

A Thesis Presented to
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Insecure Attachments in Dogs and Interpreting Human Social Signals

By

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Abstract

Dogs have been shown to understand the human communicative behaviors of gazing and pointing, and understand these human social signals more than any other non-human species. Domestic dogs are shown to have similar attachments to their owners as human infants. I used a modified version of the Ainsworth Strange Situation to determine if a dog had an insecure or secure attachment to its owner/caretaker. Blind observers observed the dog-human interactions and recorded the duration of a number of operationally defined behaviors and rated the intensity of the dog-owner greeting. The dogs were put through trials with their owner to find hidden food. The owners were only allowed to use pointing and gazing signals to guide their dog to the hidden food. We timed the dogs to see how fast they could find the food. The predicted outcome was that the insecurely attached dogs would perform poorly compared to the securely attached dogs. The results of a 2(attachment) by 2 (social signal) Mixed ANOVA showed that there was a significant main effect of social signal $F(1,15) = 6.7, p < .05$, Partial Eta squared = .224. Dogs during the pointing condition ($M = 86.1, SD = 71.9$) found the food significantly faster than during the gazing condition ($M = 119.9, SD = 71.9$). The Mixed ANOVA also showed that there was a significant interaction between the type of attachment and type of social signals on the dogs ability to find food, $F(1,15) = 4.322, p = .055$, Partial Eta Squared = .224. Dogs that had a insecure attachment ($M = 45.0, SD = 41.2$) were significantly faster at finding food using pointing signals than using gazing signals ($M = 136, SD = 61.9$). Dogs that had a secure attachment ($M = 103.17, SD = 81.92$) were significantly faster at finding food using pointing signals than dogs with an insecure attachment ($M = 45.04, SD = 41.29$).

Keywords: attachment, dog-human interaction, reading social signals

Insecure Attachments in Dogs and Interpreting Human Social Signals

It is well known that the work of Mary Ainsworth and John Bowlby revolutionized the meaning of mother infant relationship and attachment. If an infant develops a secure attachment, then the baby feels less insecure and confident to explore new environments. Later in life, a secure attachment can predict popularity, aggressive behavior, and social competence. An insecure attachment can lead to aggressive behavior, unpopularity, bullying, and dangerous behavior (Ainsworth & Bell, 1970). In Palmer and Custance's (2008) study the Ainsworth strange situation was used to discern whether domestic dogs could form similar attachment bonds to their owners as human babies. The dogs exhibited distress and search behaviors when the owner was not present. When exploring a new environment and interacting with a stranger, the dog participants looked back at the owner for support and often returned to the owner periodically when exploring. This suggests that the dogs used the owner as a secure base just like a human baby uses its mother (Mariti, Ricci, Zilocchi & Gazzano, 2013). Domestic dogs are able to develop an insecure attachment with the owner as well, especially if the owner is depressed, anxious, or abusive or has an insecure or avoidant attachment to their own parent (Konok et al. 2015). The effect of an insecure attachment in dogs is also similar to that in a human child because it causes behavioral problems. A dog with separation anxiety should show symptoms such as destructive behavior when separated from the owner, sensitivity to loud noises, aggressiveness, urinating in inappropriate places, and excessive vocalization (Storengen, Boge, Strøm, Løberg & Lingaas, 2014).

In 2011, Handlin and colleagues investigated what role oxytocin and cortisol played in the attachment. Oxytocin is a hormone released by the pituitary glands that plays a part in human mother-infant bonding. It also signals the production of milk in the breasts. Cortisol is a hormone

produced by the adrenal cortex that can result from stress. Heart rate, oxytocin levels, cortisol levels, and insulin were monitored during a dog-owner interaction. The owner pet the dog for five minutes while measurements were taken. The oxytocin levels in the owner rose within five minutes and the dog's oxytocin rose within three minutes. The dogs' and owners' cortisol levels and heart rates decreased. In Schöberlet and colleagues' (2016) study, cortisol levels decreased in the dog when the owner returned during a strange situation procedure. The cortisol level did not decrease if the attachment between the dog and the owner was insecure. So, the level of oxytocin and cortisol in the body plays a part during a dog-human interaction and attachment.

