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Developing Emotional Security Among Children Who Have Been Adopted

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DEVELOPING EMOTIONAL SECURITY AMONG CHILDREN WHO HAVE BEEN ADOPTED

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Abstract

This study investigated the development of emotional security among 6-10 year old children who have been adopted by exposing them to an experimental condition during which they could engage with either a live dog or a robotic dog. The live dog was a certified therapy dog; the robotic dog was a FurReal® toy marketed by Hasbro as "Biscuit." Utilizing a mixed-method embedded experimental design, the experimental condition was intentionally structured to promote engagement between the participant and the dog or robot. 43 children who had been adopted from the child welfare system were randomly assigned to one of two groups**.** One group was exposed to a therapy dog (n=22), while another was exposed to the social robotic dog (n=21). The development of emotional security was targeted for measurement in this study using the "Reading the Mind in the Eyes Test," a test of social understanding that has been linked in the literature to oxytocin– a hormone premised to be a marker of the development of emotional security. Physiological anxiety was also measured as an indicator of emotional security using the Revised Child Manifest Anxiety Scale-2 (RCMAS-2). Both measures were administered before and after exposure to the experimental condition. A linear mixed-effect regression analysis showed that for boys only, there was a significant effect of engagement with either companion on social understanding ($p<.01$). Social understanding decreased as engagement increased. A second model indicated that for boys only, their history of animal cruelty had a significant effect on physiological anxiety

($p<.05$). If boys had an animal cruelty history, their anxiety was reduced after the exposure to either the dog or robot. Interpretations of the findings suggest that there are differences among children who have been adopted and have a history of animal cruelty that differentially influences their development of emotional security. Social work interventions designed for practice with children who have been adopted will need to assess the presence of these variations and develop appropriate treatment protocols.

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Table of Contents

List of Figures

Chapter One: Introduction

Chapter one provides a brief overview of the current study and defines the terms of emotional security, therapy animals, social robots, and the social environment, that are critical to this work. Chapter one concludes with a discussion of why this study could contribute to the practice of social work.

Introduction and Purpose

This study examined how emotions and physical reactions related to emotional security may be differentially invoked by contrasting the effects of a child's engagement with a robotic artifact and a sentient non-human animal. In this study, the robotic artifact was a robot marketed as a toy dog and the animal was a therapy dog. Emotional security is a fundamental emotion for well being, one that has been described as a basis for attachment, self esteem, autonomy, and self regulation (Ainsworth, 1978; Barth, 2005; Bowlby, 1969; Chaffin et al., 2006; Crittenden, 2006; Haggard & Hazan, 2004; Haugaard, 2004; Levy & Orlans, 1998). Childhood trauma, that is often part of a child's early experience when he or she has been involved in the child welfare system, may negatively influence a child's ability to experience emotional security and confound a child's emotional development (Barth, 2005; Chaffin et al., 2006; Haugaard & Hazan, 2004; Perry, 2006; Yorke, 2008). Exploring situations that might invoke feelings of emotional security and therefore provide an opportunity for continued emotional development among children who have been adopted from the system is an important

area of focus that could lead to new interventions. Recent research suggests that children's environments may have key differences that promote or inhibit the development of security (Fries, Ziegler, Kurian, Jacoris, & Pollak, 2005; McEwen, 2008). In addition, scholars are increasingly recognizing the role of animals in children's lives and the benefits that children who are raised with pets often experience, such as physiological benefits (Beck, 1996; Cutt, Giles-Corti, Knuiman, & Burke, 2007; Friedman, 1995; Friedmann, Katcher, Thomas, Lynch, & Messent, 1983), companionship (Brown, 2007; Bryant, 1990; Cain, 1985; Cohen, 2002), and resiliency in the face of trauma (Perry, 2006; Reichert, 1998; Yorke, 2008).

