

AN ABSTRACT OF THE THESIS OF

Shelby H. Wanser for the degree of Master of Science in Animal Science presented on September 13, 2019.

Title: The Dog-Child Bond: Examining Synchronous Activity-based Animal-Assisted Interventions for Youth with Developmental Disabilities and their Family Dog

Abstract approved:

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Approximately one in six children in the United States has a developmental disability (CDC, 2018). Among a wide variety of interventions that have been developed to support the health, wellbeing, and development of youth with disabilities, Animal-Assisted Interventions (AAI) have become increasingly prevalent. Some AAI involve youth participating with their own pets, however there has been a lack of research on factors that may impact their participation in such AAI, especially research exploring the dog-child bond. The present study aims to address this gap in the literature by evaluating the pre-existing relationships between children with developmental disabilities (between 8 and 17 years old) and their own family dog. Additionally this work served as an important baseline measure for assessing the efficacy of a novel imitation and synchronous activity-based AAI, and analyzing the impact of the intervention on the quality of the dog-child bond. For this project, the dog-child bond was evaluated in terms of the behavioral synchronization exhibited between the dog and child in a synchronization assessment and the dog's attachment

behavior toward the child in a Secure Base Test. The present study is also the first to evaluate dog-child attachment behavior, with comparison to dog-parent and dog-stranger attachment behavior. The findings indicate that family dogs naturally synchronize their behavior with children at a rate higher than would be expected by chance. Additionally, some children already act as a secure base for their family dog, and for others it is possible, through participation in AAI, to change the attachment style between a dog and child to a more secure attachment. This research demonstrates that although dogs' bonds to primary adult caregivers are often stronger than to children in the home, there are promising qualities to the dog-child bond that provide an excellent foundation for AAI to build upon, and the present imitation and synchronous activity-based AAI shows excellent potential as an intervention for youth with developmental disabilities.

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The Dog-Child Bond: Examining Synchronous Activity-based Animal-Assisted
Interventions for Youth with Developmental Disabilities and their Family Dog

by
Shelby H. Wanser

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Shelby H. Wanser, Author

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Dr. Monique Udell and Dr. Megan MacDonald were involved with the design of the current study. Dr. Udell, Chloe Simpson, and Holly Duvall were involved with data collection. Holly Duvall, Wren Isaacs, Grace Burks, Hannah Karimi, Madison Cates, Sophia Harris, McKenzie Snyder, Emmy Chien, and Bridgette Houser assisted with data coding, and Dr. Udell assisted with the interpretation of the data. Dr. Udell, Dr. MacDonald, and Chloe Simpson contributed to writing Chapter 3.

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DEDICATION

This work is dedicated in memory of Alex Black and Lexie Merrill,
and to Ryann Autumn Merrill, who remind and inspire me
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CHAPTER 1

Child-pet attachment and its implications for animal-assisted interventions for youth with developmental disabilities

Components of this chapter have been integrated into a now published paper:

Wanser, S. H., Vitale, K. R., Thielke, L. E., Brubaker, L., & Udell, M. A. R. (2019). Spotlight on the psychological basis of childhood pet attachment and its implications. *Psychology Research and Behavior Management*, 2019(12), 469-479.

Introduction

Animal-assisted interventions (AAI), which are structured interventions incorporating animals in health, education, or human services for the purpose of therapeutic gains in humans (IAHAIO, 2018), have increased in prevalence in recent years. With that trend there has been increased research on the efficacy of different AAI approaches. However, research addressing intervention outcomes for dogs, or the impact of AAI on the dog-human bond has been underexplored. Critical gaps in knowledge about factors that may lead to successful AAI still exist, especially AAI targeted for children and AAI involving one's own dog.

One factor that may be particularly relevant in AAI involving one's own dog is attachment. Attachment can be defined as a bond that forms between two individuals, often a dependent individual (child or animal) and their caregiver, that promotes contact- and proximity-seeking, as well as stress reduction and facilitation of independent behavior in the case of secure attachments (Bowlby, 1958; Harlow, 1958). Research has demonstrated that dogs form attachment bonds to their human caregivers (Topál, Miklósi, Csányi, & Dóka, 1998; Palmer & Custance, 2008; Mariti, Ricci, Zilocchi, & Gazzano, 2013) and humans can form attachment bonds to their dogs (Barker & Barker, 1988; Cohen, 2002). These bonds often benefit both the animal (Serpell & Barrett, 1995) and human (Garrity, Stallones, Marx, & Johnson, 1989; Rooney & Bradshaw, 2002; Bennett & Rohlf, 2007; Meyer & Forkman, 2014) in terms of health and

welfare outcomes. Thus, an animal-assisted intervention conducted with a participant's own pet could be impacted by the nature and strength of the pre-established bond between the participant and animal.

Attachment bonds

When discussing the nature of attachment bonds between dependent individuals and their caregivers, it is important to recognize the range of different styles of attachment that have been identified, which can broadly be divided into secure and insecure attachment styles. Individuals with secure attachment bonds can more effectively use their caregiver to reduce stress and display contact-exploration balance (Secure Base Effect) that allows them to explore and engage effectively in novel contexts and environments (Bowlby, 1958). Individuals with insecure attachments are still bonded to their caregiver, but this bond does not as readily facilitate stress reduction or a return to normal behavior in novel contexts (Bowlby, 1982; Ainsworth, 1989). Insecure attachments can be further categorized into insecure ambivalent, insecure avoidant, and insecure disorganized styles (Bowlby, 1982; Ainsworth, 1985; Main & Solomon, 1990). As seen in Table 1, these styles are based on patterns of behavior exhibited by a dependent individual toward their caregiver.

Table 1: Definitions and criteria for the four primary styles of attachment (based on Bowlby, 1982; Ainsworth, 1985; Main & Solomon, 1990).

Secure Base Designation	Attachment Style	Definition
Secure	Secure	Dependent individual is comforted by caregiver's return after a brief absence. Dependent positively greets caregiver and seeks to be in contact with them, returning to play and exploration soon afterward.
Insecure	Ambivalent (Resistant)	Dependent individual displays contradictory behavior in response to caregiver's return. Dependent may engage in excessive proximity- and contact-seeking toward their caregiver while showing persistent distress and being difficult to soothe.
	Avoidant	Dependent individual avoids caregiver during reunion. Shows disinterest in caregiver's whereabouts during separation and may explore despite whether or not caregiver is present.
	Disorganized	Dependent individual displays contradictory behavioral patterns, undirected movements and expressions, including disorientation and stereotypies. Disoriented behaviors may include approaching caregiver with head averted, freezing for long periods of time, or displaying a dazed expression.

Child-pet attachment

The human-animal attachment literature is growing rapidly, however limited research has focused on the bidirectional bonds established between children and family dogs. While no studies to date have evaluated dogs' attachment bonds toward children, some research on children's attachments toward their dogs has been conducted. Across several studies, children have been found to exhibit at least some attachment related behaviors toward companion

animals, including protesting separation and seeking proximity and comfort when reunited (Jalongo, 2015). Some research has suggested that children with insecure attachments to human caregivers may be more primed to seek comfort and gain support from dogs, rather than from humans, in stressful situations (Beetz, Julius, Turner, & Kotrschal, 2012). In fact, a study by Julius, Beetz, and Niebergall (2010) utilized the Separation Anxiety Test (SAT) and found no correlation between children's attachment representations toward people on the SAT and their attachment representations toward their pets (assessed via questionnaire), suggesting that pets may provide social support even when children do not feel securely attached to other humans (Julius, Beetz, Kotrschal, Turner, & Uvnäs-Moberg, 2013). Additional studies conducted with adult pet-owners (e.g. Beck & Madresh, 2008; Kurdek, 2008) and one other study conducted thus-far with child pet-owners (Julius et al., 2010) have also provided evidence that there is no correlation between pet owners' generalized attachment patterns toward humans and their attachment representations toward their pets (Julius et al., 2013). When 160 children who had experienced abuse, neglect, or traumatic loss were studied, it was found that "the prevalence of a 'secure' attachment to pets (in particular cats and dogs) is approximately four times higher than a secure attachment to human attachment figures" (Julius et al., 2013, p.133).

Therefore while some studies looking at attachment related behaviors in humans with respect to their dog have been conducted (looking at behaviors such as separation distress and greeting upon reunion) (Jalongo, 2015), assessments of human attachment toward dogs have typically been conducted via survey, a method typical for assessing human-human attachment relationships in older children and adults, but different from the kinds of behavioral attachment tests more commonly conducted with human infants and their caregivers. In general, much less is known about the bidirectional bonds between children and dogs.

Thus far, besides the abovementioned studies, no further studies have specifically categorized the attachment styles of children toward their pets, but quite a few studies have been conducted with the aim of quantifying the strength of the attachment bond of children toward their pets and the factors that influence the strength of that bond. These studies have utilized a variety of questionnaires, completed by the children themselves and/or by their parents/caregivers, to quantify the strength of the children's attachments toward their dogs and other pets. It has been demonstrated that many factors influence the strength of the child-dog attachment (e.g. Bodsworth & Coleman, 2001; Westgarth et al., 2013; Jalongo, 2015; Hall, Liu, Kertes, & Wynne, 2016), and understanding these factors as well as the benefits children derive from these attachment bonds may provide valuable information that could influence the design and conduct of animal-assisted interventions for children.

One factor that seems to have a significant impact on the strength of children's attachment to pets is the availability of people in the child's life. For example, a study conducted in the U.K. using the validated CENSHARE Pet Attachment Scale (Holcomb, Williams, & Richards, 1985), found strong evidence that single children self-reported having stronger attachments to their favorite family pet than children with siblings (Westgarth et al., 2013). Another study conducted in Australia by Bodsworth and Coleman (2001) demonstrated that children being raised by a single parent were more strongly attached to their pet dog than children being raised in a two-parent family (as measured by parents' judgments of their children's level of attachment using a previously validated Companion Animal Bonding Scale) (Bodsworth & Coleman, 2001). This study also found interaction effects between child age and family type. Children in the early childhood group (ages 3-6) who were being raised by a single parent had significantly stronger attachments to the family dog than the early childhood group

being raised in a two-parent family. There was not a significant difference between the single-parent and two-parent groups for children in the middle childhood group (ages 7-12), but there was still a trend toward stronger attachment in the single-parent group (Bodsworth & Coleman, 2001).

Several other studies have also found interesting effects of age on the strength of children's attachment to pets. Westgarth and colleagues (2013) found evidence that in families with multiple children, the youngest child typically had a stronger attachment to their family pet than their older siblings. A study out of Croatia, that utilized child self-reports on a Child Pet Attachment Scale questionnaire, concluded that the strength of children's attachment to their pets gradually decreased as they got older (Vidovic, Stetic, & Bratko, 1999). Additional evidence comes from a review article by Jalongo (2015) suggesting that children typically score higher than adults on measures of the strength of their attachment to dogs.