The dog-human relationship is more intimate than we think. Domestic dogs outperform wolves and even primates at reading human communicative cues. Other domestic animals (cats, horses, goats) are able to read human communicative cues as well, but dogs have skills that go beyond other species such as sensitivity to human attention states, emotions and visual perspectives (Buttner, 2016). In Hare and Tomasello's (2005) study, domestic dogs were shown to be skilled at reading human social and communicative behavior. They used communicative behavior such as pointing and gazing, to find hidden food. Participants gazed and pointed at where food was hidden and the dogs were able to find the food a vast majority of the time. Dogs know if a person can see an object. For example, a dog is able to tell if the owner's gaze is directed away from the object, distracted by a book, or if they can see an object if the owners eyes are closed. Humans' nearest primate relatives were unable to achieve this skills to the same capacity. In a study by Miklósi, Polgárdi, Topál and Csányi (2000), dogs tried to lead their owner to hidden food using gazing gestures. The majority of the time the owner could discern where the dog was leading them. Thus, the communication understanding goes both ways between and dog and their owner. The understanding is mutual. A convergent evolution theory says that dogs

possibly evolved alongside humans and that is why they share behavioral similarities to humans. This theory suggests that the human-like social skills were inherited and evolved during domestication as a result of artificial selection for docility towards humans. Some differences in chimpanzee and human temperament suggest that a similar process may have been important in leading to the evolution of social skills in the human species such as eye movements (Hare & Tomasello, 2005).

Other than social and communicative behavior, domestic dogs are also aware of a person's attention states. A domestic dog is able to discern whether a person can or cannot see something. Call, Bräuer, Kaminski and Tomasello's (2003) study demonstrated that a dog can tell if a person can see an object if their eyes are closed, their back is turned, or if they are distracted. Domestic dogs show an empathic response to distressed humans and can discriminate between humming/white noise and crying. The dog became more oriented toward a person if they were crying rather than humming or talking. The dog is able to discriminate between different emotional states, and show more docility during the crying condition (Custance & Mayer, 2012). Being attuned to a person's emotional states reveals that domestic dogs might have an empathy towards humans. Silva, Bessa and de Sousa's (2012) study further investigates the dog's empathetic response by looking at contagious yawning. Contagious yawning is a typical sign of closeness and shared empathy between two people. If one person yawns, another person has empathy for them if they also yawn. Contagious yawning is also seen in baboons. Silva and colleagues found that contagious yawning is common for dogs if the person who yawns is a close family member, friend or owner. A dog typically will not yawn for a stranger, showing empathy only for the owner.

The owner-dog bond is a powerful connection that involves multifaceted methods of communication and interaction, but is that connection hindered by an insecure attachment? Does having an insecure attachment affect a dog's social skills similar to a person with an insecure attachment? The goal of this study is to see the effect of a dog's insecure attachment on interpreting human point and gazing gestures to find hidden food. I used a modified version of the Ainsworth Strange situation to assess the type of attachment between the dog and the owner. Then I assessed the dog's ability to read gazing and pointing gestures. I predicted that an insecure attachment will hinder the dog's interpretation of human social communication and make finding the hidden food more challenging.

Method

Participants

I had a total of 17 dogs. Of all the dogs, 8 of the dogs were purebred breeds, 8 were mutts, and 1 was unknown. The pure breed dogs included a Greyhound, Boxer, and Siberian husky. There were 8 male dogs and 9 female dogs. Twelve of the owners had other pets at home. Twelve of the dogs were 3 years of age and older, and only 4 were less than a year old. All of the dogs came with their primary owner, and the majority of owners (9) had had their dog for 4 years or more. Only 4 of the owners had had their dog for a year or less. All of this information was obtained through a demographic questionnaire which can be found in Appendix A.

Design

The study used a mixed quasi experimental design. The independent variables are 2(type of attachment) x 2(type of human communication signal). The dependent variable is how long it takes (in seconds) for the dog to find the hidden food using human communication signals.

