

## Development of the Bonding with Dog Checklist (BoDC)

Sarah C. Martinez<sup>1</sup>, Annmarie Cano<sup>1</sup>, Rita J. Casey<sup>1</sup>,  
Amy Johnson<sup>2</sup>, Dana May<sup>1</sup>, & Lee H. Wurm<sup>1</sup>

<sup>1</sup>Wayne State University  
<sup>2</sup>Teacher's Pet of Michigan

The growing interest in the mechanisms through which human-animal interaction (HAI) benefits humans suggests that new measures are needed to assess human bonding, especially to non-owned animals (i.e., animals that are not the human's pet). The current study addressed this need by developing and testing a new measure to assess human bonding behavior with non-owned animals, during an animal-assisted intervention that incorporated shelter dogs. An observational measure, a 12-item Bonding with Dog Checklist (BoDC), was created based on prior work on dog bonding and attachment. Participants in the study were incarcerated adolescents residing in two juvenile detention centers ( $N = 131$ ). An Exploratory Factor Analysis resulted in a final 7-item measure with a single factor structure and good inter-item reliability ( $\alpha = .864$ ). Raters used the 7-item BoDC to assess bonding of youth with dogs as they trained or walked shelter dogs during a 10-week intervention. Seventeen raters were trained in use of the observational measure and attended weekly supervision meetings. BoDC scores increased over the sessions and the BoDC was moderately correlated with a measure of dog attachment in the first half of the intervention, providing some evidence for construct validity. These results provide preliminary evidence for the BoDC as a reliable and valid measure to assess human bonding to animals that are not their personal companions.

*Key words:* human bonding, human-dog dyad, human-animal interaction instruments, measures

Correspondence regarding this manuscript should be addressed to Annmarie Cano, Department of Psychology, Wayne State University, 5057 Woodward Avenue, Detroit, MI 48202, email: [acano@wayne.edu](mailto:acano@wayne.edu).

This research was supported by grant R03HD070621 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development and Mars-WALTHAM®.

In recent years, an increasing amount of research has focused on the human-animal bond. Studies have shown that a relationship between a companion animal and a human can offer psychological and social benefits to humans, including but not limited to a decrease in perceived stress (Hoffmann et al., 2009; Lass-Hennemann, Peyk, Streb, Holz, & Michael, 2014), depressive symptoms (Souter & Miller, 2007; Tower & Nokota, 2006), and loneliness (Black, 2012). Having

a companion animal also predicts an increased survival rate after individuals suffer life threatening heart problems (Friedmann, Thomas, & Son, 2011) and a decrease in physiological responses in reaction to stress (Friedmann, Thomas, Son, & Chapa, 2013; Kingwell, Lomdahl, & Anderson, 2001). These findings have led researchers to investigate attachment primarily as a mechanism through which companion animals influence human

adjustment. It is clear that animals can serve as attachment figures for humans (Krause-Parello, 2008; Kurdek, 2009; O'Haire, 2010; Payne, Bennett, & McGreevy, 2015; Poresky, Hendrix, Hosier, & Samuelson, 1987; Walsh, 2009) as shown by the majority of people who consider their pets as family members and sources of love and affection (Albert & Bulcroft, 1988). However, the mechanisms behind the human-animal attachment relationship remain unclear.

Bonding behaviors may explain the manner in which human-animal attachment forms over time. Researchers have suggested that bonding behaviors (e.g., physical touch, positive reinforcement) exhibited between animal and human can aid in forming an attachment (Payne et al., 2015). Bowlby's (1969, 1982) work with parent-child attachment relationships has been applied to the development of these relationships between humans and animals (Payne et al., 2015; Payne, DeAraugo, Bennett, & McGreevy, 2016) specifically useful in animal-assisted interventions (AAI) in which the primary focus is to assess the benefits of human-animal interaction (HAI). A current question surrounding attachment concerns what behaviors help form these attachment relationships. As Rehn and Keeling (2016) point out, the term "bond" and "relationship" are used interchangeably in HAI literature, creating a conceptual challenge to define behaviors seen in human-animal interaction that may lead to attachment between a person and an animal. Bonding behaviors and attachment are conceptualized here as distinct but related constructs. Although both include emotional or affective components, attachment is conceptualized as referring to the quality of connectedness with another being, whereas bonding behaviors refer to discrete actions that promote connectedness and attachment. With varied research designs and methodologies in human-animal interaction research, bonding behaviors are

difficult to recognize and assess in AAIs (Fournier, Berry, Letson, & Chanen, R. 2016; Mueller, 2014). These challenges have led to a call from researchers to develop instrumentation that assesses observable behaviors between animal and human to meet an important need in the human-animal interaction literature. Whereas assessing human attachment to dogs (e.g., a perceived close relationship of a person with familiar animals, such as pets, that are reciprocated by the animals) can be important, doing so may not capture the particular human behaviors that create human-dog attachment relationships. Therefore, it is critical to assess bonding behaviors in relation to the mechanisms that lead to attachment.