Research also indicates that certain canine behavioral factors can influence children's attachment toward their dog. Jalongo (2015) asserts that a child's attachment to their dog is likely to be stronger when they are involved with the dog's care and understand its needs. A study by Hall, Liu, Kertes, and Wynne (2016) provided further explanation for this correlation when they demonstrated that children feel stronger attachments to dogs that are responsive to their social communicative cues. In their study, ninety-nine children aged 7 to 12 participated in a gesture following test with their dog to measure the dog's ability to utilize the child's pointing gesture to choose the correct response object in a two-object choice task. The researchers found that success with the gesture following test was positively correlated with the strength of the child's attachment toward their dog (as measured by child self-reports on the Lexington Attachment to Pets Scale, completed prior to the gesture following test). They also found that

dog-child dyads scored higher on the gesture following test when the child was responsible for the dog's care at home (i.e. feeding, walking, grooming). However, they found no evidence that stronger feelings of attachment toward their dog were directly related to their involvement in the dog's care at home. Rather it seemed that caring for the dog made the dog more likely to be more responsive to the child's communicative cues, and the greater responsiveness to their cues made the child feel more attached to the dog (Hall et al., 2016). Jalongo (2015) also suggests that mutual responsiveness between the child and dog builds stronger attachments between them, as do more shared activities and more time spent together.

Potential benefits of child-pet attachment

Research on relationships between children and their pet dogs, and relationships between children and animals they engage with as part of animal-assisted interventions (AAI), have both demonstrated that companion animals are a source of physical and emotional support for children (Taylor & Breen, 2014; Purewal et al., 2017). People have an innate need for physical touch from other humans, but sometimes people are not comfortable being touched by, or touching, other people, and in those cases dogs and other animals may provide the safest, most intimate and comforting physical touch that humans need to develop social connection (Parish-Plass, 2008; Beetz et al., 2012; Julius et al., 2013). Dogs are perceived to be accepting, non-judgmental, and stable sources of unconditional love (Parish-Plass, 2008; Barlow, Hutchinson, Newton, Grover, & Ward, 2012; Beetz, Uvnäs-Moberg, Julius, & Kotrschal, 2012; Taylor & Breen, 2014; Jalongo, 2015). Additionally, the perception that dogs are more forgiving than people, present their feelings authentically in the moment (Parish-Plass, 2008; Jalongo, 2015), and do not care about a person's history can be grounding and calming (Parish-Plass, 2008).

Studies have even shown that interactions with animals can cause children's blood pressure and heart rate to decrease (Parish-Plass, 2008; Beetz et al., 2012; Julius et al., 2013), and for those recovering from trauma the presence of animals may be especially beneficial for lowering their state of hyperarousal (Parish-Plass, 2008).

Pet attachment has been shown to promote healthy social development, social competence, increased social interaction, improved social communication, and social play behavior (Purewal et al., 2017). Companion animals can help children learn to express and understand non-verbal communication and decipher intentions, which leads to improved emotional understanding and expression (Parish-Plass, 2008). One study even showed some evidence of a correlation between children's level of attachment to their pets and their quality of life, as well as their overall satisfaction with life (Marsa-Sambola et al., 2016).

Many researchers have asserted that pet dogs have a significant impact on children's development by providing an opportunity for the child to care for a dependent. Having the opportunity to care for a dependent fulfills the child's need to feel important, needed, and have a purpose (Julius et al., 2013). One study indicated that caring for a pet was "positively correlated with feelings of importance, social competence and self-esteem" (Vidovic et al., 1999). Bodsworth and Coleman (2001) suggested that when a "preadolescent perceives that [they have] successfully cared for the dependent animal, this in turn leads to feelings of achievement" and helps them develop their self-concept. Caring for a dog can teach a child responsibility and give them a sense of capability (Bodsworth & Coleman, 2001; Parish-Plass, 2008). It seems possible therefore, that developing a relationship with, and caring for, a pet dog could be particularly beneficial for children with developmental disabilities who may experience an undermining of their autonomy and capabilities due to their disability.

Addressing risk factors to health and wellbeing for youth with developmental disabilities

Approximately one in six children in the United States has a developmental disability, including but not limited to, autism spectrum disorder, cerebral palsy, ADHD, intellectual disability, learning disability, visual impairment, and speech delays (CDC, 2018). Youth with developmental disabilities can sometimes have difficulty developing social skills (Guralnick, 1999), and gaining a sense of independence and responsibility (Blomquist, Brown, Peersen, & Presler, 1998). Additionally, children with developmental disabilities are four times less likely to be physically active than their peers without disabilities, and their physical activity levels decrease even further as they get older (MacDonald, Esposito, & Ulrich, 2011; Esposito, MacDonald, Hornyak, & Ulrich, 2012). Various types of interventions have demonstrated short-term success in increasing physical activity levels for youth with developmental disabilities, however, evidence of generalization of the intervention behavior changes outside of the treatment setting and long-term increases in physical activity levels have been limited. Barriers to long-term effects have included limited access to ongoing interventions or aging out of available interventions, as well as high costs. Promoting the dog-child bond may well have the potential to address these risk factors to the health and wellbeing of youth with developmental disabilities.

It has been demonstrated that childhood pet attachment promotes healthy social development and stronger social competence, communication, and interaction for children (Purewal et al., 2017), as well as developing children's feelings of competence, responsibility, and independence through care of the dependent animal (Vidovic et al., 1999; Bodsworth & Coleman, 2001; Parish-Plass, 2008; Julius et al., 2013). Furthermore, research has shown that children who live in a home with a dog are more physically active than children without a dog at

home (Owen et al., 2010). Thus, it may be possible that interventions that strengthen the bond between youth with developmental disabilities and their family dog, as well as promote long-term physically active behavior, could provide significant benefits for these youth.

Thesis aims

The bidirectional attachment bonds between children and family dogs may impact the efficacy of AAI involving children and their own family dogs. Given the large number of households with both dogs and children, the prevalence of developmental disabilities, and the increased popularity of child-focused dog-assisted interventions, investigating these bidirectional attachment bonds is an important pursuit that could provide valuable information for developing novel AAI approaches involving children with developmental disabilities and their family dogs. While some research already exists regarding children's attachments toward dogs, the lack of research on dogs' attachment bonds toward children must be addressed in order to gain a more complete perspective on the factors that may impact such AAI.

This thesis aimed to evaluate: (1) the pre-existing relationships between children with developmental disabilities and their own family dogs, (2) the efficacy of the implementation of a novel imitation and synchronous activity-based dog training intervention, and (3) the impact of this intervention on the quality of the dog-child bond.

In Chapter 2 the rationale for the implementation of an imitation and synchronous activity-based AAI is explored, including an evaluation of the pre-existing relationships between children and family dogs in terms of their behavioral synchronization pre-intervention. Chapter 3 addresses the lack of research on dog-child attachment by evaluating the profiles of attachment behavior exhibited by the family dog toward the child, a parent, and a stranger prior to

intervention. The post-intervention effects of an imitation and synchronous activity-based AAI on the dog-child attachment bond is also evaluated. In Chapter 4 the efficacy of the imitation and synchronous activity-based AAI is explored in terms of the factors influencing participant outcomes and success in the intervention, and the relative value of this novel AAI compared to a more traditional dog walking intervention.

CHAPTER 2

Rationale and foundation for an imitation and synchronous activity-based animal-assisted intervention

Study design

This thesis aimed to evaluate a novel imitation and synchronous activity-based dog training intervention for youth with developmental disabilities. The intervention incorporated the “Do As I Do” (DAID) dog training method into a joint activity intervention for the child and their family’s pet dog. The DAID dog training method had been validated (Topál, Byrne, Miklósi, & Csányi, 2006; Fugazza & Miklósi, 2014a; Fugazza & Miklósi, 2014b), and had previously been studied in the context of evaluating a trained service dog (Topál et al., 2006), but had never before been used as part of an animal-assisted intervention. By using a family dog for the intervention, this study aimed to maximize the long-term impact for participants as they would be able to continue the activities taught in the intervention at home without scheduled visits to an intervention site after training completion. This “Do As I Do” based dog training intervention was also evaluated for its effectiveness relative to a more traditional dog walking intervention (pseudo control group) and a waitlist control group (true control group).

Participant-dog dyads were randomly assigned to one of the three study groups. Both the “Do As I Do” intervention and the dog walking intervention were conducted in ten 1-hour sessions. During the summer the interventions were offered five days per week for two weeks and during the school year the interventions were offered two days per week for five weeks. Assessments were conducted with all participant-dog dyads during the week prior to the start of the intervention, the week after the end of the intervention, and approximately one year later. Participant-dog dyads assigned to either of the control groups – the dog walking intervention or

the waitlist control – were offered the opportunity to participate in the “Do As I Do” dog training intervention the following year, after their third assessment.

The “Do As I Do” training method

“Do As I Do” dog training teaches the dog to imitate the behavior of the trainer upon the verbal cue of “Do it.” Operant conditioning is used to train the dog to sit-stay and “watch me”, as well as perform six distinct behaviors that are imitable by both the trainer and the dog. Once the dog has mastered “watch me”, sit-stay, and at least three other behaviors to the point of only needing a verbal cue and no lure (these can be referred to as the foundation behaviors), and has learned three more behaviors to the point of needing minimal luring (these can be referred to as the generalizing behaviors), the process of teaching the dog the “Do As I Do” rule may begin.

The first stage of teaching the “Do As I Do” rule is called Phase 1. During Phase 1, the trainer asks the dog to sit-stay, then the trainer demonstrates one of the foundation behaviors, returns to the dog, and says “Do it.” followed immediately by the verbal cue for the demonstrated foundation behavior (ie. “Do it. Touch.”). The dog is rewarded immediately if it performs the demonstrated foundation behavior. The trainer continues to repeat this process with all three of the foundation behaviors, making sure to avoid asking for the same behavior more than twice in a row (to avoid the dog associating the words “Do it.” with a specific behavior). Once the dog starts to perform the demonstrated behavior immediately after the trainer says “Do it.”, before being given the verbal cue for the specific behavior, the dog is ready to move on to Phase 2.

During Phase 2, the trainer continues the same process, still alternating between the three foundation behaviors, but now only says “Do it.” without the additional verbal cue for the

particular behavior. Once the dog is consistently being successful in Phase 2, it is time to move on to the Generalization Phase.

In the Generalization Phase, the trainer now alternates between demonstrating any of the three foundation behaviors and any of the three generalizing behaviors, still only saying “Do it.” with no additional verbal cue for the specific behavior being performed and imitated. Once the dog consistently imitates the correct behavior in the Generalization Phase, the dog is ready for the Test Phase.

