Does attachment security to a human handler influence the behavior of dogs who engage in animal assisted activities?

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ABSTRACT

Pet and working dogs raised with humans are known to form attachments to their caregivers and other humans with whom they have a stable relationship. Attachment style varies across dog-human dyads, with securely attached dogs exhibiting the secure base effect, an ability to find comfort in the presence of an attachment figure in unusual situations, allowing for greater exploration. The secure base effect is also known to facilitate interactions with unfamiliar individuals. Dogs who engage in Animal Assisted Activities (AAA) are often asked to engage with unfamiliar people in unfamiliar environments, therefore it is possible that dogs with a secure attachment to their human handlers may be more prepared for success in this role. This study evaluated the behavior of 16 dogs who engage in AAA. Using a secure base test dogs were categorized as demonstrating secure (exhibiting the secure base effect with their owner/handler; n = 8) or insecure (not exhibiting the secure base effect; n = 8) attachment styles toward their handlers. Later the dyads participated in a mock animal assisted activity session to evaluate their working behavior. Our findings indicate that independent of attachment style, dogs who engage in AAA spent significantly more time in proximity to, and touching, the AAA participant than their handler (p < 0.001 for both proximity and touch). However, on average the AAA dogs spent significantly more time gazing at their handler than at the participant during the session (p = 0.03). Dogs with an insecure attachment style appear to have driven this effect as evidenced by a non-significant trend suggesting that they gazed longer at their handlers than at the participant (p = 0.07), whereas secure dogs did not display the same trend (p = 0.24). This could suggest that while their training mandates proximity and interaction with unfamiliar people, dogs who engage in AAA may be using gaze to maintain contact with their handlers, especially in the absence of a secure attachment where prolonged comfort seeking from the attachment figure would be expected.

1. Introduction

While it is well established that on average dogs and humans are capable of sharing strong mutual bonds, research exploring individual differences in the dog-human relationship is especially important in applied contexts (Udell and Brubaker, 2016), for example when trying to predict the success and welfare of individual dogs assigned to a working role. Evaluating dog attachment styles to owners or handlers provides one method for understanding how relationship patterns could affect behavioral outcomes in a variety of contexts, especially as it relates to the presence or absence of the secure base effect. The secure base effect is a byproduct of a secure attachment bond that provides the “experience of security and comfort obtained from the relationship with the partner, and yet the ability to move off from the secure base provided by the partner, with confidence to engage in other activities” (Ainsworth, 1989, p.711). For individuals with secure attachments, the presence of the attachment figure enhances the likelihood that the individual will explore and engage with the environment (Bowlby, 1982). The ability to confidently navigate unusual situations, meet strangers, or adjust to new environments is often an important consideration for working dogs, especially dogs who engage in Animal Assisted Activities (AAA) who are tasked with visiting a wide range of individuals across a variety of settings.

The presence of attachment bonds between dogs and their owners has been well documented (Topál et al., 1998; Palmer and Custance, 2008; Mariti et al., 2013), however only a few studies to date have categorized dogs into formal attachment styles (Schöberl et al., 2016; Thielke et al., 2017) or evaluated the influence of attachment security on other behaviors (Horn et al., 2013; Thielke et al., 2017). While attachment research has often been associated with the human
developmental literature, especially the Ainsworth Strange Situation Test (SST) originally developed to assess attachment style between infants and mothers, attachment bonds and the secure base effect are behavioral patterns common in nature and have been demonstrated using a variety of methods in many species that require parental care across a wide range of taxa (Gubernick, 1981; Kruith, 1984). At least one experimental assessment also predates the Ainsworth SST (Bowlby, 1960). In the 1950’s Harry Harlow conducted a test that evaluated the behavior of infant macaques when placed in an unfamiliar room with unfamiliar play objects and either their cloth surrogate mother (a rough inanimate model of a monkey covered in artificial fur that the infant had previously been imprinted to) or alone. Harlow found that when the infant was alone in the room, they would often freeze and huddle in a crouched position for the duration of the test or sometimes they would run frantically around the room and vocalize in distress. On the other hand, when the cloth mother was present, the infant would run to her and cling to her for a while, and then would move away to explore the room or engage with objects in the room, demonstrating a contact-exploration balance. He concluded that the infants were using the surrogate cloth mother as “a source of security, a base of operations” (Harlow, 1958), which became the foundation for future exploration of the secure base effect in both humans and non-human animals. Recently the secure base test has been adapted for use with dogs allowing for classification of dogs into attachment styles categories, and posits several advantages compared with the SST including shorter testing time (6 versus 21 min) and elimination of order effects associated with the SST (Thielke et al., 2017).