Unfortunately, there is a limited amount of research on bonding mechanisms between humans and animals, making it difficult to establish a clear, valid set of behaviors that characterize bonding. The majority of available instruments are self-report measures assessing humans' attachment, caretaking, and felt emotion toward their companion animals. Attachment measures include the Companion Animal Bonding Scale (CABS), CENSHARE Pet Attachment Survey (PAS), Lexington Attachment to Pet Scales (LAPS), and Owner Pet Relationship (OPR) (Holcomb, 1985; Johnson, Garrity, & Stallones, 1992; Poresky et al., 1987; Winefield, Black, & Chur-Hansen, 2008), as collected in Anderson's (2007) compendium of human-animal interaction measures. These measures have assisted researchers to make significant contributions to understanding attachment and related behaviors and attitudes in human-animal interaction. However, these measures may not be appropriate for assessing human-animal interactions that occur in other contexts, including AAIs and other contexts, in which the animals are not owned by the persons with whom they interact. With such animals, particularly in transitory situations

such as therapy, an attachment between a person and an animal has yet to be formed. Thus, it is difficult to use existing measures that rely on companion-animal specific language (e.g., “my pet”), that evaluate caretaking behaviors (e.g., feeding and grooming), and that focus on an established relationship between a human and animal.

Rather than attachment and caretaking behaviors, it is likely more appropriate to assess human bonding behaviors with animals that are either not (yet) companion animals or not owned by the human with whom they interact. Bonding consists of those behaviors that may help foster the development of a close, attachment relationship between human and animal. For instance, petting, kneeling down to an animal’s level, or gently talking to an animal could constitute human bonding behaviors that occur with animals that are not owned by the person. Attachment is conceptualized as a variety of emotions, attitudes, and behaviors such as seeking proximity when distressed, a perception that another being is a secure base/safe haven, and perceptions of emotional support (Bowlby, 1969, 1982). In HAI research, it has been acknowledged that these constructs are present in a human-animal relationship (Zilcha-Mano, Mikulincer, & Shaver, 2012); however, it is unknown how the manner in which these perceptions develop or how they translate into humans’ behaviors toward animals, because as stated earlier, the majority of measures assess feelings and thoughts. Perhaps, hugging an animal could be seen as an emotional support-seeking behavior or petting an animal could be seen as a proximity-seeking behavior. These actions may as well be common behaviors seen between strongly attached pets and their owners, but only sometimes will a person initiate such actions toward an animal that is not their pet. New measures are needed to assess bonding behaviors that might be more

easily recognized in non-owned animals. In AAIs, participants typically interact with non-owned animals, and there have been beneficial outcomes to these types of studies (Bert, 2016) but it is unknown why or how these beneficial outcomes manifest. These types of bonding behaviors could indeed be a precursor to an attachment relationship that may promote the beneficial effects of AAIs. Understanding this human-animal bonding process could enhance validated animal-assisted interventions by clarifying why and how such interventions work (Palley, O’Rourke, & Niemi, 2010), yet no studies have investigated bonding as a mechanism of action. Observable measures to assess bonding behavior between humans and non-companion animals are especially necessary as researchers become increasingly interested in bonding as a mechanism through which AAIs work. The current study focuses on human bonding behaviors with dogs that are not yet companion animals (i.e., dogs residing at an animal shelter, that are up for adoption).

In sum, it is likely that bonding behaviors contribute to attachment; that is, bonding is a mechanism through which animal-assisted interactions could develop and ultimately generate attachment. By developing a capacity for attachment, human adjustment is improved. However, the current evidence is limited because it has not been possible to assess human bonding behaviors with non-companion animals and, in particular, non-companion dogs. Existing measures of dog attachment and bonding rely on self-reports of attachment with companion animals (Johnson, Odendaal, & Meadows, 2002). The objective of this study was to develop and provide a preliminary test of the Bonding with Dog Checklist (BoDC), an observational bonding measure that could be used to assess and track bonding exhibited by humans toward non-companion dogs. The BoDC was developed as an observational

checklist, given the assumption that bonding is demonstrated through observable behaviors rather than self-report perceptions of the human-animal relationship, and to guard against biases in humans' perceptions of their relationships with animals that are not their pets. The BoDC was designed to be brief and easy to use with limited training. The BoDC was administered during clinical trial sessions of an animal-assisted intervention for adjudicated adolescents that involved two different kinds of interaction with shelter dogs. It was expected that the BoDC would demonstrate good inter-item reliability in its evaluation of bonding behavior in both intervention and control groups of participants and that it would be sensitive to change over time. It was also expected that the BoDC would be positively correlated with a self-report measure of attachment to the shelter dogs. Support for these hypotheses would indicate preliminary evidence for the reliability and validity of the BoDC, which could be used in a variety of contexts to assess bonding behavior between humans and non-companion animals.

## Methods

### *Participants*

One hundred and thirty one adjudicated adolescents were recruited from two juvenile facilities in Michigan to participate in an AAI that included difficult to adopt shelter dogs. To be eligible for the study, adolescents had to be between the ages of 13-17 years old. The adolescents included were scheduled to remain in the facility for the duration of the program; however, there was no requirement for duration of residence at the facilities. Of the 131 adolescents, 89 (67.9%) were male and 42 (32.1%) were female. This reflects the national statistics of adolescent male offenders outnumbering adolescent female offenders in juvenile

detention centers (*Juvenile Offenders and Victims: 2014 National Report*, 2014). The mean age for participants was 15.67 (SD = .92). By their own identification, a majority of participants were White (n = 60, 45.8%), 57 (43.5%) were Black, 5 (3.8%) were Hispanic, 5 (3.8%) identified as other, and 4 (3.1%) were bi-racial.