There are times in social work practice where the inclusion of live animals trained specifically to act as therapeutic adjuncts to an intervention presents challenges. For example, trained therapeutic animal handlers and animals are not always available at critical moments in work with children who are experiencing trauma, such as when a child is undergoing emergency surgery or has been removed from an abusive situation by police. The inclusion of social robots designed to mimic live animals as therapeutic agents has become increasingly popular (Banks, Willoughby, & Banks, 2008; Hinds, 2010; Libin & Libin, 2004; Libin & Libin, 2003; Melson et al., 2009; Scassellati, 2005). In situations where a traumatized person is involved, animals might be at a higher risk of abuse (Ascione, Friedrich, Heath, & Hayashi, 2003; Ascione, 1997). This presents important ethical considerations for both the animals and people involved. However, if it could be demonstrated that a robotic companion could be successfully used to invoke emotional response, a number of advantages appear. Robotic animals can also be placed in any physical setting with a child and moved between settings with relative ease. For

example, robotic animals can be deployed with relative ease as an initial step in any intervention. Future designs of robotic animals could include recording capabilities and indications of behavioral disturbance noted. Later, interventions could be tailored precisely to meet the needs of the individual child. Live animals could be introduced in a planned, safe and ethical manner. Robots and animals could unite on a continuum of interventions, dedicated to the best outcomes for both human and animal welfare. Intellectual curiosity about the role of non-human animals and robotic agents in children's environments will lead to better interventions and better outcomes.

This study examined how children, age six to ten, who have been adopted from the child welfare system develop emotional security based on a brief experimental encounter with either a social robotic toy dog or a certified therapy dog. How the children engaged with the dog or robot was recorded and pre and post measures of the child's emotional security were assessed.

Definition of Terms

Emotional security.

Bowlby's theory of attachment suggests that emotional security is derived from the relationship of an infant to his/her primary caregiver, usually the mother. This primary relationship evolves in four stages from 0-30 months and becomes a blueprint for how the infant will behave in other social relationships (Bowlby, 1969). Emotional security is the degree to which the infant feels he/ she has a secure base from which to explore the world. In Bowlby's theory, the secure base is dependent on the relationship with the primary caregiver. Ongoing research in attachment suggests that this secure base continues to evolve as a function of the child's developmental and social

psychology. For example, the speech and behavior of toddlers and young children suggest that they construe “my parents”, “my family”, and possible other reference groups as sources of security (Waters & Cummings, 2000).

Cummings and Davies (1996) proposed a control system model for children’s security as a function of multiple family relationships and events. Davies and Cummings provide a useful definition of emotional security as a latent construct with a range of prominent functions that can be represented as three more concrete processes (Davies & Cummings, 1998):

1) Insecurity may be reflected in emotional reactivity characterized by heightened fear, distress, vigilance, and covert hostility (Calrson, Cicchetti, Barnett, & Braunwald, 1989). Thus, a child’s level of anxiety can be inversely related to his or her level of security (Davies & Cummings, 1994).
2) Emotional security serves a motivational function by guiding children to regulate their exposure to stressful parental emotion (Cassidy, 1994). Children will either withdraw themselves from an emotionally painful situation or act as mediators in the face of conflict in order to minimize the threat, thereby increasing emotional security (Cummings & Davies, 1996).
3) Internal representations of marital and family relations are theorized to be a relatively accurate depiction of family life (Bretherton, 1985).

In this study, emotional security is a construct that is influenced by a number of events, relationships and contexts. This study assumes that animals can play a significant role in family life and therefore, could also contribute to a child’s base of emotional security.

Therapy animals.

For the purpose of this study, the terms “companion animal,” “pet,” and “therapy dog” will be used to refer to live dogs involved in the study. All of the dogs are pet dogs or companion animals that are included in the research because of their desirable qualities that make them good companions. They are also certified therapy animals by American Humane Association. [For a more detailed discussion of animal selection, see chapter 3.] This study focused only on dogs as animal companions.

Companion animals, most commonly referred to as “pets”, are animals that share our living spaces. Companion animals are dependent on the human caretaker to provide appropriate food, shelter, and companionship, as well as environmental and emotional stimulation that are appropriate for that species and breed. Most companion animals in the United States are dogs or cats, with 37.2% of US households owning a dog and 32.4% of US households owning a cat, according to the 2007 statistics published by the American Veterinary Medical Association (American Veterinary Medical Association, 2007). Companion animals share a mutually beneficial relationship. For example, caring for a companion animal can provide a sense of purpose, opportunities for exercise, and a desire to better care for one’s self. It may also be true in the United States that , “For many people, companion animals are the primary source of emotional and social support because more traditional human support systems have been removed in modern society” (Golab, 2006).

Social robots.