Research has also shown that dogs can provide social support for humans (Cusack, 1988; Crawford et al., 2006; Zilcha-Mano et al., 2012). This strength of dog-human interactions is why dogs are sometimes used to promote the well-being of people in a variety of settings in the form of Animal Assisted Interventions. Animal Assisted Activity (AAA) is one common type of animal assisted intervention. According to the International Association of Human-Animal Interaction Organizations (IAHAIO), Animal Assisted Activity is defined as “a planned and goal oriented informal interaction and visitation conducted by the human-animal team for motivational, educational and recreational purposes” (IAHAIO, 2018). AAA may be conducted in a variety of settings to accomplish a range of purposes, including improving the quality of life of someone in a hospital, assisted-living facility, rehabilitation center, or correctional facility (Arkow, 1984; Tai et al., 2010; Burch, 2015; IAHAIO, 2018), or “providing comfort and support for trauma, crisis and disaster survivors” (IAHAIO, 2018). Dogs who engage in AAA are often pet dogs trained by their owner, whom they work alongside during AAA.

Conducting AAA with dogs generally involves an owner/handler directing their dog to engage with an unfamiliar AAA participant. This may involve the dog approaching and touching the unfamiliar person, allowing them to pet him/her or initiate play. At other times the AAA participant may sit passively in the presence of the dog or talk to the dog. Training for AAA requires dogs to demonstrate excellent obedience, an aptitude for engaging with unfamiliar people, and appropriate and reliable responses to potential stimuli including unfamiliar places, objects, sounds, and smells, and atypical behavior from adults and children, such as unusual touch and petting behavior and vocalizations (Therapy Dogs International (TDI), 2015). Given the nature of this work, it is critical that dogs who engage in AAA not only feel comfortable in novel or ‘strange’ environments but are comfortable leaving the proximity of their owner/handler in such situations to interact with unfamiliar individuals.

Research conducted on human infant attachment styles has demonstrated that individuals with a secure attachment style are less disturbed by the presence of a stranger and are more likely to interact with them, in contrast with individuals with an insecure attachment style (Bowlby, 1982). Consequently, it seems possible that dogs who engage in AAA who have a secure attachment style might be at an advantage in their working role when compared to AAA dogs with an insecure attachment style. To date, no study has investigated whether a dog’s behavior in an AAA setting is impacted by their attachment style, and more specifically, whether or not they exhibit the secure base effect with their owner/handler.

In the present study we asked if and how the secure base effect influenced an AAA dog’s behavior toward their handler and toward an AAA participant in a mock animal assisted activity setting. Given the training requirements of the working role, we expected that all dogs who engaged in AAA would spend a substantial amount of time interacting with the unfamiliar AAA participant. However we predicted that AAA dogs exhibiting the secure base effect with their handler might spend a greater proportion of session time in proximity to, and gazing at, the AAA participant (as opposed to their handler) than dogs that did not exhibit the secure base effect with their handler.

2. Methods

2.1. Participants

Sixteen dogs who engage in AAA were recruited through personal contact, and advertisement on a local therapy dog listserv. Dogs comprised ten males (five neutered prior to study; one neutered between the two sessions of the study) and six females (all spayed), ranging in age from six months to twelve years. Participants included three golden retrievers, two German shepherds, two whippets, one Australian shepherd, one Labrador retriever, one Shiloh shepherd, one smooth collie, one Pembroke Welsh corgi, one miniature poodle, and three mixed-breeds. Dogs’ experience engaging in AAA ranged from two months to eight years. In all cases the AAA dog’s handler was also its owner, with the exception of the 8-year-old mixed breed (Labrador retriever and wirehaired pointer) who lived with a neighbor, but were highly familiar with one another and had a well-developed working relationship. From this point forward the owner/handler will be referred to simply as the handler.