The difficult to adopt shelter dogs involved in the program initially showed a range of essential behavior problems such as jumping, walking poorly on a leash, and non-aggressive lack of socialization. The majority of dogs were adult (1 year and older) and ranged in weight from 7-100 pounds. Before entering the program, dogs underwent several evaluations including a health exam and behavioral evaluation. Once determined healthy and safe for human and other dog interaction, the dogs were declared suitable to participate in the program. Dogs were transported between facilities by program staff and \$500 dollars was provided to the shelters by the researchers for cost of animal care.

### *Procedure and Measures*

The study was approved by Wayne State University's Institutional Review Board. The University's Institutional Animal Care and Use Committee (IACUC) did not review the study because the dogs were not research subjects, although the committee was provided with proof of humane care by the animal shelters. Parental or advocate permission and adolescent assent were obtained prior to participation in the study. The data presented here were part of a larger study that was a clinical trial comparing an animal-assisted intervention to a dog-walking control group. Successive cohorts of participants were randomly assigned to a dog-training (experimental) group (n = 83) or a dog-walking (control) group (n = 48) for 10 weeks. Eleven cohorts of participants were

run through the study. Both groups attended a twice-weekly humane education class in addition to their hour long, bi-weekly dog walking or training time. In the dog-training group, adolescents trained one shelter dog across 10 sessions (first 5 weeks) and a second dog across the last 10 sessions (last 5 weeks). The analyses below were conducted for the first 10 sessions and last 10 sessions separately to account for the change in dogs. In the dog-walking group, adolescents walked up to two different dogs each session for an hour twice per week. Because the goal of this paper was to assess the BoDC's reliability and not to evaluate the outcomes of the intervention, further details about the intervention are not provided here. More information about specifics of the intervention is available by contacting the second author.

#### *BoDC Instrumentation*

Items on the BoDC were generated in a theoretical and practical manner: 1) based on the bonding behavior and proximity-seeking literatures that identify various behaviors conducive to bond formation and 2) through consultations with dog trainers associated with Teacher's Pet of Michigan, a non-profit run by the fourth author that is dedicated toward humane education and community outreach aimed at enhancing the adoptability of shelter dogs. Teacher's Pet of Michigan runs multi-week sensory-based integration programs that use the human-animal bond to help troubled youth manage, control, and prevent negative behavior and also improve anger management, patience, empathy and self-esteem. Dog trainers in this program are trained by the fourth author to deliver this program and attend to youth behaviors including bonding behavior. Bonding behaviors were identified that had been witnessed by the dog trainers and the fourth author in the field and that had

appeared to indicate behaviors indicative of bonding. These behaviors were also judged to be easily observable within a 6-foot radius, and thus observable to a trained rater who could remain physically distant enough to not interfere with the human-dog interaction (see Table 1 for list of behaviors).

#### *BoDC Rating Procedure*

Trained undergraduate student raters ( $n = 17$ ) observed and rated adolescent-dog interactions on various behaviors displayed during the dog walking or training time using the Bonding with Dog Checklist (BoDC). Raters were not involved in any other aspects of the intervention nor did they have expertise in dog behavior beyond personal knowledge with their own companion animals. Finally, raters were not aware of the history of the youth they were rating; thus, observations were not influenced by knowledge of the adolescents' backgrounds or reasons for residing at the detention center. The initial 12-item observational measure evaluated bonding behavior expressed by a human toward a dog (see Table 1 for a list of the behaviors as well as frequencies of each behavior across all sessions). Since behaviors on the BoDC are easily observable, raters determined whether a behavior was present (if a behavior is observed during the interaction) or absent (if a behavior is not observed in the interaction). The raters were trained and collected data across 11 cohorts of study participants. The first and fourth authors trained raters through a detailed orientation to the BoDC, which included proper dress and protocol when visiting the facilities, as well as the importance of remaining attentive but not interfering with the adolescent-dog interactions. Raters were instructed to refrain from program-related conversations with the adolescents but to engage in general conversation (e.g., "How are you doing today?") if an adolescent

initiated conversation. If an adolescent seemed wary of a rater, raters were directed to inquire about the adolescent's dog or to comment on the teen's effort working with the dog, to establish a degree of comfort. The goal was for the rating to be unobtrusive and by all accounts, it appears that this approach was successful. Note that live coding was necessary given the sample and location: minors who were incarcerated. Video recording of the sessions was not permitted by the juvenile detention centers.

Raters were assigned to both detention sites to observe the sessions. Initial raters were mentored on-site by the first and fourth authors in conducting the ratings; later, new raters were mentored by more senior trained raters during the adolescent-dog interaction sessions. Adolescents were informed that raters would attend some of the sessions to observe; however, they were not told that the raters would be assessing bonding behaviors so as not to unduly influence adolescent behaviors. Bi-weekly supervision sessions for raters were led by the first author throughout the study to maintain rater adherence to the rating protocol and item definitions and prevent rater drift. Supervision included detailed discussions about the behaviors that would constitute a rating of "present." Hypothetical and actual examples were also discussed. Raters were encouraged to supply questions and present difficulties in making a rating so that the team of raters could achieve agreement for future ratings. A rating "tip sheet" was also developed to aid raters in their work, which included general rater demeanor and comportment at the detention centers and ideas for observing unobtrusively. Inter-rater testing was not logistically possible because dogs were kept several yards from each other during the training in order to limit interference with other dogs or adolescents. In addition, the constant movement of

adolescents and dogs required raters to follow the adolescents wherever they went with the dogs, making notes and ratings of individuals as behaviors on the checklist were observed, and completing their rating sheets immediately after the session. It was also necessary to minimize social desirability and demand effects by ensuring that multiple raters were not surrounding a single youth as he or she walked or trained a dog, which could have interfered with the participant's freedom of movement, attention of the dog or the adolescent, and showing their authentic selves.