References to “companion robots,” “robotic dog,” and Biscuit, the robotic dog manufactured by FurReal® friends by Hasbro and chosen for comparison in this study,

are all social robots. [More on the social robot selection for this study can be found in Chapter 3.] Like companion animals, "social robots" are "the class of robots that people anthropomorphize in order to interact with them" (Breazeal, 2003). The idea that robots can, "behave and interact with humans, act socially, remains unclear" (Bartneck & Forlizzi, 2004, p. 591). Yet this emerging genre of agent can be a compelling companion for children (Woods, 2006) and is consistently growing in its prevalence as a childhood companion (Louv, 2005). Social robots are, "an autonomous or semi-autonomous robot that interacts and communicates with humans by following the behavioral norms expected by the people with whom the robot is intended to interact" (Bartneck & Forlizzi, 2004, p. 592). These social robots are already being used in therapy. For example, in Japan and the United States, robots have been companions to older adults in institutional care (Banks, Willoughby, & Banks, 2008; Kanamori, Suzuki, & Tanaka, 2002) and applications for robots with children with autism are also being explored (Scassellati, 2005). The social robots of concern in this study are toy robots that are designed to be companions for children in ways that a pet would be.

Social environment.

According to social ecological theory, the social environment is, "the space within which human behavior and development occur, the boundaries beyond which they may not (easily) go, and the physical things that represent obstacles or facilitators of which much human activity has to be concerned" (Germain & Bloom, 1999, p. 32). The physical environment of the natural world, plants, animals, geographic characteristics, and the built environment of our rural and urban layouts, media, transportation, electronics and computers, all contribute to the social environment. The social

environment of the child is where he or she experiences daily life. The social environment is where all elements of the world, including animals and robots, interact with the person and the person, in turn, mutually interacts with them.

Animals and Robots and the Practice of Social Work

Social work is a profession that is rooted in using an ecological approach, working with people in their environments to use the strengths that accompany the clients and their surroundings towards the changes they desire (Gitterman & Germain, 2008; Hepworth, Rooney, & Larsen, 2002; Risley-Curtiss, Holley, & Wolf, 2006; Saleeby, 1992). Children who have experienced trauma through abuse or neglect and are consequently relocated to new homes through the involvement of the child welfare system are particularly sensitive to cues from their environment about their well being. Hyper-vigilance, clinging, and hiding are not uncommon behaviors for children who are in transition throughout the system and are good indicators of how multiple environments threaten a child's sense of security (Fahlberg, 1991). Understanding our connection to other living beings in our environment is part of our developmental process and may be why humans are drawn to animals. This is especially true of children (Melson, 2003). The inclusion of companion animals in both practice and research should be a natural process that would enhance the profession's ability to work with clients and their challenges, coping mechanisms, and resilience factors (Risley-Curtiss et al., 2006; Yorke, 2008). As social robots are rapidly becoming part of our social environment, scientific investigations about human social relations with these non-human, non-animal, but socially stimulating companions is warranted. Social robots provide a compelling

comparison to companion animals as emotionally-evocative players in human emotional development.

Chapter Two: Literature Review

Chapter two is a review of the literature related to this study. The roles of animals in our society, the importance of embodiment and the rise of the social robot as a social companion are considered. Then, the chapter addresses how children who have been adopted could benefit from knowledge generated in this area. The chapter concludes with presenting the research questions for this study.

Animals' Roles in Society and Family

It would be difficult to argue that companion animals do not play a crucial role in our social environment, simply by examining their prevalence. There are approximately 74.8 million dogs and 88.3 million cats in the United States; thirty-nine percent of U.S. households own at least one dog, while thirty-four percent of U.S. households own at least one cat (American Pet Products Manufactures Association APPMA, 2008). Sixty eight percent of Americans consider pets as members of their family (Brookman, 1999). It is estimated that more than 64 million households in the U.S. include one or more companion animal. More than 70% of US households with minor children have pets (Melson, 2003). In a recent study of pet owners, over 97% of people agreed with the statement, "My pet is a member of my family" (Risley-Curtiss et al., 2006).

The family is the most intimate and influential environment in which human development takes place (Germain & Bloom, 1999). "Family" is defined by the

individual and society. Individuals who play family roles assume the most important positions in the individual's human experience. These roles are often defined in society by blood or social institutions such as marriage or adoption. Calling pets family members is a way for individuals to emphasize the importance of pets' roles in the intimate social environments of individuals surveyed. Children who designate pets as family members may also derive a relational space from which they can explore the world and from which emotional security can be derived. On the same note, to the degree that these human-animal relationships are unhealthy or compromised, insecure feelings may result.