The Test Phase is the final stage of the “Do As I Do” protocol, and is the stage during which the trainer may now model previously unknown behaviors for their dog to imitate. The trainer still starts with the dog in a sit-stay, but now demonstrates a previously unknown behavior, returns to their dog, and says “Do it.” If the dog successfully imitates the demonstrated behavior, the dog is rewarded immediately. If the dog does not perform the correct behavior multiple times in a row, the trainer should simplify the behavior, try a different behavior, or go back to the Generalization Phase. The dog has officially learned the “Do As I Do” rule when it consistently performs the previously unknown behaviors that the trainer demonstrates (Fugazza, 2014).

Rationale for the “Do As I Do” intervention

Incorporating the imitation-based “Do As I Do” dog training method into a joint synchronous activity-based intervention for youth with developmental disabilities and their family dog is a novel approach with a wide variety of potential benefits. Synchronous behavior is an important part of social development that promotes prosocial behavior and learning, and

has been used successfully in human-human therapeutic contexts for people with developmental disabilities.

Human-human imitation and joint synchronous activity, in which two people engage in the same behavior in rapid succession or in tandem, have been shown to promote solidarity (Koudenburg, Postmes, Gordijn, & van Mourik Broekman, 2015), social bonding (Tarr, Launay, Cohen, & Dunbar, 2015), social attachment, cooperation (Wiltermuth & Heath, 2009), and improve physical pain thresholds (Tarr et al., 2015). Significant behavioral, social, and emotional benefits have been demonstrated in studies that have integrated human-human reciprocal imitation training, naturalistic imitation, and joint synchronous activities into behavioral therapy for people with developmental disabilities, including people with autism spectrum disorder (Ingersoll & Lalonde, 2010; Koehne, Behrends, Fairhurst, & Dziobek, 2016).

Additionally, dog-human behavioral synchronization, which is a key component of the DAID training method, has been shown to increase mutual affiliation (Duranton, Bedossa, & Gaunet, 2019), and the stronger the affiliation between individuals, the more behavioral synchronization they exhibit (Duranton & Gaunet, 2016). This supports the evidence that mutual responsiveness between dog and child promotes stronger attachment (Jalongo, 2015), and that stronger attachment positively correlates to mutual responsiveness (Hall et al., 2016).

Behavioral synchronization and mutual responsiveness are primary objectives of the “Do As I Do” imitation and joint synchronous activity-based dog training intervention, thus stronger dog-child affiliation and attachment is a predicted outcome of the intervention. With the potential for stronger dog-child affiliation and attachment, which has been shown to promote healthy social development, improved communication, and increased social interaction (Purewal et al., 2017), there are many potential benefits for children with developmental disabilities engaging in this

AAI. Additionally, dog training programs have been shown to increase the trainer's patience, empathy, confidence, and self-control, as well as provide an opportunity for independent skill development, lessons about cause and effect, and clear communication (Leonardi, Buchanan-Smith, McIvor, & Vick, 2017).

Thus, the "Do As I Do" dog training intervention may have the potential to result in significantly greater physical, behavioral, and social benefits in comparison to other forms of AAI, especially for people with developmental disabilities. The dog walking intervention was designed as the pseudo control group for the present study because of the synchronous nature of dog walking and therefore presents the opportunity to compare a novel imitation and synchronous activity-based dog training intervention (DAID) with a more traditional synchronous activity-based dog training intervention (dog walking).

Dog-human synchronization

Researchers have demonstrated that dogs synchronize their behavior with the behavior of their adult owners in both an unfamiliar indoor space (Duranton, Bedossa, & Gaunet, 2017) and a familiar open outdoor space (Duranton, Bedossa, & Gaunet, 2018). Two individuals are said to be synchronizing their behavior when they are doing the same thing in the same place at the same time, and accordingly, behavioral synchronization can be analyzed according to the corresponding three components: activity synchrony, local synchrony, and temporal synchrony (Duranton et al., 2019). In Duranton, Bedossa, and Gaunet's (2019) study with shelter dogs they found that on average the shelter dogs exhibited activity synchrony and temporal synchrony with their caregivers at a slightly lower rate than pet dogs did with their adult owners. This finding supports the evidence that more closely affiliated pairs exhibit greater behavioral synchrony

(Duranton & Gaunet, 2016; Duranton et al., 2017), as pet dogs would be expected to be more closely affiliated to their owners than shelter dogs to their caretakers.

No studies to date have investigated behavioral synchrony between dogs and children, and since the present AAI is based in joint synchronous activity for children with developmental disabilities and their family dogs, the current study aimed to investigate whether family pet dogs naturally exhibit behavioral synchrony with the child participant prior to their joint participation in the AAI. It was predicted that family dogs would naturally exhibit behavioral synchrony with the child participant but at a lower rate than the literature has shown for pet dogs and their adult owners or shelter dogs and their adult caretakers (Duranton et al., 2019). This prediction was based on the association between behavioral synchronization and affiliation (Duranton & Gaunet, 2016; Duranton et al., 2017), and it was predicted that prior to the intervention most of the dogs would have weaker affiliations with a child family member than with an adult owner or caregiver, given that the adult is more likely to be the dog's primary caregiver prior to the intervention (Davis, 1987).

Methods

Participants

Sixteen youth with developmental disabilities (per parental report) between 9 and 16 years old who had a family dog participated in this study (mean = 12.3 years; SD = 2.4 years; 5 females; 11 males). Their pet dogs comprised 8 females and 8 males of various breeds and ranged in age from 5 months to 10 years (mean = 4.4 years; SD = 3.5 years). At the time of the assessment, the length of time the dogs had lived in the home with the participating children ranged from 2 weeks to 9 years (mean = 3.2 years; SD = 2.9 years).

Ethical approvals

All child-dog dyads participated on a voluntary basis. Written informed consent was obtained from the parents/guardians of all participants, and assent was obtained from all of the children explicitly indicating their understanding and desire to participate in the research. The Institutional Review Board (IRB) and Institutional Animal Care and Use Committee (IACUC) of Oregon State University approved all methods and procedures for this study (IRB #7848; ACUP #4898).

Synchronization assessment

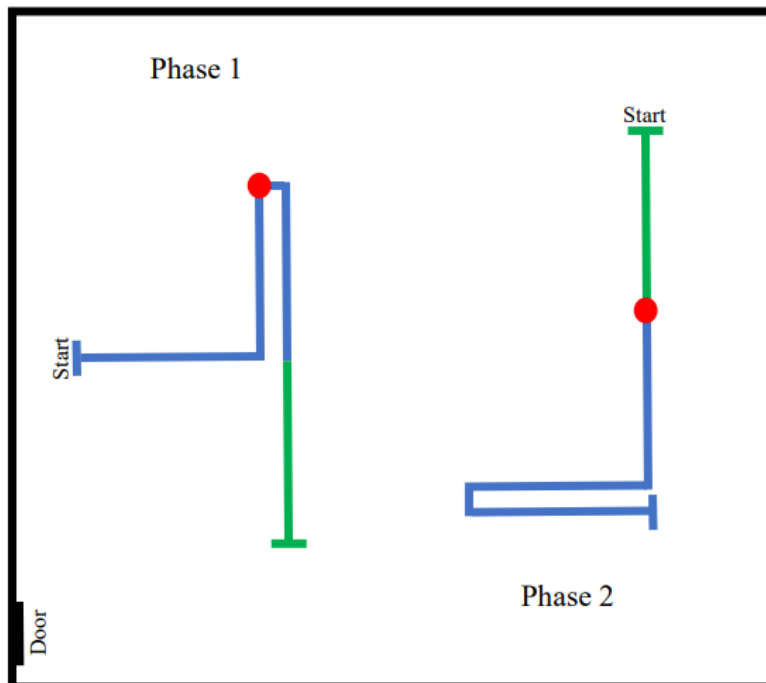
The testing area was a large empty room with cement floor measuring approximately 27 meters by 24 meters with an 11.5-meter-tall vaulted ceiling. At the beginning of the assessment, each dog was given a 3-6-minute habituation period to explore freely about the room in the presence of the participant and the experimenter both waiting passively. The experimenter explained the test procedure to the participant during this habituation period. Based on the protocol of Duranton, Bedossa, and Gaunet (2019), the habituation period was ended by the experimenter when the dog re-approached and was attentive to the participant on its own accord.

Color-coded lines of tape were applied to the floor to aid the child participants in following the assessment procedure. The participant was instructed to walk slow on the blue tape lines, stop on the red poly spot and stand still for 15 seconds (timed by the experimenter), and walk fast on the green tape lines (see Table 2 for protocol and Figure 1 for diagram). There were two phases conducted with a brief break in between to assist with participant focus. During both phases the participant was instructed to stay silent, with their hands at their sides, not talking to or touching their dog.

The experimenter remained stationary directly behind the starting point of each phase and videoed the behavior of both the dog and child during the assessment. The experimenter kept their speaking to a minimum except to tell participants “go” at the beginning, “wait there” as a reminder when they got to the red poly spot, and “go” at the end of the 15 seconds on the spot. A second experimenter, remaining silent and stationary in a balcony overlooking the room, also videoed the behavior of the dog and child to provide multiple angles of visibility for later analysis.

Table 2: Synchronization assessment protocol.

Phase 1		
1.	Walk Slow	6.4 m
2.	Turn	90° left
3.	Walk Slow	6.4 m
4.	Stop	15s
5.	Turn	180° right (<i>Turn 90° right, then walk slow 1 m, then turn 90° right again</i>)
6.	Walk Slow	6.4 m
7.	Walk Fast	6.4 m
Phase 2		
8.	Walk Fast	6.4 m
9.	Stop	15s
10.	Walk Slow	6.4 m
11.	Turn	90° right
12.	Walk Slow	6.4 m
13.	Turn	180° left (<i>Turn 90° left, then walk slow 1 m, then turn 90° left again</i>)
14.	Walk Slow	6.4 m

Figure 1: Synchronization assessment layout.

Behavior coding and statistical analysis

Videos of both phases were combined and coded for the following behaviors using the Countee© app (created by Krushka Design and Dr. Varsovia Hernández): stationary synchrony (percentage of time that the dog was stationary while the participant was stationary), movement synchrony (percentage of time that the dog was moving at any speed while the participant was moving at any speed), local synchrony (percentage of total combined phase duration that the dog was within a 1 meter radius of the participant), and directional synchrony (percentage of total combined phase duration during which the dog's chest was pointed in the same direction as the participant's hips, within 45° to either direction). Additionally, overall activity synchronization was calculated by combining the time in seconds of stationary synchrony and movement synchrony and dividing by the total combined phase duration. Mean percentages and standard deviations for all measures are reported in addition to one-sample *t*-tests used to assess whether each measure of behavioral synchrony was occurring at a rate higher than would be expected by chance.

A randomly selected subset of six of the sixteen participants' synchronization assessment videos were also independently coded by a second coder. Inter-observer reliability on each of the measures of behavioral synchrony was calculated using Pearson Correlation Coefficients. There was strong agreement for all behavioral measures (stationary synchrony, $R = 0.95$; movement synchrony, $R = 0.88$; activity synchrony, $R = 0.91$; local synchrony, $R = 0.96$; directional synchrony, $R = 0.84$). All data used in the analysis was determined by Coder 1.