### *Dog Attachment*

An adapted measure of dog attachment was also administered to the adolescents to test the construct validity of the BoDC. Five items were selected from the CABS (Poresky et al., 1987) that consisted of perceived closeness and responsiveness to one's pet as well as five items from the Affectionate Companion subscale that assessed safe haven and secure base from the Pet Relationship Scale (Kafer, Lago, Wamboldt, & Harrington, 1992). These 10 items were chosen because they did not assume a pre-existing or companion-type relationship with the animal. The 10 items were summed to create a total dog attachment score. The self-report measure was administered to the participants in both groups at baseline ( $M = 52.36$ ,  $SD = 11.47$ , Cronbach's  $\alpha = .836$ ), mid-intervention ( $M = 49.22$ ,  $SD = 16.00$ ,  $\alpha = .887$ ), and post-intervention ( $M = 56.38$ ,  $SD = 11.55$ ,  $\alpha = .843$ ). A  $t$ -test was also conducted to test intervention and control group differences in attachment. Results showed no group differences in attachment at baseline  $t(112) = .495$ ,  $p = .622$ ), mid-intervention  $t(70) = .726$ ,  $p = .470$ , and post-intervention  $t(119) = -.486$ ,  $p = .628$ ).

**Table 1.** Bonding with Dog Checklist (BoDC) Item Frequencies Across All Sessions and Inter-item Reliability.

Item	Frequency of Each Item Across Sessions		
	Dog Training Intervention Group	Dog Walking Control Group	Entire Sample
1. Pats animal*	90%	84%	88%
2. Strokes animal*	88%	78%	85%
3. Hugs, rubs or scruffs-up animal's coat*	70%	59%	67%
4. Looks at animal and smiles*	78%	73%	77%
5. Praises animal's performance*	85%	71%	80%
6. Expresses affection for animal*	73%	66%	71%
7. Kisses dog	14%	16%	15%
8. Youth smiles or pats dog when animal does affectionate things like this*: - Animal leans against the youth while not actually performing instruction (or walking) - Animal places his head on the youth's lap or arm when the youth is seated - Animal licks the youth	71%	57%	67%
9. Youth cries, becomes sad, or teary-eyed as graduation day draws near	8%	3%	7%
10. Youth becomes upset if he/she thinks his/her dog is sick	3%	4%	4%
11. Youth treats dog roughly (e.g. pushes, pulls dog)	2%	3%	3%
12. Youth labels dog negatively (e.g. "bad dog")	2%	2%	2%

*Note.* Responses to each item included Absent (0) or Present (1). Overall  $\alpha = .78$ .

\* indicates items that were retained after the Exploratory Factor Analysis.

## Results

### *Exploratory Factor Analysis*

An Exploratory Factor Analysis (EFA) with varimax rotation was conducted on the 12-item scale. Initial results showed that 7 items (Items 1-6, 8) appeared to assess a single dog bonding construct, whereas 4 items did not. Examination of the items that

were not included in the final EFA showed that the poorly fitting items were observed infrequently compared to the other items (see Table 1). In addition, Items 9 - 12 appeared to tap, not into bonding behaviors, but affect and emotion. Specifically, Items 9 and 10 appeared to assess compassion for the dog whereas Items 11 and 12 appeared to tap into negative affect directed toward the dog.

When the EFA was conducted again with the 7 items, the single-factor solution accounted for 56.6% of the variance. The factor solution is displayed in Table 2. The 7-item BODC demonstrated good inter-item

reliability (Overall Cronbach’s  $\alpha = .864$ ; Intervention Group  $\alpha = .856$ ; Dog Walking Control Group  $\alpha = .870$ ) and was used in the analyses described below.

**Table 2.** Component Matrix of 7-item BoDC and Correlations of Each Item with Entire Scale.

Item	Loading	Correlation with Entire Scale if Item Deleted
1. Pats animal	.741	.856
2. Strokes animal	.807	.846
3. Hugs, rubs or scruffs-up animal’s coat	.764	.853
4. Looks at animal and smiles	.788	.845
5. Praises animal’s performance	.644	.871
6. Expresses affection for animal	.673	.857
8. Youth smiles or pats dog when animal does affectionate things like this:		
- Animal leans against the youth while not actually performing instruction (or walking)		
- Animal places his head on the youth’s lap or arm when the youth is seated	.832	.838
- Animal licks the youth		

*Note.* Overall  $\alpha = .86$ .

