previous research showed that more than the majority of visitors only interact with one dog (mean = 1.6 dogs: Protopopova and Wynne, 2014).

It is possible that visitors exhibited demand characteristics and were influenced by their guesses about the goals of the study. However, it is unlikely that adopters would acquire a dog in order to fulfill the experimenter’s expectation. To partially overcome this limitation, the experimenter took care as to not reveal the hypothesis of the study to the potential adopters.

A third limitation of the present study is that we assessed a multi-component treatment consisting of taking the dogs to a smaller area, providing preferred toys, encouraging lying down, and facilitating the interaction; therefore, it is not possible to draw conclusions on the individual components of this program. Furthermore, it is possible that the interaction with a friendly experimenter, who was showing affiliative behavior towards the potential adopter and the dog, was at least partially responsible for the increased adoptions. Future research is needed in order to determine the degree of importance of each component in influencing the behavior of the shelter dogs and the decisions of shelter adopters, though such research will have to be carefully designed to avoid putting dogs into the ethically unacceptable situation of being given opportunities for adoption that are inferior to current best practice.
5. Conclusion

We developed and validated a brief play preference assessment for shelter dogs. A modified version of the assessment was then used as a component of the experimental condition in which potential adopter-dog interactions were structured. We showed that structuring first-time interactions between potential adopters and shelter dogs by conducting the interaction in a smaller area, using preferred play items, and encouraging dogs to lie down next to potential adopters more than doubled the likelihood of adoption. Dogs spent more time engaging in appropriate behavior such as lying down next to potential adopters and less time engaging in inappropriate behavior such as ignoring play initiatives from potential adopters during the structured interactions. Furthermore, we demonstrated that this intervention was not more time consuming and was not perceived by potential adopters as more invasive than a regular unstructured interaction.

Acknowledgements

The authors thank the Humane Society Veterinary Medical Association for providing funding for the study. We thank Lindsey Mehrkam and Julie Hecht for assistance with play preference assessment design and Nathaniel Hall for assistance with statistics. The authors thank the student research assistants with data collection and video analysis: Courtney Alexander, Rachel Bradley, Nancy Ordax, Jessica Vondran, Sarah Weinsztok, Monica Perdomo, Devin Caballero, Austin Folger, Kissel Goldman, Estafania Junco, Caroline Leibrecht, Jonathan Pruitt, and Kaila Ames. Finally, we greatly thank the staff and dogs of Alachua County Animal Services.

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.2015.12.003.

References