Scoring

The procedure for analyzing the dogs' behavior during the episodes was similar to the procedure of Palmer & Custance's (2008) study. The episodes in part A were observed by two-three blind observers who record the dog's behavior in thirty second intervals. An observation technique called Partial Interval Behavioral Count was used whereby a behavior occurs at any point during the interval, a code for the behavior was placed in that episode time slot. Behaviors such as exploration (the dog sniffs around the room) or vocalization (barking, whining, or growling) were recorded. The score for the behaviors went by episode. So if a dog vocalizes in episode 1, that behavior was marked in episode 1. The operationally defined behaviors are listed in Appendix B. The greeting behavior of the dogs towards the owner and stranger was recorded, in seconds, for the duration of greeting before the dog resumed another behavior. The intensity of the greeting was also recorded for the first minute of episodes 5 and 6. Greetings were awarded points on a scale of 0–5 according to intensity. These ranged from 0 (no greeting) to a score of 5 (intense greeting).

Dogs could engage in a behavior up to 6 times per episode. For example, if a dog explored during every 30 second interval during the 3 minutes then their exploring score would be 6.

A dog with a secure attachment showed a greater exploration when the owner was in the room than when the owner was absent. If owners served as a secure base, then dogs felt safe to engage in passive behavior when their owner was present. The secure dogs showed significantly more passive behavior with the owner present. Independent play decreased significantly when the dogs were alone or in the presence of just the stranger, but quickly recovered when the owner returned. A secure attachment also showed that the dogs were more willing to play with the

stranger when the owner was present. Dogs spent significantly more time in close proximity to the door when they were in the company of the stranger when the owner was absent. Overall, when the owner is absent, securely attached dogs showed significantly lower levels of (1) exploration, (2) passivity and (3) independent play.

Each dog was scored as a 1, secure attachment, or a -1, insecure attachment, for each behavior. Then, the attachment scores were averaged to get the dogs' overall attachment score which ranged between -1 and 1. Dogs' whose average score was 0 or below were labeled insecure and dogs above a zero were labeled secure. Using this scoring procedure, 3 of the 17 dogs were classified as insecurely attached and the remaining 14 dogs were classified as securely attached.

Procedure

In part A of the procedure, I set up a room with one door and 2 large windows. Two chairs were set up an equal distance from the door. An equal distance from both chairs I set up a pile of three dog toys. The procedure consisted of eight episodes derived from the Ainsworth Strange Situation (Appendix C).

I recorded the dogs' behavior, especially search behavior and proximity seeking behaviors, by observing through the window and video recordings using a list of operationally defined list of behaviors (Appendix B).

In part B of the procedure I subjected the same dog and owner pairs to a social communication test where half of the dogs and owners completed the task and then the order was counterbalanced for the other participants. First, without the dog present, I placed a dog treat in a plastic bag and put under 1 of four identical cups. I, then, showed the owner where the treat was. I instructed the owner to show the dog where the treat was using only eye gazing movements.