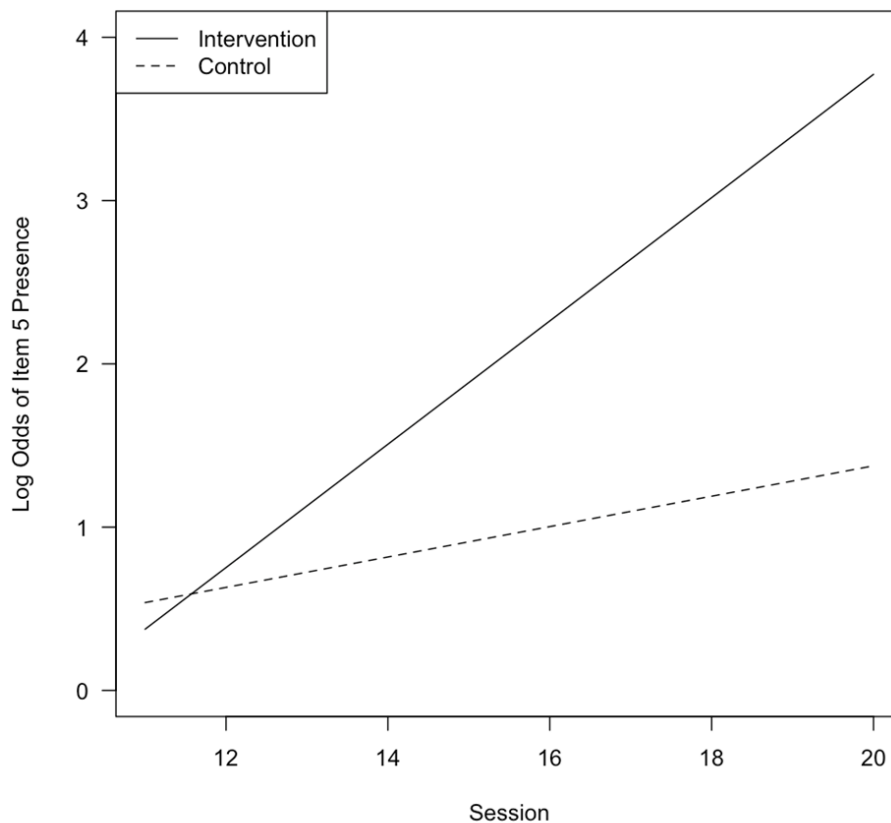


### Changes in the BoDC over time

Multilevel modeling analyses were conducted to test the second hypothesis that the BoDC would be sensitive to change over time. Multilevel analyses were chosen because multiple ratings were provided for each participant over the course of time. The statistical models included main effects for session number and group (coded 1 if intervention and 2 if dog walking control group) as well as the interaction between these two variables to test the possibility of differential change in the two groups. Random effects accounted for the nesting of BoDC scores within individuals over time. Recall that the intervention was 10 weeks long with two sessions per week (i.e., 20 sessions over 10 weeks). Analyses were run

separately for each 10-session/5-week block because adolescents in the intervention group worked with a single dog for the first 10 sessions and another dog for the second 10 sessions. The interaction between group and session was not significant in either time frame, suggesting that groups did not experience significantly different changes in bonding across sessions for the first half ( $p > .15$ ) or the second half ( $p > .15$ ) of the program.

However, there were some main effects of group and session. Bonding scores were slightly greater in the intervention group than in the control group during the first half of the program ( $b = -.55$ , S.E. = .30,  $df = 127.57$ ,  $t = -1.81$ ,  $p = .073$ ), and significantly greater than the control group in the second half of the program ( $b = -.81$ , S.E.



**Figure 1.** Significant Interaction Between Session and Group in Predicting the Log Odds of Reporting Item 5 “Praises Animal Performance” in the Second Half of the Program.

= .27,  $df = 115.35$ ,  $t = -3.02$ ,  $p = .003$ ). In addition, when group was held constant, BoDC scores increased significantly over sessions for the first half of the program ( $b = .11$ ,  $SE = .04$ ,  $df = 98.35$ ,  $t = 2.51$ ,  $p = .014$ ) but no significant change was observed for the second half of the program ( $b = .05$ ,  $SE = .04$ ,  $df = 85.61$ ,  $t = 1.32$ ,  $p = .19$ ).

One might argue that the intervention group had higher bonding scores simply because certain BoDC items might reflect training behaviors. An inspection of the items revealed that the content of Item 5 (“Praises animal’s performance”) may be one such item because praise is often involved in training activities. Binomial multilevel analyses (performed because the dependent variable was dichotomous) showed that there were no group or session differences found on Item 5, nor was there a significant interaction between group and session in predicting Item 5 for the first half of the program. However, in the second half of the program, there was a significant group by session interaction ( $b = -.28$ ,  $SE = .11$ ,  $z = -2.48$ ,  $p = .013$ ). Figure 1 displays the interaction effect, which showed that the odds of this behavior being observed over the second half of the program was greater for the intervention group as compared to the control group.

#### *Bonding, Attachment, and Affective Reactions*

Finally, the third hypothesis was that the BoDC would correlate with a measure of dog attachment. This hypothesis was tested in two ways. First, multilevel analyses were performed to examine the correlation of bonding scores and dog attachment while accounting for the fact that each participant provided multiple bonding scores. Second, Pearson Product-Moment correlations were computed, collapsing or averaging across the bonding scores for each participant. These

analyses were performed twice, once to examine the correlation of BoDC scores through the first half of the program with dog attachment assessed at session 10 (i.e., after intervention participants completed their work with their first dog and before they met their second dog) and again to examine the correlation of BoDC scores from session 11 to session 20 with dog attachment assessed at completion of the 10-week program.

During the first 5 weeks, the association between bonding scores and dog attachment scores assessed at the completion of the first 5-week segment approached significance,  $b = .025$ ,  $SE = .013$ ,  $df = 67.30$ ,  $t = 1.89$ ,  $p = .064$ ; Pearson  $r(70) = .22$ ,  $p = .061$ . A group by bonding interaction was also explored in predicting attachment, but was not significant ( $p > .08$ ).