Results

The dogs and children exhibited activity synchronization for 55.4% of the assessment, significantly above what would be expected by chance (one-sample t -test, $m_0 = 50\%$, $t(15) = 2.63$, $p = 0.019$, $SD = 8.2\%$). Broken down further into active and stationary periods, the dogs were moving for an average of 70.4% of the time that the child participants were moving, which was significantly above chance (one-sample t -test, $m_0 = 50\%$, $t(15) = 3.93$, $p = 0.0013$, $SD = 20.7\%$). However, the dogs' stationary synchronization was 34.5% on average and not above what would be expected by chance ($m_0 = 50\%$, $SD = 24.4\%$).

In addition, local synchrony was exhibited for an average of 18.9% of the assessment, significantly above what would be expected by chance based on the area of the room (one-sample t -test, $m_0 = 0.5\%$, $t(15) = 3.86$, $p = 0.0015$, $SD = 19.1\%$). Directional synchrony was also exhibited at a rate higher than would be expected by chance, at an average of 33.4% of the assessment (one-sample t -test, $m_0 = 25\%$, $t(15) = 2.17$, $p = 0.047$, $SD = 15.5\%$).

Discussion

Overall, the dogs exhibited behavioral synchronization with the child participant at a higher rate than would be expected by chance on four out of five measures. Stationary synchronization was the one exception, which was observed occurring 34.5% of the assessment duration. Interestingly, while Duranton, Bedossa, and Gaunet found that pet dogs exhibited stationary synchronization for 81.8% of the time that their adult owner was stationary (2018), they found that shelter dogs were only stationary for 49.1% of the time their caregiver was stationary (2019), which, like the results of the current study, falls slightly below what would be expected by chance (50%).

Although above the rate of chance, the finding of 18.9% local synchrony for dogs and children falls considerably lower than the average rates of local synchrony observed by Duranton and colleagues among pet dogs of 72.9% (2018) and among shelter dogs of 39.7% (2019) with adults. This may be a result of the dogs' weaker affiliations with the children, and/or it could be influenced by the dog having experienced a past history of interactions with the child that were unpredictable, uncomfortable, distressing, or excessively rough, to which the dogs may have adapted by decreasing their typical proximity to the child (Burrows, Adams, & Millman, 2008).

No prior studies on dog-human behavioral synchronization have assessed directional synchronization, but it may be a useful secondary measure of local synchrony in addition to proximity. The present results show that the dogs were facing in the same direction as the child for an average of 33.4% of the assessment duration (greater than the 25% expected by chance). Particularly under circumstances in which dogs may have learned to give the human more space due to unpredictable behavior or unpleasant interactions, the directional synchronization measurement may be an indicator of whether dogs are still adjusting their body position and direction of travel based on the body position and direction of movement of the human, which is an element of location synchronization.

In addition to the previously mentioned measures of stationary synchrony and local synchrony, the findings of the present research for movement synchrony and overall activity synchrony appear to also follow the same trend when compared with pet dogs with adult owners and shelter dogs with adult caregivers. Pet dogs and their adult owners have shown higher levels of behavioral synchronization on all measures compared to shelter dogs and their adult caregivers (Duranton et al., 2019), who themselves have demonstrated higher levels of behavioral synchronization than the family dogs and children with developmental disabilities.

Overall, these findings appear to suggest that as predicted, family dogs may not have as strong of affiliations with children with developmental disabilities within the home, as compared to with adult caregivers prior to an intervention. This is unsurprising given that most of the children are probably not caregivers for the dogs, therefore their daily interactions are likely unstructured, and the dogs would have less motivation to synchronize with them than with an adult caregiver who is more likely to provide food, attention, and other resources. However, given those considerations, it is remarkable that nonetheless several types of behavioral synchronization are occurring between the dog and child prior to any intervention at statistically significant levels. This level of pre-existing behavioral synchrony, and the noted room for improvement identified between child and adult synchrony levels, provides strong support for the premise of using an imitation-based dog training intervention, such as “Do As I Do” training, where activities can build upon this natural tendency with the aim of strengthening the dog-child bond and promoting physical, behavioral, and social benefits for the child.

CHAPTER 3

Profiles of family dog attachment behavior and the impact of an imitation and synchronous activity-based animal-assisted intervention on the dog-child bond

Introduction

An attachment bond is one that promotes proximity seeking, provisioning of needed resources, and stress reduction for a dependent individual from a caregiver (Bowlby, 1958; Harlow, 1958). Attachment bonds can be categorized into four attachment styles: secure, insecure ambivalent, insecure avoidant, and insecure disorganized (see Table 1) (Bowlby, 1982; Ainsworth, 1985; Main & Solomon, 1990). Individuals with secure attachments exhibit the Secure Base Effect, which is 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 many family pet dogs, an adult/parent provides the primary care (i.e. feeding, walking, etc.) for the dog, thereby serving as the dog’s primary attachment figure.

It is important to consider that a dog’s attachment style toward their caregiver may influence their performance in AAI contexts. In one study, the attachment styles of dogs who engage in animal-assisted activities (AAA) were evaluated and it was found that dogs who exhibited secure versus insecure attachments toward their owner behaved similarly on all behavioral measures, except gaze, during an AAA session. Dogs with a secure attachment toward their owner appeared to spend less time gazing at their owner than did dogs with an insecure attachment, possibly because secure dogs may have lower stress levels during the AAA session (Wanser & Udell, 2019). The attachment style of the dog toward the primary attachment figure may be especially relevant to AAI applications in which the dog is serving as an intervention or therapeutic partner for an individual in the household who does not provide

primary care, such as a child. In such cases the dog may have a strong secure attachment to the adult, but not necessarily to the child.

It has been shown that a human participant's feelings of attachment toward a dog during animal-assisted interventions promotes participation in the interventions, including greater motivation to attend and greater prosocial engagement (Jones, Rice, & Cotton, 2019). Thus, one goal of dog-assisted interventions with children might be to establish or promote secure attachments between the dog and child engaged in AAI given the associated benefits reported in cases where stronger attachment relationships are perceived or exist. In addition, there is evidence in the human literature that the establishment of a secure attachment style to primary caregivers can influence the strength and security of attachments formed with other individuals (Simpson, 1990; Maccoby, 1992; Smyke, Zeanah, Fox, Nelson, & Guthrie, 2010). Therefore, it is also possible that the style of attachment relationship developed between an adult owner and the family dog, may not only influence therapeutic or intervention performance directly (Wanser & Udell, 2019), but could also be predictive of the style of attachment bond formed between a child and that same dog within an intervention setting. Currently little research exists on dog attachment bonds to children, much less dog attachment bonds with both adult and child family members within a household. Given that human-dog attachment has been shown to influence both human therapeutic outcomes and dog behavior in AAI settings, when considering AAI with children and family pet dogs, it may be important to ask how pre-existing relationships between the dog and adult caregiver in the home, and the dog and the child, could influence AAI motivation and performance.

The present study aimed to analyze and compare the pre-existing profiles of attachment behavior exhibited by family dogs toward their primary adult caregiver, toward a child family

member (recruited for participation in the AAI program), and toward a stranger. It was predicted that the attachment behavior of the dog toward the child would resemble the attachment behavior the dog exhibited toward either the parent or the stranger, respectively indicating either the presence or absence of an established attachment bond to the child. It was also expected that the dogs would exhibit more secure attachments with the adult caregiver than with either the child or stranger. It was predicted that secure attachments would exist within dog-child dyads, but based on human attachment style research (Smyke et al., 2010), it was expected that dogs showing a secure attachment to an adult caregiver would be more likely to show a secure attachment to the child participant than those with an insecure attachment to the adult caregiver. Additionally, it was anticipated that in general, family dogs would seek comfort and interaction (i.e. touch and play) from the parent the most and from the stranger the least, with the child ranking in the middle.

While the present study primarily aimed to evaluate the pre-existing dog-child relationships of the participant-dog dyads from all three of the study groups in order to provide an important baseline measure for future analysis of AAI efficacy, the dog-child attachment behavior pre- and post-intervention was also compared in the present study for the participants randomly assigned to the DAID intervention as preliminary evidence of the impact of this intervention. As with sociability in prior research (Tepfer et al., 2017), it was predicted that the attachment style of dogs in the DAID intervention would either remain constant or become more secure over the course of AAI participation.

Methods

Participants

Twenty-two youth with developmental disabilities (per parental report) between 9 and 17 years old who had a family pet dog participated in this study (mean = 12 years; SD = 2.7 years; 7 females; 15 males). Three pairs of siblings participated and shared the same dog between them. Thus, nineteen pet dogs of various breeds participated, ranging in age from 5 months to 10 years (mean = 3.9 years; SD = 3.4 years; 12 females; 7 males). At the time of the initial assessment, the length of time the dogs had lived in the home with the participating children ranged from 2 weeks to 8 years (mean = 2.6 years; SD = 2.4 years). Nineteen parents also participated in this study (15 females; 4 males). Ten participant-dog dyads were randomly assigned to the “Do As I Do” dog training intervention.

Ethical approvals

All child-dog dyads participated on a voluntary basis. Written informed consent was obtained from the parents/guardians of all participants, and assent was obtained from all of the children explicitly indicating their understanding and desire to participate in the research. The Institutional Review Board (IRB) and Institutional Animal Care and Use Committee (IACUC) of Oregon State University approved all methods and procedures for this study (IRB #7848; ACUP #4898 and #4837).

Secure Base Test

The Secure Base Test (Harlow, 1958) was used to evaluate the attachment behavior of the family dog toward the child participant at the initial assessment (for dyads from all three

study groups), and again at the post-assessment just for the ten participant-dog dyads in the DAID intervention. The Secure Base Test was also used to evaluate the attachment behavior exhibited by the dog toward an adult owner/parent, and toward an unfamiliar adult (confederate), on separate days, for comparison to the dog's behavior toward the child. This test, which predates the Ainsworth Strange Situation Test (SST), was developed to assess the quality of attachment of non-humans to attachment figures and has previously been used to assess dog-human attachment security (Thielke, Rosenlicht, Saturn, & Udell, 2017). Assessments were conducted in a room that was novel to the dog and human participants prior to testing. One chair was located inside a marked circle of 1-meter radius on the floor, along a wall opposite the door used. Three toys – tennis ball, rope toy, and plush-squeak toy – were on the floor outside the circle. Two experimenters conducted the test. E1 provided instructions at the start of each phase to ensure consistent participant behavior (E1 remained outside of the room during all phases). E2 stood neutrally/inattentively in a corner of the room controlling the video camera (except during the alone phase when the camera was left on a tripod). The Secure Base Test was divided into three two-minute phases.

Baseline/habituation phase

The experimenter led the dog and the human participant (child, parent, or stranger) into the room and indicated for them to remove the dog's leash and sit in the chair. The human participant 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.