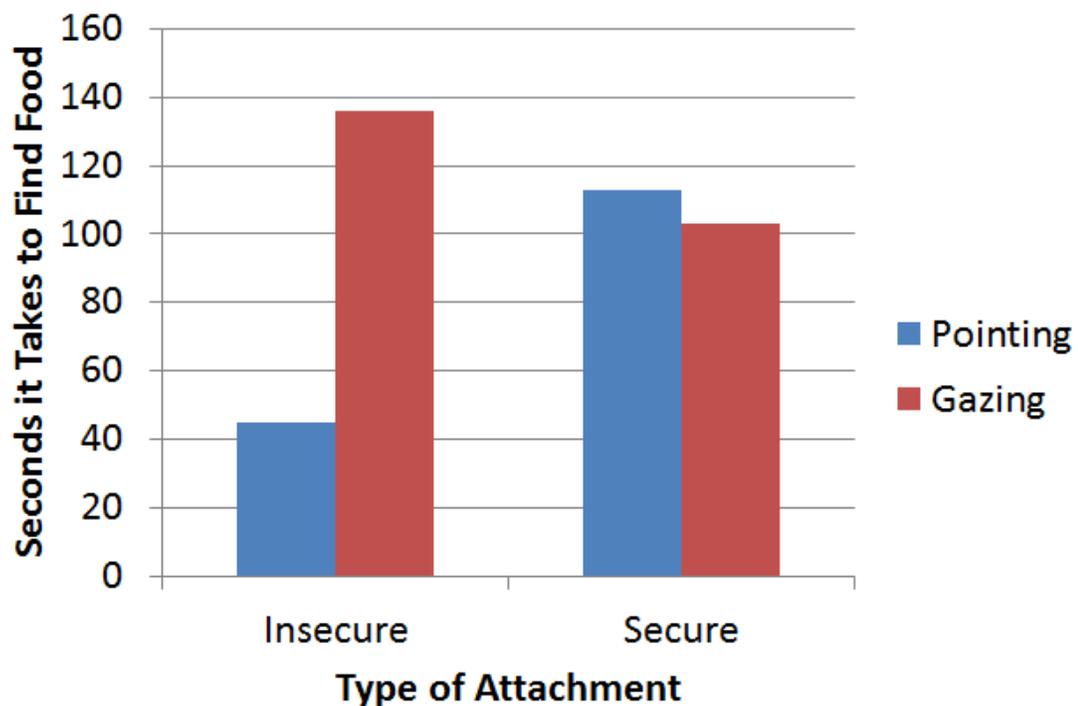
The owner stayed seated with arms at their sides for the test. The dog was then let into the room and I observed from a window. The owner then said, “find the treat” and gazed at the cup that has the treat. The sessions were timed and observed to see how long in seconds it took for the dog to find the food. If the dog found the treat, the owner then rewarded the dog with it. If dog didn’t find the treat after three minutes, the test was ended. I returned to the room and the dog was taken out. I moved a new treat to another cup and told the owner to show the dog where the treat is by pointing at the cup but not touching it. The dog was then returned to the room and the owner said, “Find the treat” and pointed at the cup with the treat. Again, the session was timed to see how fast the dog could find the food. If the dog found the treat he/she was rewarded with it. If the dog was unable to find the treat after three minutes, the test was terminated. Finally the participants filled out a demographic questionnaire about the dog’s history (Appendix A). Participation in the study took approximately 1 hour. If at any point the participant felt distressed by the dog's behavior they were welcome to end their participation or go back into the room to comfort the dog.

Results

The results of a 2(attachment) by 2 (social signal) Mixed ANOVA showed that there was a significant main effect of social signal $F(1,15) = 6.7, p < .05$, Partial Eta squared = .224. Dogs during the pointing condition ($M = 86.1, SD = 71.9$) found the food significantly faster than during the gazing condition ($M = 119.9, SD = 71.9$). The Mixed ANOVA also showed that there was a significant interaction between the type of attachment and type of social signals on the dogs ability to find food, $F(1,15) = 4.322, p = .055$, Partial Eta Squared = .224. (See Figure 1.) Post hoc comparisons using the Bonferroni correction indicated that dogs with an insecure attachment ($M = 45.0$) were significantly faster at finding food using pointing signals than using

gazing signals ($M=136.0$). Post hoc comparisons also indicated that the difference between the securely attached and insecurely attached dogs was not significant for either social signal conditions (Means: 113.2 and 136.0 for gazing for the secure and insecure dogs, respectively; and 103.2 and 45.0 for pointing for the secure and insecure dogs, respectively).