Bonding scores assessed during the second half of the program were not significantly correlated with attachment scores assessed upon program completion ( $b = .003$ ,  $SE = .013$ ,  $df = 116$ ,  $t = .259$ ,  $p = .79$ ; Pearson  $r(124) = .05$ ,  $p = .593$ ). Group did not interact with bonding scores to relate to attachment assessed at the end of the second half of the program ( $p > .22$ ).

## **Discussion**

Human-animal interaction research has suggested that attachment to animals fosters a host of positive outcomes for humans (Peacock, Chur-Hansen, & Winefield, 2012). To this end, researchers have created several measures that assess humans’ perceived attachment and related behaviors, such as caretaking (Anderson, 2007). Because an attachment has yet to be formed with these animals, measures that assess human bonding behaviors may be more appropriate than focusing on the presence of attachment (Payne et al., 2015). Yet there is a dearth of measures that can be used to assess human bonding behaviors toward animals. Our aim was to develop and

test an assessment tool to measure human bonding behaviors as they occur with non-owned animals, the Bonding with Dog Checklist (BoDC), which can be used to address this gap in the literature.

As expected, the BoDC demonstrated good inter-item reliability in both groups of participants. In addition, it was hypothesized that the BoDC would be sensitive to change. Indeed, bonding behavior expressed by the adolescents increased through the first half of the program. Although the two groups of participants did not show differential changes in bonding over the sessions, bonding scores were higher for the intervention group than for the control group in the first half and significantly higher than the control group in the second half. The higher scores for the intervention group may have been due to training activities in the intervention, which fostered greater youth engagement with the dogs. It is also important to note that the items are not strictly training-related. That is, the items do not assess clicker training or other training behaviors that are a part of the training. However, it is possible that training activities are a catalyst for fostering bonding behaviors. The intervention group participants interacted with the same dog for each 5-week session compared to the participants in the control group who interacted with a different dog each session. As the intervention group spent more time with their individual dog, it is likely they would have displayed more bonding behaviors due to forming a relationship. In fact, for the item “praising animal’s performance”, an increase in this behavior was observed in the latter half of the program for the intervention group only. It is also possible that differential changes over time by group may occur in a step-wise or non-linear fashion, patterns that were not assessed in this study; thus, additional work is needed to examine differential time courses of bonding behaviors.

The BoDC was marginally positively correlated with self-reported dog attachment after working with the first dog (i.e., first half of the program), providing some preliminary evidence for the construct validity of the new observational measure. However, in the second half of the program, the BoDC was not significantly correlated with dog attachment. The null association in the second half of the program could be due participants’ experiences with their first dog. Anecdotally, adolescents in the intervention group expressed joy that the dogs from the first half of the program were going to be adopted, but they also reported sadness that they would not continue to work with their first dogs. It is possible that they were then guarded when working with a second dog, even to being less likely to exhibit behaviors that could build into a deeper relationship that might again be severed when this second dog went away. Another possibility for the lack of an association between bonding and dog attachment in the second half of the program is that adolescents reported sadness about the entire program’s conclusion. Given the population of the study (at-risk incarcerated youth), several of whom had multiple placements prior to incarceration; it is possible that participants had faced interpersonal challenges that may have affected their interactions with the dogs. Multiply-placed youth, for example, have increasing trouble developing close relationships with each change in foster family placement (Newton, Litrownik, & Landsverk, 2000; Terling-Watt, 2001). In this case, a distrustful youth may not be willing to exhibit affection towards a dog. In addition, it is likely that the opposite of this occurred in which a dog expressed some sort of behavior that prompted the youth to interact with it. Although the BoDC only measured the unidirectional aspect of human behavior towards dogs, it is conceivable that dog behavior also had an influence in the

interactions. It is also important to note the attachment measure used was derived from a measure of pet attachment; therefore, this measure may not adequately assess attachment to a non-companion dog. Nevertheless, the modest correlation of the BoDC with dog attachment supports the assumption that the BoDC is measuring bonding behavior and not attachment. This result is consistent with current research that indicates that human-animal attachment measures tend to focus on perceptions and beliefs in line with theoretical components of attachment such as secure base, emotional bond, and seeking proximity (Crawford, Worsham, & Swinehart, 2006), rather than behaviors that might promote that bond. Continued work on the assessment and predictive validity of bonding behaviors is necessary, especially in AAIIs that utilize non-pet animals for brief interventions.

The current findings must be interpreted in light of the study's limitations. First, the sample consisted of youth from an incarcerated adolescent population. The BoDC should be tested in other populations such as adults, as well as adolescents who are not in the juvenile justice system. BoDC's inter-rater reliability was not examined in this study, in part because of the ban on video recording at the sites, which did not allow another coder to rate bonding behaviors in the laboratory. In addition, there was a concern that additional live raters following each participant would affect their behavior, resulting in biased estimates of bonding. Nevertheless, a necessary next step in the development of this measure is to establish inter-rater reliability. The measure was created in the context of an animal-assisted intervention that included shelter dogs. Further work is needed to determine whether the measure is suitable for other settings in which humans may bond with dogs (e.g., animal adoption) and whether the measure can be adapted to assess bonding behaviors

toward other animals. Finally, the behavior of the dogs was not assessed in this study. Dog behaviors are very likely to influence human bonding behaviors as research indicates that human-dog relationships are bi-directional as opposed to uni-directional (Payne et al, 2015). However, most research focuses on the human component of the interaction, rather than also including the influence of dog behaviors toward humans (Payne et al., 2015). Thus, research is needed to determine the extent to which dog behaviors influence human bonding behaviors. It is promising that other research groups are interested in the assessment of human-animal interaction behaviors. For instance, the Human-Animal Interaction Scale (HAIS) (Fourier et al., 2016) is a self-report measure that assesses human and animal behaviors after an interaction; however, more research is needed on the assessment of bonding behaviors that could signal the development of an attachment relationship. In addition, work is needed to investigate the reciprocal bonding behaviors between humans and dogs that could contribute to attachment representations in both dogs and humans. Despite the findings that the BoDC was reliable across raters and cohorts, which suggests that it is also reliable across dogs, continued work is needed to determine if the BoDC is in fact sensitive to dog responsiveness. Additional work is needed to also norm the measure in other populations including adults and those who care for animals, such as shelter workers and dog care professionals.