2.2. Ethical statement

AAA dog-handler dyads participated on a voluntary basis. Informed consent was obtained from the handlers. No data were collected on any humans involved. The methods associated with this study were approved by the IACUC (ACUP #4444) of Oregon State University. All mandatory laboratory health and safety procedures were complied with in the course of conducting this experiment. There were no conflicts of interest or competing interests associated with this research.

2.3. Testing area

The testing area was a sparsely furnished room measuring 4 m by 4.5 m. The room had one window and two doors but only one door was used for entrance and exit. The secure base test methods and testing area layout were based on the canine version of the test conducted by Thielke et al. (2017). One chair was located along a wall approximately 3 m from the door. A circle with a 1 m radius was measured around the chair with tape (see Fig. 1). A tripod and video camera were located in the corner opposite the door and chair. Three toys – a tennis ball, a squeaky toy, and a rope toy – were spread out on the floor outside of the taped circle. This room and setup was novel to the dog and handler prior to testing.

A mock animal assisted activity session was conducted on a later date (four to thirty days later) in the same room. For this session, two chairs were located facing each other at a right angle in the corner of the room opposite the door. Two tangential circles (each with a 0.66 m radius) were taped on the floor, one around each chair (see Fig. 2). The tripod and video camera were near the door, opposite from the chairs.
2.4. Secure base test

There were two female experimenters: E1 provided instructions at the start of each condition to ensure consistent handler behavior (E1 remained outside of the room during all conditions). E2 stood neutrally/inattentively in the corner of the room controlling the video camera (except for during the alone condition during which the camera was set on a tripod facing the door). The secure base test was divided into three conditions, each lasting two minutes.

2.4.1. Baseline condition

The experimenter led the AAA dog and handler into the room and indicated for the handler to remove the dog's leash and take a seat in the chair. The handler was instructed that when the dog entered the circle surrounding their chair, they could interact with the dog (i.e. talking, petting, playing), but when the dog was outside the circle, they must remain silent, passive, and non-moving (no talking, no gestures).

2.4.2. Alone condition

E1 opened the door to indicate to the handler to stand up, say "goodbye" to the dog, and exit the room. E2 placed the camera on the tripod, left it filming in the direction of the door, and followed the experimenter and handler out of the room, leaving the dog alone. The primary purpose of the alone phase was to serve as a mild stressor, which would allow for assessment of the secure base effect during the return condition.

2.4.3. Return condition

E1 directed the handler to enter the room and sit back down in the chair. E2 followed closely behind the handler in entering the room and returned to the corner to control the camera, without any interaction with the dog. The handler's instructions were the same as for the baseline condition: when the dog entered the circle surrounding their chair, they could interact with the dog, but when the dog was outside the circle, they were to remain silent, passive, and non-moving.

2.5. Mock animal assisted activity session

At a later date, four to thirty days after the secure base test, the dog-handler dyads returned to the same testing location for a mock animal assisted activity session. A mock session was chosen over in situ sessions to ensure experimental control over the session location, context, and duration allowing for consistency across dogs/experimental groups, something that might not be ethically possible within the context of genuine AAA sessions. Two females of college age served as the mock AAA participants across all dogs, determined by scheduling availability. These individuals were unfamiliar to both the dog and handler at the time of the session.

E1 provided instructions prior to the session. Session protocol was determined based on handler reports of what their typical AAA sessions looked like, which were then integrated into one standard methodology that could be used consistently across all dogs. The mock AAA participant (E3) was seated in one of the two chairs prior to the dog’s arrival. The handler was instructed to enter the room with their dog, introduce themselves and the dog to E3, give the dog the greeting/release command they would typically use on an AAA visit, and then sit down in the chair next to E3. The session lasted for seven minutes with the first minute as a greeting phase (when the AAA dog and handler entered the room and greeted the mock AAA participant; important because during this minute the handler was moving within the space and initiating interactions with both the dog and E3). The remaining six minutes consisted of the interaction phase of the mock AAA session during which the dog’s behavior was video recorded and later analyzed. The dog remained on leash (handler holding the end of the leash) for the entire session, but was to have freedom of movement between and around the handler and E3 to the extent the leash’s length permitted (about 2 m). This was done to remain consistent with the AAA practices these dyads would typically encounter in their working roles with actual AAA participants. The handler and E3 were required to stay seated in their designated chairs located within the taped circles on the floor for the duration of the session. For the three small dogs (less than
Table 1
Attachment Style Definitions.
Adapted from Schöberl et al., 2016 and Thielke et al., 2017.