Figure 1: Interaction Between Social Signal and Attachment on Finding Food



The answers from the demographic questionnaire were also analyzed to find demographic frequencies, and to see if any of the questions had a significant relationship with the type of attachment and social signal. The question “Does your dog have a history of abuse?” from the demographic questionnaire were analyzed using a Chi Square to see if they had a relationship with the type of attachment. Four owners said yes their dog did have a history of abuse, 8 said no and 5 did not know their dog’s history. There was no significant relationship between whether the dog had a history of abuse and the type of attachment, $\chi^2(2) = 3.152, p$

=.207. Dogs that had an insecure attachment were not more likely to have a history of abuse than secure dogs. However, dogs whose owner did not know if they had a history of abuse were all securely attached, while dogs whose owners knew they did have a history of abuse were all spread out in their type of attachment. The same question of abuse was analyzed by using a 3 (abuse) by 2 (social signal) Mixed ANOVA to see if abuse had a relationship with how fast the dogs could find the food. There was a non-significant relationship between whether the dog had a history of abuse and how fast the dog found the food. Dogs with a history abuse did not find the food any slower than dogs who did not have a history of abuse. The results of a 3 (abuse) by 2 (attachment) ANOVA showed that dogs that had a history of abuse had no difference in their attachment style than dogs that did not have a history of abuse. Also some of the other demographic questions such as, “How long have you had your dog?” and “How old is your dog?” were analyzed using a Mixed ANOVA. Four owners had their dog for less than a year, 4 had their dog for 2 years, 1 owner had their dog for 3 years, and 8 had their dog for 4 years or more. How long the dog had been with the owner had no effect on how well the dogs read social signals. Four of the dogs were 1 year old, 1 was 2 years old, and 12 were 3 years or older. The age of the dog had no effect on their ability to read social signals.

Discussion

My hypothesis, dogs with a secure attachment would be able to find hidden food faster using human social signals than dogs with an insecure attachment, was supported by the data. There was a significant difference between the gazing and pointing conditions for insecurely attached dogs. Although securely attached dogs could read pointing and gazing in about the same amount of time, insecurely attached dogs were significantly slower in the gazing condition compared to the pointing condition. The majority of dogs were securely attached. There is a

possibility the results were affected by the sample size. I was only obtained 17 participants and all but 3 were insecurely attached. A confound could be that those 3 insecurely attached dogs are not representative of the insecurely attached dog population because there was so few of them. Another confound is that the researchers observed the dogs through a set of glass doors so the dogs were still able to see the observers. This may have distracted the dogs so they spent more time oriented towards the door watching the researchers. Unfortunately, I lacked access to a space with a one way mirror window, and the glass doors may have skewed the data. A room with a one way window would be a good idea for a repeat of this study.

It is also possible that there is a relationship between the attachment style of a dog and their ability to read human social signals even despite confounds. Hare and Tomasello (2005) talked about how dogs potentially developed the ability to read human social signals by living around human settlements. The ability to read those signals might be a survival adaptation to gain food and the attachment arose out of that. My study, also, supports the findings of Storengen and colleagues (2014) who reported that dogs with an insecure attachment had behavior problems and poor social skills similar to insecurely attached humans. Dogs with an insecure attachment showed more vocalization and aggression and they were not able to read humans social signals just as well as securely attached dogs. The procedure from Palmer and Custance's (2008) study was shown to work, to determine the attachment style of a dog, during my study. Palmer and Custance's modified version of the Ainsworth Strange Situation showed distinct behavioral differences between a securely attached dog and an insecurely attached dog, and made it easy to pick out the patterns between the two categories.

This experiment would need to be repeated with more participants to determine if the result really is significant. Other unanswered questions for future research are, "For dogs who

have a history of abuse, does the extended amount of time living with the owner influence if the dog can form a secure attachment?" In order to test this, the modified Ainsworth Strange Situation procedure should be done again but compare dogs who are still living in a shelter to dogs who were shelter dogs, but have since been adopted. The research on dog attachment is still relatively new and needs to be researched more to see if dog attachment is as similar to human attachment as previously thought. Another question is, would the dog's attachment affect its sociability with other dogs similar to how a human child's attachment affects their popularity? Storengen and colleagues would predict that yes, the attachment style would influence dog sociability, but that is yet to be researched and is a possible topic for follow-up studies. The concept of dog attachment still has many facets to be explored, and how that attachment relates to their interaction with humans. There is still an overall question of why we as humans use dogs in so many aspects of our lives from guiding for the blind, therapy, and even upholding the law instead of another animal to this extent.