Alone phase

E1 opened the door to indicate to the human participant to exit the room. E2 left the camera on the tripod filming toward the door and also exited, leaving the dog alone. The alone phase serves as a mild stressor, allowing for assessment of the Secure Base Effect during the return phase.

Return/reunion phase

E1 directed the human participant to enter the room and follow the same instructions as the baseline phase. E2 followed closely behind the participant in entering the room and returned to the corner to control the camera, without any interaction with the dog.

Behavior coding

Attachment styles

All assessments were videotaped. The return phase was viewed by two coders, with prior training in evaluating canine attachment styles, who 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 ambivalent, insecure avoidant, and insecure disorganized (see Table 3). There was 73.9% 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).

Table 3: Canine attachment style definitions (adapted from Schöberl et al., 2016 and Thielke et al., 2017). *No dogs in the current study were unclassifiable.

Attachment Style	Definition
Secure	Dog's greeting behavior is active, open, and positive. Little or no resistance to contact or interaction with the human participant. Seeks proximity and is comforted upon reunion, returning to exploration or play.
Insecure Ambivalent	Dog shows exaggerated proximity-seeking and clinging behavior (but may struggle if held by human participant). Exhibits a mix of persistent distress with efforts to maintain physical contact with the human participant and/or physically intrusive behavior toward the human participant. (Dogs who the judges agreed seemed essentially secure but with ambivalent tendencies were categorized as secure.)
Insecure Avoidant	Dog shows little or no visible response to the human participant's return. Ignores or turns away from human participant but may not resist interaction altogether (e.g. laying, sitting, or standing without physical contact with, out of reach of, or at a distance from human participant).
Insecure Disorganized	Dog exhibits evidence of a strong approach-avoidance conflict or fear upon reunion (e.g. circling human participant, 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 stereotypies 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).
Unclassifiable*	Judges were unable to reach consensus on the attachment style categorization of the dog. Unclassifiable dogs were excluded from further analysis on dog attachment.

Duration measures

The video of the two-minute return phase was also analyzed and coded by a third coder using the Countee© app (created by Krushka Design and Dr. Varsovia Hernández). The durations of the following behavioral states were recorded, and reported as proportions of the two-minute phase duration: proximity, touching, playing, exploring, avoiding, and door-directed behavior (see Table 4 for ethogram). A randomly selected subset of 38% of the return phase videos were also independently coded by a fourth coder. Inter-observer reliability for each of the behavioral states was calculated using Pearson Correlation Coefficients, which indicated strong agreement for all behavioral measures except avoiding (proximity, $R = 0.99$; touching, $R = 0.99$; playing, $R = 0.95$; exploring, $R = 0.97$; avoiding, $R = 0.45$; door-directed behavior, $R = 0.87$). The low Pearson Correlation Coefficient for avoidance can be attributed to the low avoidance scores and low variability, however the data found by both coders for this measure were very similar (coder 1, mean = 0.04, median = 0, SD = 0.12; coder 2, mean = 0.04, median = 0, SD = 0.14). All data used in the analysis was determined by Coder 3.

Table 4: Secure Base Test ethogram of duration measures.

Behavior	Description	Notes
Proximity	The dog has at least 1 paw inside the 1 meter radius circle taped around the participant's chair.	
Touching	The human and dog are physically in contact with one another with any part of their bodies.	
Playing	The dog is making physical contact with a toy or is actively engaged in chasing a toy.	<u>Cannot</u> occur at the same time as "exploring" or "avoiding".
Exploring	The dog is moving around the room; including <u>brief</u> pauses in movement (remaining standing) during which apparent sniffing or looking around is occurring.	<u>Cannot</u> occur at the same time as "avoiding", "door-directed behavior", or "playing".
Avoiding	The dog is laying, sitting, or standing stationary outside of the proximity circle; including sniffing and looking around that is occurring while dog is laying or sitting, or while dog is standing stationary for longer than a brief pause in walking (see "exploring").	<u>Cannot</u> occur at the same time as ANY other behaviors.
Door-directed behavior	The dog is gazing or sniffing at the door, under the door, or around the edges of the door; jumping at the door or making any physical contact with the door; or whining directed at the door.	<u>Cannot</u> occur at the same time as "exploring" or "avoiding". <u>Can</u> occur at the same time as "proximity", "touching", or "playing". (If testing room has multiple doors this only applies to the door used for entrance and exit during the test.)

Statistical analysis

A Shapiro-Wilk test did not confirm a normal distribution for the measures of proximity, touching, playing, exploring, avoiding, and door-directed behavior, therefore Kruskal-Wallis H tests were used to analyze these measures. For measures that the Kruskal-Wallis H tests demonstrated statistically significant differences between the dogs' behavior toward the child, parent, and/or stranger, paired *t*-tests were conducted to further assess the differences. The alpha level was set to $p < 0.05$ for all tests.

Results

Attachment styles

The percentages of dogs exhibiting each attachment style in the presence of the parent, stranger, and child (pre-intervention) are presented in Table 5. Seven dogs had a secure attachment style toward their child participant at the initial assessment, and as predicted, all of those dogs also had a secure attachment with the parent. Five of the nineteen dogs were categorized as secure in their behavior in the presence of the stranger. Four of those five dogs were also categorized as secure with the parent, but the other dog that exhibited secure behavior with the stranger had an insecure ambivalent attachment style toward the parent. Interestingly, all of the dogs that exhibited insecure disorganized attachment styles with the child exhibited secure attachment behavior toward the stranger. (See Table 6.)

Table 5: Dog attachment style categorizations by human participant (parent, child, or stranger).

	Secure	Insecure Ambivalent	Insecure Avoidant	Insecure Disorganized
Dog-parent	68%	32%	-	-
Dog-child	32%	32%	23%	13%
Dog-stranger	26%	42%	32%	-

Table 6: Attachment style profiles of the dogs toward the parent, the child (pre-intervention), and the stranger.

Dog-parent attachment style	Dog-child attachment style	Dog-stranger attachment style
Secure	Secure	Secure
Secure	Secure	Secure
Secure	Secure	Insecure ambivalent
Secure	Secure	Insecure ambivalent
Secure	Secure	Insecure ambivalent
Secure	Secure	Insecure avoidant
Secure	Secure	Insecure avoidant
Secure	Insecure ambivalent	Insecure ambivalent
Secure	Insecure ambivalent	Insecure avoidant
Secure	Insecure ambivalent	Insecure avoidant
Secure	Insecure avoidant	Insecure avoidant
Secure	Insecure avoidant	Insecure avoidant
Secure	Insecure disorganized	Secure
Secure	Insecure disorganized	Secure
Secure	Insecure disorganized	Secure
Insecure ambivalent	Insecure ambivalent	Insecure ambivalent
Insecure ambivalent	Insecure ambivalent	Insecure ambivalent
Insecure ambivalent	Insecure ambivalent	Insecure ambivalent
Insecure ambivalent	Insecure ambivalent	Insecure avoidant
Insecure ambivalent	Insecure avoidant	Secure
Insecure ambivalent	Insecure avoidant	Insecure ambivalent
Insecure ambivalent	Insecure avoidant	Insecure ambivalent

Effects of the “Do As I Do” intervention

At the initial assessment, among the ten participants in the “Do As I Do” dog training intervention, two had a secure dog-child attachment style, four had an insecure ambivalent attachment style, two had an insecure avoidant style, and two displayed an insecure disorganized attachment style. At their post-assessment following the DAID intervention, the numbers were: seven secure, zero ambivalent, two avoidant, and one disorganized. The two dyads that started out with a secure attachment maintained the secure attachment. Three of the four dyads with an initially insecure ambivalent attachment style developed a secure attachment style, one of the dyads with an insecure avoidant style developed a secure attachment, and one of the dyads with a disorganized style also developed a secure attachment style. (See Table 7.)

Table 7: Pre-intervention and post-intervention dog-child attachment style categorizations of dyads in the DAID intervention.

Pre-intervention dog-child attachment style	Post-intervention dog-child attachment style
Secure	Secure
Secure	Secure
Insecure ambivalent	Secure
Insecure ambivalent	Secure
Insecure ambivalent	Secure
Insecure ambivalent	Insecure avoidant
Insecure avoidant	Secure
Insecure avoidant	Insecure avoidant
Insecure disorganized	Secure
Insecure disorganized	Insecure disorganized

Pre-intervention behavior duration measures

The Kruskal-Wallis H tests demonstrated significant differences were present between at least two groups for the measures of proximity ($H = 6.52, N = 60, p = 0.0384$) and door-directed behavior ($H = 9.53, N = 60, p = 0.0085$), but not for the measures of touching ($H = 2.86, N = 60, p = 0.2398$), playing ($H = 3.32, N = 60, p = 0.1901$), exploring ($H = 0.79, N = 60, p = 0.6735$), and avoiding ($H = 0.89, N = 60, p = 0.6404$).

As predicted, during the return phase of the SBT, the family dogs on average spent more time in proximity to the parent than to either the child (paired t -test, $t(21) = 3.88, p = 0.0009$), or the stranger (paired t -test, $t(18) = 2.61, p = 0.0178$). However, there was no significant difference in the amount of time that the dog spent in proximity to the stranger versus the child (paired t -test, $t(21) = 0.66, p = 0.5170$). (See Figure 2.) On the other hand, the dogs engaged in door-directed behavior the most in the presence of the stranger and the least in the presence of the parent, with the child ranking in the middle (see Figure 3), and statistically significant differences between each group (parent versus stranger, paired t -test, $t(18) = 5.03, p < 0.0001$; parent versus child, paired t -test, $t(21) = 2.54, p = 0.0191$; child versus stranger, paired t -test, $t(21) = 2.68, p = 0.0139$).