In addition, there are several opportunities to further develop the BoDC as a useful measure of dog bonding. For instance, participants could be asked to evaluate their own behaviors toward animals (see HAIS) as well as their own bonding with the same quantitative measure to compare observer and self-reports. Qualitative approaches could also be used to assess

adolescents' perceptions of bonding to inform future item development. Another approach is to explore alternative response formats to determine whether a frequency count of each bonding behavior would enhance the feasibility of the measure. A presence vs. absence rating system was used to account for the fact that raters spent variable amounts of time observing adolescents during the sessions. The variation depended on number of human-dog pairs to rate, weather conditions, or other situational variables.

In conclusion, the BoDC is a novel measure that assesses human bonding behaviors with non-companion animals. There is a great need for bonding behaviors to be studied with non-companion animals,

which are often the focus in animal-assisted intervention and therapy. Our measure proved reliable during the course of a randomized control trial of an animal-assisted intervention. Current research is limited concerning the influence of bonding with animals on human adjustment. Thus, it is critical that future research explores the extent to which human bonding with animals explains important positive effects, including perceived attachment, that are reported from animal-assisted interventions. Additional research is needed to understand the nature of this association of bonding with animals and improved human outcomes, how these processes change over time, and how they might be the mechanisms for successful animal-assisted interventions.

## References

- Albert, A., & Bulcroft, K. (1988). Pets, families, and the life course. *Journal of Marriage and the Family*, 50(2), 543. doi: <http://dx.doi.org/10.2307/352019>
- Anderson, D. C. (2007). *Assessing the Human-Animal Bond: A Compendium of Actual Measures*. West Lafayette, IN: Purdue University Press.
- Bert, F. (2016). Animal assisted intervention: A systematic review of benefits and risks. *European Journal of Integrative Medicine*, 8(5), 695-706. doi: <http://dx.doi.org/10.1016/j.eujim.2016.05.005>
- Black, K. (2012). The relationship between companion animals and loneliness among rural adolescents. *Journal of Pediatric Nursing*, 27(2), 103-112. doi: <http://dx.doi.org/10.1016/j.pedn.2010.11.009>
- Bowlby, J. (1969). *Attachment and loss, VI*. New York: Basic Books.
- Bowlby, J. (1982). Attachment and Loss: retrospect and prospect. *American Journal of Orthopsychiatry*, 52(4), 664-678. doi: [10.1111/j.1939-0025.1982.tb01456.x](https://doi.org/10.1111/j.1939-0025.1982.tb01456.x)
- Crawford, E. K., Worsham, N. L., & Swinehart, E. R. (2006). Benefits derived from companion animals, and the use of the term "attachment". *Anthrozoös*, 19(2), 98-112. doi: [10.2752/089279306785593757](https://doi.org/10.2752/089279306785593757)
- Fournier, A.K., Berry, T.D., Letson, E., & Chanen, R. (2016). The human-animal interaction scale: Development and evaluation. *Anthrozoös*, 29(3), 455-467. doi: <http://dx.doi.org/10.1080/08927936.2016.1181372>
- Friedmann, E., Thomas, S. A., & Son, H. (2011). Pets, depression and longterm survival in community living patients following myocardial infarction. *Anthrozoös*, 24(3), 273-285. doi: [10.2752/175303711X13045914865268](https://doi.org/10.2752/175303711X13045914865268)
- Friedmann, E., Thomas, S. A., Son, H., & Chapa, D. (2013). Pet's presence and owner's blood pressures during the daily lives of pet owners with pre-to mild hypertension. *Anthrozoös*, 26(4), 535. doi: <http://dx.doi.org/10.2752/175303713X13795775536138>
- Hoffmann, A. O. M., Lee, A. H., Wertenuer, F., Ricken, R., Jansen, J. J., Gallinat, J., & Lang, U. E. (2009). Dog-assisted intervention significantly reduces anxiety in hospitalized patients with major depression. *European Journal of Integrative Medicine*, 1(3), 145-148. doi: [10.1016/j.eujim.2009.08.002](https://doi.org/10.1016/j.eujim.2009.08.002)
- Holcomb, R., Williams, C.R., Richards, S.P. (1985). The elements of attachment: Relationship