<table>
<thead>
<tr>
<th>Attachment Style</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>Secure</td>
<td>Dog’s greeting behavior is active, open, and positive. Little or no resistance to contact or interaction with the owner/handler. Seeks proximity and is comforted upon reunion, returning to exploration or play.</td>
</tr>
<tr>
<td>Insecure-Avoidant</td>
<td>Dog shows little or no visible response to the owner/handler’s return. Ignores or turns away from the owner/handler but may not resist interaction altogether (e.g. laying, sitting, or standing without physical contact with, or out of reach of, or at a distance from the owner/handler).</td>
</tr>
<tr>
<td>Insecure-Ambivalent</td>
<td>Dog shows exaggerated proximity-seeking and clinging behavior (but may struggle if held by owner/handler). Exhibits a mix of persistent distress with efforts to maintain physical contact with the owner/handler and/or physically intrusive behavior toward the owner/handler. (Dogs who the judges agreed seemed essentially secure but with ambivalent tendencies were categorized as secure.)</td>
</tr>
<tr>
<td>Insecure-Disorganized</td>
<td>Dog exhibits evidence of a strong approach-avoidance conflict or fear upon reunion (e.g. circling owner/handler, hiding from sight, rapidly dashing away upon reunion, or ‘aimless’ wandering around the room). A lack of coherent strategy is shown by contradictory behavior. Dog may show stereotypes upon reunion (e.g. freezing or compulsive grooming). “Dissociation” may be observed, that is, still or frozen posture, staring into space without apparent cause, for at least 20 seconds (in a non-resting, non-sleeping dog).</td>
</tr>
<tr>
<td>Unclassifiable</td>
<td>Judges were unable to reach consensus on the attachment style categorization of the dog. Unclassifiable dogs were excluded from further analysis on dog attachment.</td>
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</table>

* No dogs in the present study were unclassifiable.

25 pounds), both handler and E3 sat on the floor in the same spots that the chairs were located with larger dogs. E3 was allowed to casually talk to the dog and with the handler, as would be the case in an actual AAA session, as they engaged in petting and interacting with the dog. The handler was instructed to engage with their dog and the participant (E3) in the session as closely as to how they would in a normal AAA session, while remaining in the designated location. The handler, E1, and E3 were all blind to the attachment categorization of the dog at the time of the mock AAA session.

2.6. Behavior coding

2.6.1. Secure base test

All sessions were videotaped using a Kodak Playtouch Zi10 video camera, manufactured by Eastman Kodak Company, Rochester, NY, USA. Two coders, with prior training in evaluating canine attachment styles, independently viewed the video recordings of the return phase and independently categorized the dog’s behavior according to canine attachment style categories previously described in the literature (Schöberl et al., 2016; Thielke et al., 2017): secure, insecure-avoidant, insecure-ambivalent, and insecure-disorganized (see Table 1). We found 93.75% independent inter-rater agreement for attachment style categorization. Categorization disagreements were then jointly reviewed to come to consensus for the final attachment style designation using the standard procedure for holistic canine attachment style categorization (Thielke et al., 2017). The broader categorization of secure or insecure attachment, indicating the presence or absence of the Secure Base Effect, was the primary focus in this study.