Figure 2: Proportion of the 2-minute return phase of the SBT that dogs spent in proximity to the human participant (stranger, child, or parent). * $p < 0.05$

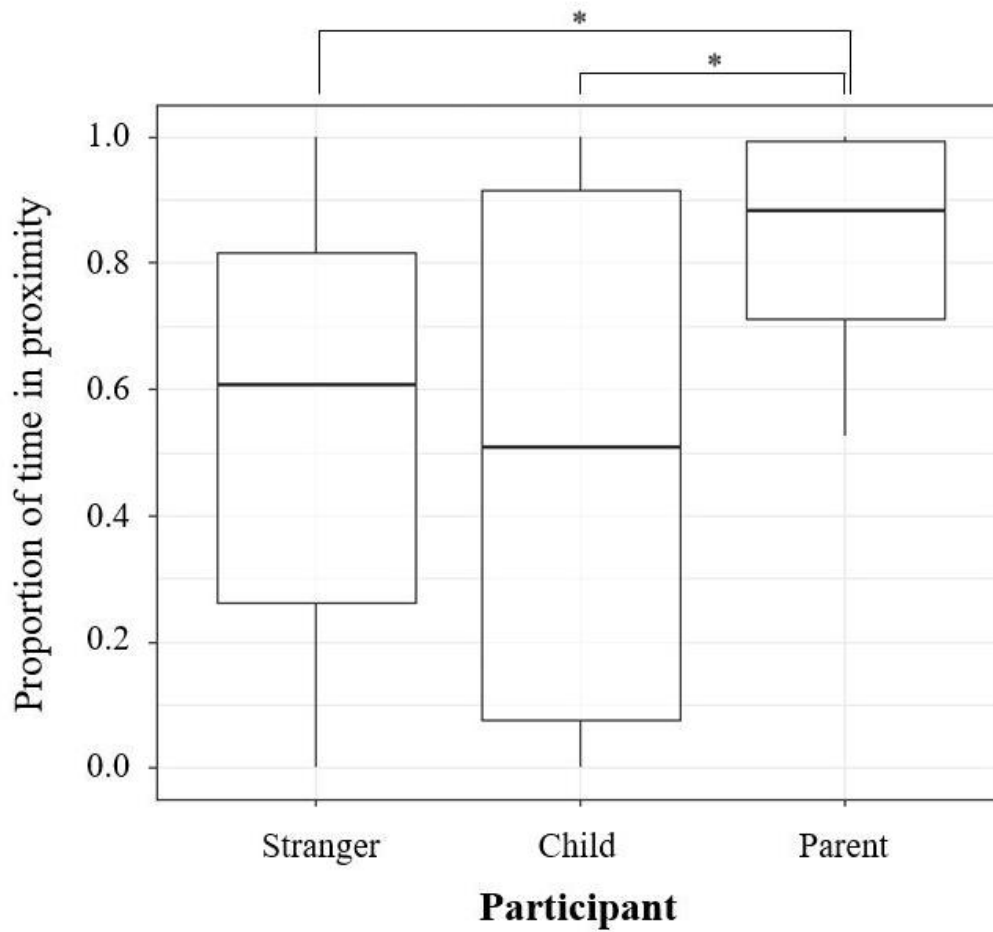
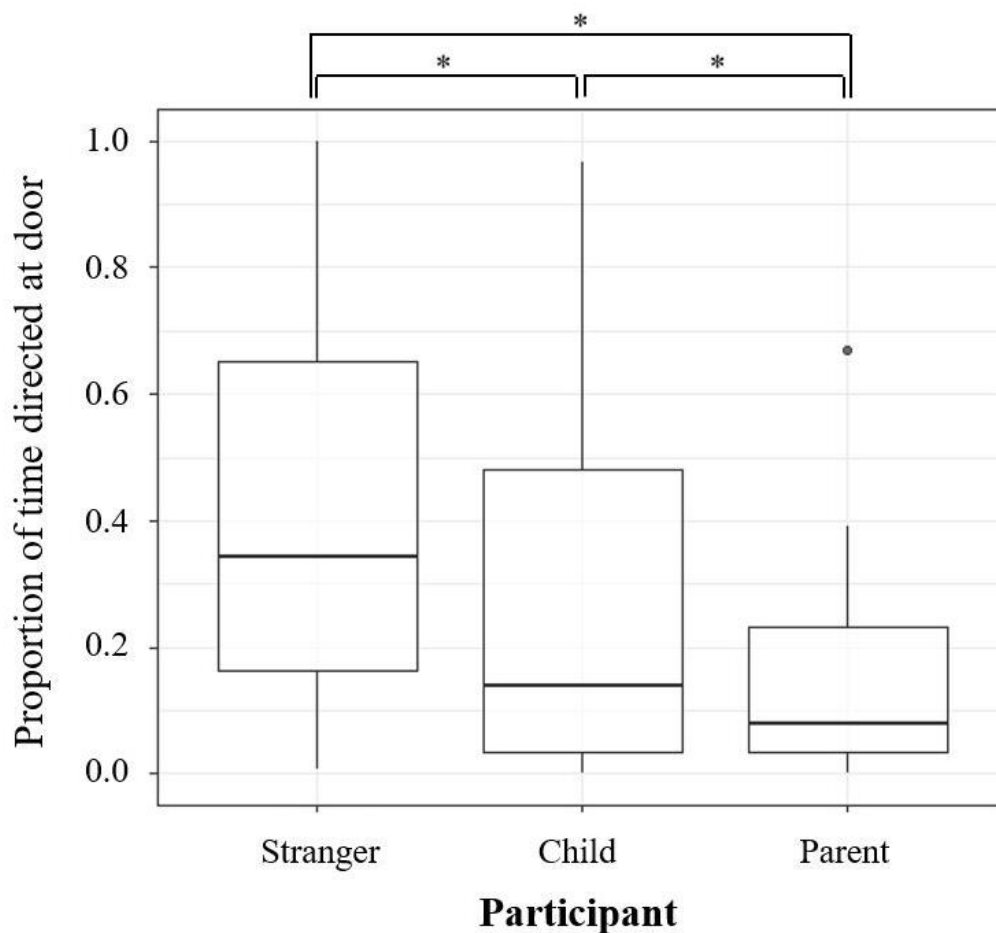


Figure 3: Proportion of the 2-minute return phase of the SBT that dogs spent engaged in door-directed behavior in the presence of the human participant (stranger, child, or parent). * $p < 0.05$



Discussion

Research indicates that the bonds between dogs and adult owners fulfill the criteria of an attachment bond (Topál et al., 1998; Palmer & Custance, 2008; Mariti et al., 2013), and some studies have gone on to categorize dogs into formal attachment styles (Schöberl et al., 2016; Thielke et al., 2017). However, this is the first study to evaluate the attachment bond between a child in the household and the family dog using the Secure Base Test and compare it to the

behavior of the dog with a parent/adult owner and with a stranger using separately conducted SBTs with each person.

In many households the primary caregiver of the family dog is likely a parent, making them the primary attachment figure. However, it is common for both humans and dogs to have multiple attachment figures. Thus, it is not surprising that more secure attachments were observed between the dogs and parents than between the dogs and children at the initial assessment, but as demonstrated in the current findings, under conditions where a child fills an important companionship, caregiving, or training role for the dog, secure attachment development is possible. This is consistent with research that has demonstrated that younger siblings sometimes develop a secure attachment to older children within the household, especially if the older sibling shares in caretaking responsibilities (Stewart, 1983). Moreover, the present results support the evidence in the human literature that the establishment of a secure attachment style to primary caregivers can influence the strength and security of attachments formed with other individuals (Simpson, 1990; Maccoby, 1992; Smyke et al., 2010) since all of the dogs in the present study that had a secure attachment to the child at the initial assessment also had a secure attachment to the parent.

The Secure Base Effect, which is a product of a secure attachment style to a present attachment figure (Ainsworth, 1989), is known to have a wide range of benefits including stress reduction, increased exploration and persistence, improved executive function, and a reduction of behavior problems in dogs and humans (Bowlby, 1982; Ruiter & van IJzendoorn, 1993; Cooper, Shaver, & Collins, 1998; Horn, Huber, & Range, 2013; Bernier, Beauchamp, Carlson, & Lalonde, 2015). The changes in the dog-child attachment style observed in six of the ten dyads that participated in the DAID intervention may be evidence that many family dogs might not

have developed a stable attachment style with a child in the home yet. Moreover, with four of those shifts resulting in the development of a secure attachment style post-intervention, the present study demonstrates that AAI has the potential to change the attachment style between a family dog and child to a more secure attachment. In turn, the abovementioned benefits of a secure attachment could be impactful in the AAI setting where the dog's ability or inability to experience the Secure Base Effect could have a significant impact on the animal's welfare, focus, or performance in the AAI (Wanser & Udell, 2019). When the child becomes a secure base, this should enhance the dog's sense of security to engage in the environment alongside the child, which may enhance AAI motivation and performance. The development of a secure attachment may also have wide ranging benefits for the dog and child outside of the intervention and post-intervention. For example, the dog may seek out the child more for interaction when the parent is absent/unavailable, fostering increased interactions and greater feelings of responsibility and companionship for the child.

The finding that there were no significant differences between the duration of time that the dogs spent playing and exploring in the presence of the parent versus in the presence of the stranger sharply contrasted with the human literature that has previously shown significantly less play and exploration in the presence of the stranger than in the presence of the parent (Ainsworth & Bell, 1970). On the other hand, the findings for door-directed behavior in the current study seem to be congruent with prior human literature. Ainsworth and Bell (1970) categorized this type of behavior as "search behavior" during the phases of the SST when the primary attachment figure was not present. Their findings showed moderately strong search behavior persisted when the stranger returned for episode 7 of the SST even though the infant was no longer alone, but was still presumably searching for their primary attachment figure. Similarly, significantly more

door-directed behavior was observed in both the presence of the stranger and in the presence of the child than in the presence of the parent, likely because the dog was seeking to locate their primary attachment figure when the person present (i.e. the child or stranger) was not sufficiently fulfilling their needs for comfort-contact or the Secure Base Effect. These findings are also similar to findings in the human literature that concluded that many human infants appeared to cease attempts to elicit caregiving from their older sibling during an attachment test, not due to satisfaction of their needs for caregiving, but rather due to insufficient response by the older sibling to provide care (Stewart, 1983). While technically door-directed behavior could be categorized as a type of exploration, and resuming exploration after reunion is part of the definition of a secure attachment style, the dogs' door-directed behavior during the SBT may in many cases, especially when occurring for long durations, be a behavioral indicator of the dog having unsatisfied needs for caregiving that the particular person present is ineffective at providing.

Interestingly, while Ainsworth and Bell (1970) on average observed significantly more proximity- and contact-seeking behavior from the infants toward the parent than toward the stranger, they highlighted that some of the infants exhibited much more proximity- and contact-seeking behavior toward the stranger than many of the other infants did. That is congruent with the present findings as well, with 42% of the dogs exhibiting insecure ambivalent behavior toward the stranger, categorized by exaggerated proximity-seeking and clinging behavior.

The attachment profiles of the dogs that exhibited an insecure disorganized attachment style with the child merit further exploration. The insecure disorganized attachment style commonly occurs among dependents who have been mistreated by the caregiver, although not always (Granqvist et al., 2017). In the present study, three dog-child dyads exhibited a

disorganized attachment style, while no dog-parent or dog-stranger dyads did. Each of the three children in those dyads did in fact display behavior toward their dog at their initial assessment that was judged by the researchers to be rough, uncomfortable, or distressing for the dog which may have led to the approach-avoidance conflict or fear that was observed during their SBT. Two of those dyads went on to be randomly assigned to the DAID intervention and while one of those dogs still exhibited a disorganized attachment style toward the child at their follow-up assessment, one dog had developed a secure attachment style with the child by the end of the intervention. This is an exciting result suggesting that the AAI has the potential to dramatically improve the relationship between a dog and child by teaching the child more positive ways to interact with their dog.