The Biophilia Hypothesis: Animals Provide Important Social Cues

The biophilia hypothesis as described by Harvard biologist E.O. Wilson in 1984, offers a rationale for how humans and animals interact in relation to emotional security. The biophilia hypothesis argues that humans co-evolved with animals within the natural world and that humans have an innate interest in living things. This interest has been advantageous because humans learn about our environments by the cues that animals give. Animals at rest in our environments signal well-being and reassurance to humans (Wilson, 1984). For example, animals grazing peacefully in a sunny field signal that there is no danger present, while birds in sudden flight signal danger (Katcher & Wilkins, 1993). Gail Melson, professor emeritus of child development at Purdue University who has studied the importance of animals in children's lives for over thirty years, argues that biophilia informs a "biocentric" approach to children's development and speculates that animals could give children important cues about security:

> If there is an innate predisposition to associate friendly animal presence with safety, children should derive reassurance from such animal presence, particularly in the absence of human attachment figures. Interacting with companion animals, even just observing them, should produce relaxation effects in children independent of their history with pets….To what extent, if at all, can animals compensate for the absence of ineffectiveness of human efforts to reassure children? Are the security-enhancing roles of animals limited to dogs and cats? By what process--- physical presence, holding, stroking, confiding, etc. --- do animals restore perceived security (Melson, 2000, p. 377)?

Consistent with the biophilia hypothesis, recent research has shown that infants have evolved with a pre-disposition to non-verbal social cues in their environment (Trevarthen, 2004). Trevarthen's work has focused on the relationship between the mother and infant, but he comments that certain kinds of human play and young mammalian (such as kittens, puppies, young rats and monkeys) play are similar such as games where "half-expected" surprises occur. These interactions produce an emotional response that in turn helps teach the infant about communication and his or her environment. Human infants and young animals have co-evolved to anticipate social cues from others.

In particular, domesticated dogs have shared a common environment with humans for over ten thousand years and communicate non-verbally with humans with understood gestures, movements, and behaviors (Udell & Wynne, 2008). For humans, these games are important to language development as meanings are assigned to these emotionally charged experiences of laughter. A diverse set of fun and interactive playmates will help an infant to integrate non-verbal social cues as a means of gathering information about her environment (Crittenden, 2006; Perry, 2006; Trevarthen, 2004). Often, the infant will be able to infer that an environment is secure by the signals that are given non-verbally, from human and non-human animals.

There is additional evidence that gaze and visual cues are fundamental to our core knowledge and human cognition (Spelke & Kinzler, 2007). Spelke and Kinzler describe recent research that suggests there is a core knowledge system, with roots in our evolutionary past that emerges in infancy and serves as a foundation for learning and reasoning. This visual core system is used primarily for understanding social partnerships and group memberships. Oxytocin has also been shown to increase in humans as a result of interacting with their dogs (Odendaal, 2000; Odendaal & Meintjes, 2003). When dissecting the features of the social interaction of the dog and owner, oxytocin levels for dog owners were higher when the interaction was initiated by the dog's gaze (Nagasawa, Takefumi, Onaka, & Ohta, 2009). These findings have an important influence on the selection of measures in this study, described in more detail in Chapter 3.

Could a family dog sleeping under the table signal to a child that he/ she is in a secure place? In this way, companion animals may broaden the base from which a child or adult derives his or her emotional security.

Animals as Indicators of Security: Biophilia and Current Findings

Indeed, there are multiple studies that have examined how animals alter perceptions of an environment or person. Lockwood (1983) showed that people shown in scenes including animals were described as friendlier, less threatening and happier than those in scenes without animals. Rossbach and Wilson (1992) analyzed responses to three photographs, one with people alone, another with flowers, and another with a dog, and found that people in the photographs containing the dog were perceived as happier and more relaxed. These photos were also chosen as the 'best photos.' In a similar

study, the same researchers found that people with a dog were judged to be happier and safer. Additional examination of this phenomenon found that there are differences in perceptions that can be associated with human gender and animal species (Budge, Spicer, Jones, & St. George, 1996). The presence of an animal, the animal's species, and its behavior all contribute information to children about an environment.

Additional research supports the premise that certain animals can act as calming agents, particularly in stressful situations. In one study, ten dog owners and ten non-dog owners were exposed to psychological testing in a stressful (psychological laboratory) and a non-stressful (in their own home) setting. The participants were significantly less-anxious and behaved less-anxiously when the researcher's dog was present (Sebkova, 1977). Also, participants paid more attention to the researcher's dog in the high than in the low stress situations which suggests that the relaxing external focus of attention or feeling of safety provided by a friendly animal might be particularly important in stressful situations.