2.6.2. Mock animal assisted activity session

Video of the dog’s behavior during the six-minute interaction phase of the mock AAA session was analyzed and coded using JWatcher Version 1.0 coding software, developed at Macquarie University, Sydney, Australia. Each video was coded twice: once for the interaction between the dog and the mock AAA participant and a second time for the interaction between the dog and the handler. The behavioral states recorded were: gazing at the participant, touching the participant, participant proximity-seeking (entering the circle taped around the participant’s chair), gazing at the handler, touching the handler, and handler proximity-seeking (entering the circle taped around the handler’s chair). The proportion of time spent engaging in each behavior during the six-minute period was recorded. Proximity and touching were not treated as mutually exclusive.

Videos were analyzed by two independent coders. Inter-observer reliability on proportion of total time for each behavior was calculated using Pearson Correlation Coefficients. There was strong agreement for all behavioral measures (gaze at handler, R = 0.85; gaze at participant, R = 0.75; touching handler, R = 0.83; touching participant, R = 0.99; proximity to handler, R = 0.89; proximity to participant, R = 0.99). All data used in the analysis were determined by Coder 1.

2.7. Statistical analysis

A Kolmogorov-Smirnov test demonstrated an absence of a normal distribution in the behavior of all of the dogs as a whole in terms of their touch, proximity, and gaze toward the handler versus the AAA participant, therefore Wilcoxon Signed-Rank tests were used to compare these measures. Unpaired t-tests were used to assess any differences in age or AAA experience between the dogs categorized as having a secure versus insecure attachment style. Unpaired t-tests were also used to assess any differences between the secure versus insecure dogs in terms of their time spent touching their handler, touching the participant, in proximity to their handler, in proximity to the participant, gazing toward their handler, and gazing toward the participant. Additionally, paired t-tests were used to assess within-group differences in the dogs’ behavior toward the handler versus the participant (secure dogs – touch; insecure dogs – touch; secure dogs – proximity; insecure dogs – proximity; secure dogs – gaze; insecure dogs – gaze). The alpha level was set to p < 0.05 for all tests.

3. Results

3.1. Secure base test

Based on the canine attachment style definitions presented in Table 1, eight dogs were categorized as displaying a secure attachment style and eight dogs were categorized as having an insecure attachment style to their handler. Seven dogs in the insecure category demonstrated an insecure-ambivalent attachment style and one demonstrated an insecure-disorganized attachment style.

After categorization, the age and work experiences of the two groups – secure and insecure – was compared to ensure these factors were roughly equivalent and could not account for possible differences in the AAA setting. The mean age of dogs in the secure group was 5.6 years (SD = 3.0) and in the insecure group was 6.9 years (SD = 4.5). There was no significant difference in the ages of the dogs in the secure versus insecure groups (unpaired t-test t (14) = 0.65, p = 0.53). The mean number of years of AAA experience for dogs in the secure group was 2.8 years (SD = 2.6) and insecure group was 2.3 years (SD = 2.3). There was no significant difference in the AAA experience of the dogs in the secure versus insecure groups (unpaired t-test t (14) = 0.36, p = 0.73).
3.2. Mock animal assisted activity session

First the behavior of all AAA dogs as a group was analyzed to determine if different patterns of behavior toward their handler versus an AAA participant would be observed in the AAA setting. We predicted that given the training associated with this working role, dogs who engage in AAA should spend more time with the AAA participant than with the handler independent of attachment style. A Kolmogorov-Smirnov test did not confirm a normal distribution so a Wilcoxon Signed-Rank test was used. As predicted, dogs who engage in AAA spent a significantly greater proportion of time in physical contact with the AAA participant than their handler (median proportion of time in physical contact with participant = 0.86, handler = 0.08; Z = -3.52, p < 0.001) and in proximity to the AAA participant compared to their handler (median proportion of time in proximity to participant = 0.85, handler = 0.17; Z = -3.36, p < 0.001). However, dogs who engage in AAA spent a significantly greater proportion of session time gazing at their handler compared to session time spent gazing at the AAA participant (median proportion of time spent gazing at participant = 0.09, handler = 0.14; Z = -2.12, p = 0.03).