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Appendix A

Demographic Questionnaire:

1. How long have you had your dog?
 - Less than 1 year
 - 2 years
 - 3years
 - 4 years or more

2. What is your dog's breed?
 - Mix
 - I don't know
 - Other : _____

3. What is your dog's sex?
 - Male
 - Female
 - Other

4. How old is your dog?
 - 3 months or younger
 - 1 year
 - 2 years
 - 3 years or older

5. Do you have other pets at home?
 - Yes other dogs
 - Yes, cats
 - Yes, other pets: _____
 - No

6. How often is your dog walked?
 - Once a day
 - Twice a day
 - 3 times a day
 - Not at all

7. How often do you play with your dog?

- Once a day
- More than once a day
- Once a week
- Once a month
- Not at all

8. Has your dog had any formal police or guiding eyes training?

- Yes
- No

9. Does your dog have a history of abuse?

- Yes
- No
- I don't know

Appendix B

Operationally
Defined Behaviors

Label	Definition
Mutually exclusive categories	
Exploration (E)	Activity directed toward physical environment, including sniffing, visual inspection and gentle oral examination
Passive (P)	Sitting, standing or lying down without paying any obvious attention to physical or social environment
Independent play (IP)	Any vigorous or galumphing gaited behaviour, usually directed toward a toy, when clearly disengaged from social interaction
Social play(SP)	Any vigorous or galumphing gaited behaviour performed when interacting with owner or stranger often including a toy
Following (F)	Walking in the same direction behind owner or stranger
Approach (A)	Moving toward, while clearly visually oriented to, owner or stranger
Withdraw (W)	Obvious avoidance of interaction with owner or stranger by moving away clearly turning or looking away and distinct refusal of interaction
Oriented to door (OD)	Staring fixedly at the door either in close proximity of three feet.
Oriented to person (OP)	Staring fixedly at owner or stranger either in close proximity or from a distance, regardless of whether behaviour is reciprocated
Oriented to chair (OC)	Staring fixedly at empty chair
Contact door	All active behaviour resulting in physical contact with doors

Non-mutually exclusive categories

Locomotion (L)	Walking, pacing or running around the room (excluding when playing)
Contact person (CP)	Any physical contact with owner or stranger regardless of visual orientation
Contact chair (CC)	Any contact with owner's or stranger's chair whether empty or occupied
Vocalising (V)	Any vocalisation, including barking, growling, whining and howling
Alert (AT)	Stood absolutely still with ears raised and often head cocked to one side

Appendix C

Modified Strange Situation Episodes:

Episode 1: the dog and the owner will be introduced into the room and the owner will sit on one of the chairs and for the first minute the owner will not give attention to the dog.

Episode 2: for three minutes the owner and dog will play freely and owner will give attention to the dog only if the dog initiates play.

Episode 3: a researcher designated as the “stranger” will enter the room and sit in the opposite chair and talk to the owner for 1 minute. After one minute, the stranger will then try to initiate play with the dog. The stranger will try three times, one for each toy, to initiate play and if the dog refuses to play after three tries the attempts are terminated.

Episode 4: the owner says, “goodbye, (dog’s name)” and leaves the room. Once out of the room the owner goes to the one way window to watch. The owner should stay out of the room for three minutes. If the owner feels the dog is too distressed after leaving then they may return to the room.

Episode 5: The owner returns to the room and the stranger leaves quietly. The owner should pause just inside the door. If the dog comes to greet the owner the owner can greet back. Then, the owner will try to initiate play with the dog.

Episode 6: The owner leaves the room again for three minutes and the dog is alone. If dog is too distressed owner can return to the room after

one minute.

Episode 7: The stranger returns to the room for three minutes, without the owner present, and sits in the chair. If the dog seeks comfort and attention the stranger can comfort the dog. The stranger will then attempt three times to initiate play with the three toys. If, after three tries, the dog refuses then attempts are terminated.

Episode 8: the owner returns to the room and the stranger leaves. The owner stops just inside the door and holds hands out towards the dogs and says, "hello (dog's name)". If dog seeks attention and comfort, the owner can give some.