- maintenance and intimacy. *Journal of the Delta Society*, 2(1), 28-34.
- Johnson, R. A., Odendaal, J. S. J., & Meadows, R. L. (2002). Animal-assisted interventions research: Issues and answers. *Western Journal of Nursing Research*, 24(4), 422-440. doi: 10.1177/01945902024004009
- Johnson, T. P., Garrity, T. F., & Stallones, L. (1992). Psychometric Evaluation of the Lexington Attachment to Pets Scale (Laps). *Anthrozoös*, 5(3), 160-175. doi: 10.2752/089279392787011395
- Juvenile Offenders and Victims: 2014 National Report*. (2014). Pittsburgh, PA: National Center for Juvenile Justice.
- Kafer, R., Lago, D., Wamboldt, P., & Harrington, F. (1992). The Pet Relationship Scale: Replication of psychometric properties in random samples and association with attitudes toward wild animals. *Anthrozoös*, 5(2), 93-105. doi: <http://dx.doi.org/10.2752/089279392787011476>
- Kingwell, B., Lomdahl, A., & Anderson, W. (2001). Presence of a pet dog and human cardiovascular responses to mild mental stress. *Clinical Autonomic Research*, 11(5), 313-317. doi: 10.1007/BF02332977
- Krause-Parello, C. A. (2008). The Mediating Effect of Pet Attachment Support Between Loneliness and General Health in Older Females Living in the Community. *Journal of Community Health Nursing*, 25(1), 1-14. doi: 10.1080/07370010701836286
- Kurdek, L. A. (2009). Pet dogs as attachment figures for adult owners. *Journal of family psychology*, 23(4), 439-446. doi: 10.1037/a0014979
- Lass-Hennemann, J., Peyk, P., Streb, M., Holz, E., & Michael, T. (2014). Presence of a dog reduces subjective but not physiological stress responses to an analog trauma. *Frontiers in Psychology*, 5, 1010. doi: 10.3389/fpsyg.2014.01010
- Mueller, M.K. (2014). The relationship between types of human-animal interaction and attitudes about animals: An exploratory study. *Anthrozoös*, 27(2), 295-308. doi: <http://dx.doi.org/10.2752/175303714X13903827487728>
- Newton, R., Litrownik, A., and Landsverk, J. (2000). Children and youth in foster care: Disentangling the relationship between problem behaviors and number of placements. *Child Abuse and Neglect*, 24(10), 1363-74. doi: [http://dx.doi.org/10.1016/S0145-2134\(00\)00189-7](http://dx.doi.org/10.1016/S0145-2134(00)00189-7)
- O'Haire, M. (2010). Companion animals and human health: Benefits, challenges, and the road ahead. *Journal of Veterinary Behavior: Clinical Applications and Research*, 5(5), 226-234. doi: <http://dx.doi.org/10.1016/j.jveb.2010.02.002>
- Palley, L. S., O'Rourke, P. P., & Niemi, S. M. (2010). Mainstreaming animal-assisted therapy. *ILAR Journal*, 51(3), 199-207. doi: <http://dx.doi.org/10.1093/ilar.51.3.199>
- Payne, E., Bennett, P. C., & McGreevy, P. D. (2015). Current perspectives on attachment and bonding in the dog-human dyad. *Psychology Research and Behavior Management*, 8, 71-79. doi: <http://dx.doi.org/10.2147/PRBM.S74972>
- Payne, E., DeAraugo, J., Bennett, P., & McGreevy, P. (2016). Exploring the existence and potential underpinnings of dog-human and horse-human attachment bonds. *Behavioural Processes*, 125, 114-121. doi: <http://dx.doi.org/10.1016/j.beproc.2015.10.004>
- Peacock, J., Chur-Hansen, A., & Winefield, H. (2012). Mental health implications of human attachment to companion animals. *Journal of Clinical Psychology*, 68(3), 292-303. doi: 10.1002/jclp.20866
- Poresky, R. H., Hendrix, C., Hosier, J. E., & Samuelson, M. L. (1987). The companion animal bonding scale- internal reliability and construct validity. *Psychological reports*, 60(3), 743-746. doi: 10.2466/pr0.1987.60.3.743
- Rehn, T., & Keeling, L.J. (2016). Measuring dog-owner relationships: Crossing boundaries between animal behaviour and human psychology. *Applied Animal Behaviour Science*, 183, 1-9. doi: <http://dx.doi.org/10.1016/j.applanim.2016.07.003>
- Souter, M. A., & Miller, M. D. (2007). Do Animal-Assisted Activities Effectively Treat Depression? A Meta-Analysis. *Anthrozoös*, 20(2), 167-180. doi: 10.2752/175303707X207954
- Terling-Watt, T. (2001). Permanency in kinship care: An exploration of disruption rates and factors associated with placement disruption. *Children and Youth Services*, 23(2), 111-126. doi: [http://dx.doi.org/10.1016/S0190-7409\(01\)00129-3](http://dx.doi.org/10.1016/S0190-7409(01)00129-3)

- Tower, R. B., & Nokota, M. (2006). Pet companionship and depression: Results from a United States Internet sample. *Anthrozoös*, 19(1), 50-64. doi: 10.2752/089279306785593874
- Walsh, F. (2009). Human-animal bonds I: The relational significance of companion animals. *Family Process*, 48(4), 462-480. doi: <http://dx.doi.org/10.1111/j.1545-5300.2009.01296.x>
- Winefield, H. R., Black, A., & Chur-Hansen, A. (2008). Health effects of ownership of and attachment to companion animals in an older population. *International Journal of Behavioral Medicine*, 15(4), 303-310. doi: 10.1080/10705500802365532
- Zilcha-Mano, S., Mikulincer, M., & Shaver, P.R. (2012). Pets as safe havens and secure bases: The moderating role of pet attachment orientations. *Journal of Research in Personality*, 45(5), 571-580. doi: <http://dx.doi.org/10.1016/j.jrp.2012.06.00>