Next the in-session behavior of AAA dogs categorized as secure or insecure was compared. Both secure and insecure dogs spent significantly more time in physical contact with the AAA participant than with their handler (secure dogs, paired t-test t (14) = 14.34, p < 0.0001; insecure dogs, paired t-test t (7) = 7.52, p = 0.0001). There was not a statistically significant difference between insecure and secure dogs in terms of the proportion of time spent touching the handler (unpaired t-test t (14) = 0.91, p = 0.38) or the participant (unpaired t-test t (14) = 0.89, p = 0.39), see Fig. 3.

Dogs in both the secure and insecure categories spent significantly more time in proximity to the participant than the handler (secure dogs, paired t-test t (7) = 11.77, p < 0.0001; insecure dogs, paired t-test t (7) = 3.04, p = 0.02). There was not a statistically significant difference between the groups in terms of the proportion of time spent in proximity to the handler (unpaired t-test t (14) = 0.70, p = 0.49) or the participant (unpaired t-test t (14) = 0.75, p = 0.47), see Fig. 4.

In terms of gaze, however, there was a non-significant trend suggesting that dogs in the insecure group spent more time gazing at their handler than did the dogs in the secure group (unpaired t-test t (14) = 1.90, p = 0.08). No such trend between the insecure and secure groups was found for the dogs’ gazes toward the AAA participant (unpaired t-test t (14) = 0.33, p = 0.75). Additionally, there was a non-significant trend suggesting that the insecure dogs spent more time gazing at their handler than at the AAA participant (paired t-test t (7) = 2.12, p = 0.07), whereas there was no such trend in the proportion of time the secure dogs spent gazing at the handler versus at the participant (paired t-test t (7) = 1.30, p = 0.24), see Fig. 5. The dog’s lifetime experience in animal assisted activities had no impact on time spent gazing at the handler during the session (pearson correlation r = -0.2053, n = 16, p = 0.45).

4. Discussion

Overall the patterns of behavior demonstrated by the securely and insecurely attached AAA dogs were more similar than different within the mock AAA setting. The results of this study suggest that, in general, AAA dogs spend a greater proportion of time in proximity to, and in physical contact with, the AAA participant than their handler during an AAA session, independent of attachment style toward their handler. Therefore within the current population, dogs that do not exhibit the secure base effect with their handler appeared to be equally effective in carrying out the basic requirements of their working role as dogs that exhibited the secure base effect. However, evaluating the gaze of the AAA dogs illuminated an interesting trend that, although not quite statistically significant, suggests that insecurely attached dogs (dogs who do not exhibit the secure base effect) may spend more time than securely attached dogs gazing at their handler during an AAA session.

Dogs who engage in AAA have been specifically trained to interact with unfamiliar AAA participants by remaining close to the stranger and allowing that person to pet them. Thus, it is not surprising that AAA

![Fig. 3. Physical contact.](image-url)
dogs demonstrated greater time spent in proximity to, and touching, the AAA participant than the handler; their training history may outweigh the influence of attachment style toward their handler in this case. However, an AAA dog’s gaze to one person or the other during an AAA session is not typically instructed by the handler, therefore it is possible that gaze could be a more honest behavioral signal in this context. Consequently it may be worth considering if “gaze” should be used as another standard measure of contact or proximity-seeking behavior when evaluating behavioral cues of attachment in applied contexts; especially in cases where physical proximity is incompatible with a

**Fig. 4. Proximity.**
Proportion of time dogs spent in proximity to the owner/handler and the AAA participant during the mock animal assisted activity session, grouped by attachment style. Total session time was six minutes. The box outlines the second and third quartiles. The bold horizontal line in the box interior indicates the median. The whiskers mark maximum and minimum values.

**Fig. 5. Gaze.**
Proportion of time dogs spent gazing toward the owner/handler and the AAA participant during the mock animal assisted activity session, grouped by attachment style. Total session time was six minutes. The box outlines the second and third quartiles. The bold horizontal line in the box interior indicates the median. The whiskers mark maximum and minimum values.
trained working role (as is the case for AAA dogs) or is physically impossible (e.g., search and rescue dogs working at a distance).