The finding that each of those dogs that initially displayed a disorganized attachment style with the child displayed secure attachment behavior toward the stranger (and toward the parent) may indicate that the dogs that experienced increased stress in the presence of the child tended to more readily accept any friendly and respectful adult as a secure base. Such a tendency could be associated with a similar phenomenon observed in a population of Romanian orphans adopted into the UK in the 1990s. Researchers measuring the attachment behavior of the then 6-year-old children who had been exposed to deprived conditions in Romanian orphanages during their early lives found that many of the children exhibited behavior that did not fit the typical categorizations of attachment behavior, particularly in their behavior toward strangers (Rutter et al., 2007; Rutter, Kreppner, & Sonuga-Barke, 2009). Rutter and colleagues labeled this pattern of behavior disinhibited attachment (2007). Disinhibited attachment behavior is characterized by four key features: (1) the dependent demonstrates a lack of differentiation in their social response to a stranger versus their caregiver; (2) the dependent rarely checks back with their caregiver in

stressful situations; (3) there is a clear indication that the dependent might readily go off with a stranger; and (4) the dependent exhibits intrusive physical contact with a stranger (Rutter et al., 2007; Rutter et al., 2009). Disinhibited attachment is not its own attachment style per se; it can be found in individuals with any of the four main styles of attachment described in Table 1. Disinhibited attachment has not previously been studied in dog-human attachment research, however hyper-sociability, which seems to have some overlapping features with disinhibited attachment, is a documented characteristic of domestic dogs (Trut, Oskina, & Kharlamova, 2009; vonHoldt et al., 2017), and is often considered to be a positive trait for pet dogs and dogs in some working contexts (Udell & Brubaker, 2016; Wanser & Udell, 2019). In fact, each of the four key features of disinhibited attachment could be considered an advantageous trait for dogs in a variety of circumstances, including AAI. The phenomenon of disinhibited attachment seems to be a link from the human literature that has previously been overlooked in the dog literature, but merits further investigation. It seems that the behavior of several of the dogs in the present study might fit the criteria for disinhibited attachment, including the dogs with disorganized attachment styles toward the child.

Overall the prediction that the majority of dogs would either exhibit the same attachment style with the parent and child but not the stranger (suggesting that the dog had an established attachment bond with the child), or would exhibit the same attachment style with the child and stranger that was different from the parent (suggesting that the dog did not have an established attachment bond with the child) was not supported. Six dogs did have the same attachment style with the parent and the child (and not the stranger), but only three dogs had the same attachment style with the child and stranger (different from the parent), amounting to only nine of twenty-two dogs fitting the prediction. Surprisingly a total of ten dogs had the same attachment style

with the parent and the stranger, which may be an indicator of potential disinhibition. The final three dogs displayed different attachment styles with each person, and it is worth noting that two of those dogs were the youngest dogs in the study at less than 6 months old, suggesting that they may not have developed stable attachment styles with anyone yet.

It is clear that attachment profiles are complex and many factors impact the behavior of the dogs toward their primary caregiver, toward children with developmental disabilities in the home, and toward strangers. While more empirical evaluations are needed, the knowledge that AAI can have a beneficial impact on the dog-child relationship (with no evidence of a negative impact identified in the current study) is a promising finding that supports the One-Health mission of many AAI efforts. More research will help improve our understanding of how the dog-human bond may influence AAI outcomes, to identify ways to maximize the health and wellbeing of human and animal participants, as well as to improve human-animal interactions in AAI settings.

CHAPTER 4

Efficacy of synchronous activity-based animal-assisted interventions for youth with developmental disabilities and their family dog

General discussion

The present research is the first to evaluate the dog-child bond in terms of behavioral synchronization and attachment through the use of behavioral assessments with children and their family dogs. The findings have demonstrated that family dogs naturally synchronize their behavior with children in the family beyond what would be expected by chance. The present study has also demonstrated that some children act as a secure base for their family dog, and that for others it is possible, through participation in AAI, to change the attachment style between a dog and child to a more secure attachment. While it was evident that at the beginning of the study most dogs had stronger bonds with the parent than with the child, the present findings have demonstrated that the qualities of the pre-existing relationships between youth and their dogs provide a promising foundation upon which animal-assisted interventions can be built.

The final consideration in this thesis is to evaluate the efficacy of the novel imitation and synchronous activity-based dog training intervention for youth with developmental disabilities. Per the study design, all participants enrolled in the present study were randomly assigned to one of three treatment groups: the “Do As I Do” intervention, the dog walking intervention (pseudo control group), or a waitlist control group (true control group). Participants assigned to either of the control groups were offered the opportunity to return again one year later to participate in the DAID intervention. Preliminary data on the factors that have influenced participant outcomes and success in the “Do As I Do” intervention will be considered, as well as the relative value of this novel intervention compared to the more traditional dog walking intervention.

“Do As I Do” intervention outcomes

A total of fifteen youth with developmental disabilities (per parental report) between 8 and 17 years old have completed the “Do As I Do” (DAID) dog training intervention with their family dog. Ten of those participants were randomly assigned to the DAID intervention group, and the other five participants had been randomly assigned to one of the control groups and elected to return again one year later to participate in the DAID intervention. Of the fifteen-total participant-dog dyads who participated in the DAID intervention during either their first or second year involved in the study, four dyads (27%) completed the DAID protocol through the final Test Phase, demonstrating mastery of the new training technique in their dog’s learned ability to imitate novel behaviors modeled by the participant. Two more participant-dog dyads (13%) achieved success at the Generalization Phase, the next-to-last phase of the DAID protocol, by demonstrating that their dog was able to successfully imitate a wide range of familiar behaviors when modeled by the participant (without the use of any other cues). Of the preceding three levels in the DAID protocol, one participant-dog dyad achieved success at Phase 2 (7%), three reached Phase 1 (20%), and five participant-dog dyads remained at the pre-training phase (33%). Whether the dyad participated in the DAID intervention during their first or second year involved in the study, appeared to have no impact on the phase they achieved in the DAID protocol.

Factors influencing “Do As I Do” intervention outcomes

Dog-child attachment

While the present research has established that participation in the DAID intervention has the potential to change dog-child attachment bonds to a more secure attachment, regardless of

the dog-child attachment style at the initial assessment, the pre-intervention dog-child attachment style may hold some predictive value into which dyads are more or less likely to master the DAID protocol during the 10-session intervention. Six of the dogs achieved either the Test Phase or the Generalization Phase, which can be considered successful acquisition of the basic concept of the DAID imitation rule. Of those six dogs, two exhibited a secure attachment style and four exhibited an insecure ambivalent attachment style toward the participating child prior to the intervention. Of the nine dogs that did not successfully learn the imitation rule, four exhibited a secure attachment style, one exhibited an insecure ambivalent attachment style, two exhibited an insecure avoidant attachment style, and two exhibited an insecure disorganized attachment style at their initial assessment. While dogs with both secure and insecure ambivalent attachment styles fell into both groups – the group that was successful and the group that was not successful at learning the imitation rule – dogs with insecure avoidant and insecure disorganized attachment styles were only found in the group that was not successful. This is not surprising given that avoidant and disorganized attachment styles indicate that those dogs do not seek out their participating child for comfort-contact or for play in an unfamiliar and potentially stressful situation. Additionally, the dogs with disorganized attachment styles in particular may have been experiencing increased stress due to the presence of the participating child. Not seeking comfort-contact or play with the child, or experiencing increased stress in the presence of the child, may have resulted from the dog having experienced a history of interactions with the child that were distressing, uncomfortable, excessively rough, and/or unpredictable. In such cases, more time during the 10-session intervention was spent teaching the child how to appropriately interact with the dog and how to develop a more positive and trusting relationship, and in so doing, they progressed through the DAID protocol at a slower rate.

Interestingly, physical touch in particular appears to be associated with the abovementioned differences between the dog-child dyads that succeeded at the DAID protocol and those that did not. During the return phase of the SBT, the dogs and children who would go on to succeed at the DAID protocol spent significantly more time in physical contact with each other than the dogs and children who would not go on to successfully learn the imitation rule (unpaired t -test $t(13) = 2.33, p = 0.036$). On the other hand, there was no significant difference between the time the successful dogs and the unsuccessful dogs spent in proximity to the seated child, playing with a toy, or directing their attention toward the door during the return phase of the SBT (proximity, unpaired t -test $t(13) = 0.98, p = 0.34$; play, unpaired t -test $t(13) = 1.71, p = 0.11$; door-directed behavior, unpaired t -test $t(13) = 1.72, p = 0.11$). This is particularly interesting because, of those four behaviors (touching, proximity, playing, and door-directed behavior), touching is the only behavior measurement that depends on the mutual action of the dog and child to be in physical contact with each other, as the child is petting the dog. Perhaps children who pet their dogs more prior to the intervention may have been more attentive to their dog's behavior and needs, and more motivated to interact with them, all of which are important foundational elements to training the dog, thus providing an advantage that promoted faster progress through the DAID protocol during the intervention. However, more research is needed to evaluate the mechanisms behind this correlation.

Other factors

Every participant-dog dyad was unique, and in addition to pre-intervention dog-child attachment styles, several other factors also influenced the phase of the DAID protocol that each of the dyads achieved during the 10-session intervention. One important factor was attendance.

Attendance ranged from 7 to 10 days, and as evidenced by all four dyads that mastered the Test Phase having attended at least nine sessions, a minimum of nine days attendance may be a critical factor in completing the DAID protocol. Moreover, one dyad that achieved success at the Generalization Phase attended only seven sessions, whereas had they attended at least two more sessions it is likely they would have mastered the Test Phase as well.

The preliminary data suggests that the dogs' age, socialization, and training histories were also important factors. The mean age of the dogs that successfully learned the imitation rule was 7.1 years ($SD = 3.3$), whereas the mean age of the dogs that did not successfully learn the rule was 3.2 years ($SD = 3.0$), a statistically significant difference (unpaired t -test $t(13) = 2.37, p = 0.03$). This may be explained by the naturally slower progress of the younger dogs, especially those under two years of age, due to the necessity of prioritizing socialization and taking more frequent breaks. Dogs of any age that lacked socialization also experienced slower progress due to the necessity of prioritizing socialization. Counter conditioning was frequently utilized with these dogs to help them feel more comfortable and confident in the intervention environment, which was necessary before further training could effectively take place. Additionally, dogs of any age that lacked name recognition or any prior training tended to make slower progress, especially during initial sessions, as the dyad had to begin by establishing a training relationship and teaching name recognition before they could work on progressing through the DAID protocol.

On the other hand, dogs that entered the DAID intervention with a pre-established training foundation generally progressed faster. For example, dogs that already demonstrated a reliable sit-stay for their child participant could focus more of their initial intervention sessions on training behaviors to be applied to the DAID protocol. Additionally, dogs that already had a

history of training generally learned new behaviors more quickly, as they had developed learning set (Harlow, 1949), and dogs that entered the intervention already knowing some tricks that could be applied to the DAID protocol were able to begin Phase 1 of the protocol much sooner than other dogs.