While further interpretations of a dog’s gaze need to be made with care, it is possible that the secure base effect is a determining factor in directional gazes during AAA sessions. Interestingly, in Mary Ainsworth’s research on attachment styles in children she observed that children often kept their eyes and posture oriented toward their mother while being held by an unfamiliar person (Bowlby, 1982). Gazing may be a form of social referencing, the seeking of information from another individual from which to base one’s response to a stimulus or from which to base one’s actions. For example the dog may be gazing at their handler to gain information about how to interact with the other person or other stimuli in the room. In one study, Merola et al., 2012 found that while dogs alternated their gaze between their owner and a stranger similarly, dogs based their behavior more on cues received from their owner than from the stranger. Consistent with the secure base effect, the handler’s presence would give the secure dogs the base from which to perform the AAA work. The secure dogs may not need to refer to their handler for much reinforcement or guidance, so they could be expected to gaze at each person for roughly similar amounts of time as Merola et al., 2012 demonstrated. In contrast, the insecure dogs may gaze at the handler more often due to a greater need for reassurance or behavioral guidance.

Another recent study concluded that both dogs and owners experienced increased urinary oxytocin concentrations as a result of mutual gazing. The duration of time the dog spent gazing at the owner was proportional to the change in the oxytocin level of both the dog and owner (Nagasawa et al., 2015). Given that all of the AAA dogs spent some time gazing at their owner/handler, we could expect that this behavior served to increase oxytocin levels in both themselves and their owner/handler, which may serve to reinforce the gazing behavior or possibly the AAA work as a whole. This may also represent another mechanism by which gazing at the owner/handler could reduce stress that dogs, especially insecure dogs, may experience when engaging with an unfamiliar person in an AAA setting.

5. Limitations and future directions

The current study provides the first behavioral evidence that the attachment style of an AAA dog to their handler may influence some aspects of their human-directed interactions in a working context. Future studies are needed to determine if the trends identified here are present in larger populations and across different types of animal assisted interventions, or if attachment style holds more predictive value for dogs engaged in various activities versus others.

Considering that individuals with an insecure attachment style typically prefer to seek the proximity of bonded individuals in unfamiliar settings, prolonged interaction with an unfamiliar AAA participant by the insecure dogs is quite likely the result of training instead of an independent drive to engage with the unfamiliar person. If so, another potential consideration for future research is whether animal-assisted activities result in higher stress levels for some animals (i.e., those with an insecure attachment style) more than others, even if both show similar levels of interaction with the AAA participant. This could have important welfare implications and should be further evaluated using additional behavioral and physiological measures of stress (e.g. cortisol levels during AAA sessions). Data collected during actual AAA sessions, as opposed to mock sessions, would also be valuable although likely would require much larger sample sizes due to more variable interactions in naturalistic settings.

6. Conclusions

There is a great need for more research evaluating the behavior and welfare of the animals participating in working roles (Cobb et al., 2015), including animal assisted activities. Such research is important for a number of reasons. First, animals are most likely to perform their jobs well if they are well suited to the task and do not show signs of stress within their working environment. Second, in many working roles the comfort level of an animal may have implications for the safety and wellbeing of the humans involved. This may be especially true in AAA settings where animals are expected to work with vulnerable populations, where injury or even rejection by a nervous animal could have serious implications. However there are equally compelling reasons to consider the behavior and the wellbeing of working animals in their own right. Doing so will allow us to better understand what aspects of their lives they are well suited for, which aspects might be causing stress or even injury, as well as what knowledge, methods, and practices result in positive welfare outcomes for both dogs and people, as well as the best human-animal interactions possible.

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References


Harlow, L., Huber, L., Range, F., 2013. The importance of the secure Base effect for domestic dogs – evidence from a manipulative problem-solving task, 2018 dogs – evidence from a man-


Schofield, I., Beetz, A., Solonos, J., Wedli, M., Gee, N., Kotschalk, K., 2016. Social factors influ-

encing cortisol modulation in dogs during a strange situation procedure, 2018 influ-


Topal, M., Mildeš, Ž., Galyn, V., Đoka, A., 1998. Attachment behavior in dogs (Canis famil-


Tsai, C., Friedmann, E., Thomas, S., 2010. The effect of animal-assisted therapy on stress re-


Udell, M.A.R., Brubaker, L., 2016. Are dogs social generalists? Canine social cognition, at-