Child behavior and adaptations to the “Do As I Do” intervention

Several factors related to the child’s behavior may have also played a role in the rate of progress of each participant-dog dyad in the DAID intervention. In particular, the child’s threshold for frustration appeared to be a significant factor. Dog training requires significant patience, and children who had a very low threshold for frustration seemed to find this dog-assisted intervention particularly challenging. They showed slower progress through the DAID protocol, especially due to the necessity of frequent breaks. Children who had a very hard time maintaining focus and engagement with their dog and/or with the volunteers working with them also showed slower progress through the DAID protocol, as significant time was spent redirecting the child’s attention, and frequent breaks were necessary.

For children who had a hard time maintaining focus or engagement in the intervention with their dog, or who had low thresholds for frustration, many adaptations and techniques were utilized. These adaptations and techniques included stations, visual aid diagrams of the goal behaviors, step-by-step diagrams and/or written instructions breaking down the steps to teach new behaviors, and token economies. Additionally, colored tape and/or colored spots on the floor were often used to assist participants with incremental steps toward fading a lure or increasing the distance from which they could direct their dog to do a behavior (such as to stand on a platform, go around a cone, or go over a jump). Some of these adaptations and techniques

were found to be so universally beneficial that they were utilized with nearly all of the participants to aid in the dog training process.

Additionally, at the start of this study, it was observed that many of the child participants were lacking an effective understanding of dog body language and signaling, and as such, many were observed engaging in behaviors during their first assessment that their dog appeared to find uncomfortable or distressing. This observation is supported in research that has evaluated children's lack of understanding of dog signaling and demonstrated the successful increase of children's awareness and understanding through an intervention teaching them to correctly interpret and respect dogs' body language, thereby keeping both children and dogs safer and happier (Meints, Brelsford, & De Keuster, 2018). Therefore, on the first day of the 10-session DAID intervention, prior to implementing the "Do As I Do" protocol, all participants were taught a lesson about dog body language, as well as about respecting dogs' boundaries and recognizing signs of stress and fear in dogs. Additionally, positive reinforcement was discussed on the first day and volunteers coached the participants to explore what was rewarding to their own dog (ie. types of treats, toys, touch, and/or praise that their dog responded to positively, as seen in their body language). These lessons during the first session of the intervention were deemed necessary to provide the essential foundation for the participants to begin developing a stronger relationship of mutual trust and understanding with their dog.

Throughout the 10-session intervention, volunteers continued to coach participants on understanding their dog's body language, respecting their dog's boundaries, and using positive reinforcement to train their dog. Over the course of the intervention, it appeared that many of the dogs became more comfortable with their child participant, as the dogs' body language became increasingly more relaxed and/or happy when the child and dog were interacting. Most

importantly, this potential benefit of the intervention was independent of the participant-dog dyad's progress through the DAID protocol.

All of these factors represent important future considerations that may influence the success and study of AAI's conducted with children and their family dogs. More experimental research is needed to specifically evaluate how the noted variables of interest factor into outcomes of interest.

“Do As I Do” intervention efficacy

As discussed, all of the abovementioned dog- and child-related factors appeared to contribute to comparatively slower or faster progress through the DAID protocol. However, the intervention process itself may be more important than the phase of training reached during the course of the intervention. While it can be stated that six of the fifteen dogs successfully learned the imitation rule, and nine of the dogs did not successfully learn the imitation rule, that does not fully represent the impact, value, or effectiveness of the intervention on the lives of any of the dogs and children. On the contrary, participation in this program seems to have the potential to improve the relationship between the participant and the dog regardless of their achieved phase of the protocol. Of the five dogs discussed in Chapter 3 that developed a secure dog-child attachment style over the course of the DAID intervention, three had learned the imitation rule and two had not.

It is evident that there is no single measure on which to base overall conclusions about the effectiveness or value of the DAID intervention. Based on the preliminary data, it appears that the DAID protocol may be particularly well-suited for children who have the desire to develop a stronger relationship with their dog, and for those who have adult dogs that already

have some foundational obedience training, as they are the most likely to be able to progress considerably through the phases of the protocol and master “Do As I Do” training. Efforts to complete the DAID protocol may be too much to expect from puppies however, and children with puppies generally remain at the pre-training phase throughout the 10 sessions. That is not to say however that the current intervention is not effective or valuable for those with puppies. On the contrary, working with a child-puppy dyad for up to 10 sessions on socialization, relationship-building, basic obedience, and tricks, has the potential to be highly valuable and create long-term benefits for the child, the puppy, and their relationship. Similar benefits may also be afforded to dog-child dyads that are initially categorized as disorganized or avoidant in their attachment style. Thus it is evident that regardless of the phase of the protocol they achieve during the intervention, participation in the intervention has the potential to dramatically improve the dog-child relationship. Nevertheless, while all of these potential benefits of the DAID intervention are promising, in order to thoroughly evaluate the efficacy of this novel intervention it is important to also consider how participation in a more traditional dog walking intervention compares.

Dog walking intervention outcomes

Eight youth with developmental disabilities (per parental report) between 8 and 17 years old have completed a more traditional dog walking intervention with their family dog. Of these eight participant-dog dyads, one dyad achieved very good, consistent loose leash walking both indoors and outdoors. Two dyads achieved very good, consistent loose leash walking indoors and dramatically improved, somewhat consistent loose leash walking outdoors. Three participant-dog dyads achieved very good, consistent loose leash walking indoors, but did not

achieve consistent loose leash walking outdoors due to the increased distractions. One dyad achieved occasional loose leash walking indoors. The final participant was disinclined to participate in training their dog.

Factors influencing dog walking intervention outcomes

Similar to the DAID intervention group, many factors impacted the progress and achievements of the dyads in the 10-session dog walking intervention. The most significant factors in the dog walking intervention were the dogs' age, socialization, and training histories. Half of the dogs in the dog walking intervention were under one year of age. Predictably, these puppies were particularly distracted by the environment and their participants struggled to maintain their attention. Their progress toward loose leash walking was dramatically slower than those with adult dogs, but participation in the program provided excellent opportunities for socialization for the puppies. Additionally, dogs that were particularly interested in other dogs made slower progress toward loose leash walking due to the dogs' lack of focus on their participant whenever another dog was in sight.

Attendance was a less significant factor in the dog walking intervention than in the DAID intervention. Attendance ranged from 7 to 10 days, and there was no correlation between days attended and progress toward loose leash walking. A more significant factor seemed to be the child's interest in teaching their dog to have good leash manners and basic obedience skills. As previously stated, one participant showed no interest in engaging in the training activities, but several additional dog walking participants also showed little interest in teaching their dog leash manners, and expressed that they would rather teach their dog tricks. However, tricks were not taught in the dog walking intervention, whereas they were a major focus in the DAID

intervention. According to the dog walking intervention protocol, participants were taught how to teach their dog good leash walking skills, as well as basic obedience skills including sit, down, stay, and come.

Overall, it was evident throughout this project that children displayed greater interest and motivation in the DAID intervention than they did in the dog walking intervention. Systematic evaluations of participant preferences may be worth considering for future research, as preference could also predict long-term compliance. Most, if not all, of the participants in the dog walking intervention were noted by their volunteers in their daily progress notes to be bored usually by at least day 5 of the ten-day intervention. The value and importance of teaching the dog leash manners and basic obedience was frequently discussed with participants, however it was unclear whether this rationale helped at all with participant interest and motivation. Additionally, games and activities were utilized to try to increase the participants' enjoyment of the intervention and interest in working on the training. These games and activities included 'Red Light, Green Light', scavenger hunts, and obstacle courses. Token economies were also used with some participants.

All participants in the dog walking intervention received the same lesson as the DAID participants on the first day of the intervention about understanding dog body language, respecting dog's boundaries, recognizing signs of stress and fear in dogs, and understanding positive reinforcement, particularly as it related to their own dog's preferences (see previous section). Volunteers also continued to coach the dog walking participants on these topics throughout the 10-session intervention. Consistent with what was observed among the participants in the DAID intervention, many of the participants in the dog walking intervention also entered the study lacking an effective understanding of dog body language and often

unintentionally caused their dogs discomfort or stress through their interactions. Over the course of the intervention, it appeared that many of the dogs became more comfortable with their child participant and the lessons from day one in particular seemed to have provided an essential foundation for the participants to build stronger relationships of mutual trust and understanding with their dogs, independent of their leash walking and basic obedience outcomes.

Relative value of the “Do As I Do” and dog walking interventions

Both interventions are based in synchronous activity, with the added component of imitation-based training in the DAID intervention, and documented benefits have been found for participants in both interventions. However, when comprehensively assessed, the “Do As I Do” intervention seems to have stronger potential overall to strengthen the child-dog relationship than the dog walking intervention for a number of reasons. Most importantly, it seemed that there was generally more buy-in from the participants in the DAID intervention than participants in the dog walking intervention based on the following evidence. Participants in the dog walking intervention tended to express boredom more often than participants in the DAID intervention. Dog walking participants also frequently expressed a strong desire to train tricks rather than leash manners and basic obedience, even when they did not know that the other intervention group was training tricks. For most participants learning the “Do As I Do” protocol, their interest and motivation in the training was reported by their volunteers to increase over the course of the 10-session intervention, whereas for most participants participating in the dog walking intervention, their interest and motivation in the training seemed to dramatically decrease after the first 3-5 sessions, per volunteer report. As such, an intervention that maintains the participant’s interest and motivation through the entire program is inherently more valuable

than an intervention in which extra effort must be expended to try to keep it engaging. Thus, even if the effects of both training protocols are equally impactful to the child-dog relationship, the DAID intervention appears more valuable given the greater motivation and enjoyment among the participants involved in that intervention, and future research should consider conducting systematic evaluations of participant preferences to further assess this consideration.

Conclusions

Research has shown that children exhibit attachment behaviors toward their pets (Jalongo, 2015), and can be strongly attached to them (Bodsworth & Coleman, 2001; Westgarth et al., 2013; Jalongo, 2015; Hall et al., 2016). This is the first study to show that this is truly a bidirectional bond and that family dogs exhibit both behavioral synchrony and attachment behaviors toward children in the family as well. The present study has demonstrated that family dogs with a secure attachment to the parent are more likely to already have a secure attachment to the child, and also that participation in the “Do As I Do” intervention can increase the attachment security between dogs and children. Many children may not understand dog body language and signaling (Meints et al., 2018), and some may unintentionally cause increased stress for their dog (Burrows et al., 2008), but as demonstrated in both interventions in the present study, children can be taught to better understand their dog’s communication, boundaries, and preferences which can improve the dog-child relationship and the dog’s quality of life. Overall, the “Do As I Do” dog training intervention appears to have great potential for promoting health and wellbeing for youth with developmental disabilities by strengthening the dog-child bond and increasing the mutual responsiveness in their relationship, thereby promoting feelings of capability, independence, and social wellbeing in the child.

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