In another study with children ages 9-15, blood pressure and heart rates were measured as indicators of stress while children rested and read out loud, both with and without a friendly dog present. The conditions for the presence of the dog were randomized. The study found that the average mean arterial (MAP), systolic (SBP) and diastolic (DBP) blood pressures during the entire experiment were lower for the children who had the dog present initially than for those who had the dog present the second half of the experiment (Friedmann et al., 1983). Blood pressure was consistently higher for children when they were reading, but attenuated with the presence of the dog. As

children receive both internal (reduced blood pressure) and external (calm behavior) reductions in stress from the dogs, their feelings of security were increased.

There is some convergent research that indicates that companion animals could contribute to security as it relates to trustworthiness. In one study, 428 German fourth-grade children were surveyed. The children were divided into two groups: those that owned pets and those that did not. The children were asked about their family composition, their experience with their current pet, or if they did not have a pet, what kind of pet they would like, about caring activities, and other kinds of interactions with the animal. The majority of children (80%) owned a pet and 82% of children who did not own a pet would like to have one. 79% of the children said that they prefer the company of their pet when they are sad ($p<.001$, $h=1.24$) and nearly all of the pet owners (94%: p, .001, h=2.15) consider their pet as an especially good friend (Rost & Hartmann, 1994). One could infer that children turned to pets in times of sadness because they helped them to feel more secure, although this specific question is a topic for future inquiry.

Mader, Hart, and Bergin (1989) examined whether disabled children in wheelchairs with service dogs received more frequent social acknowledgment that when no dog was present and found that social acknowledgments (e.g., friendly glances, smiles and conversations) were substantially more frequent when a service dog was present. A study of adult service dog owners found that twelve percent participants saw the most important function of their dog as a guard or deterrent. It is unclear if this function is still an important feature of the relationship for other recipients of service dogs, even thought it was not ranked as the “most important” (Lane, McNicolas, & Collins, 1998). Some of the other “most important” tasks were: retrieving and carrying (84%), opening doors

(40%), companionship (35%), and barking on command (35%). It would be worthwhile to investigate why barking on command was valued by owners. Could this be a function of personal security? One could hypothesize that the value of barking is to warn others in the area not to come too close, thus providing security if there is a perceived threat.

Service dogs are shown to facilitate social interaction with other people (Lane et al., 1998; Mader et al., 1989), contributing to an enhanced social network and providing companionship that allows owners to feel more connected with the other people in their lives. In both studies, the somewhat unfamiliar condition of blindness or disabled condition seemed to be mitigated by the presence of a friendly dog. This presence seems to have an effect on others in the social context. The owners of the dogs, both children and adults, were judged to be approachable and safe as evidenced by the increased interactions when the dogs were present. It appears that service dogs provide cues of safety both to their owners and to others in the social context.

In another study, 507 adolescents, both youth who were considered normal and those who were delinquent, responded to an open-ended questionnaire concerning the role of pets in their lives (Robin, ten Bensal, Quigley, & Anderson, 1983). Companionship and friendship were the most common benefits cited to pet ownership among all of the participants. Delinquent youth reported that their pets kept them from physical harm more frequently than public school youth. This finding has been discussed by others (Covert, Whiren, Keith, & Nelson, 1985) and could be an indication that pets play a special role in the lives of delinquent and impaired youth. Could it be that children who are marginalized place a greater importance on animals in their lives to provide security?

The American Humane Association has studied the co-occurrence of violence to people and violence to animals, "The Link®." In one study, 57 families who were being treated for incidents of child abuse were interviewed. 88% of the families, with sustained physical abuse, interviewed also reported animal abuse within the home and in two thirds of the cases the abusive parent had killed or injured the animals to control a child (DeViney, Dickert, & Lockwood, 1983). In the same study, 38% of the caseworkers involved with the participants said that they had observed animal abuse or neglect that was either underreported or not reported in the interviews. In only five of the fifty-three interviews did the interviewer note favorable treatment towards the animals in these "abusive" homes (DeViney et al., 1983). In such environments, it makes sense that children would pay special attention to animals to provide them with information about their own safety, particularly when there are consistent links between violent behavior towards children and pets.

The evidence of a link between children, companion animals, and emotional security has been notably pursued in investigations involving children. For example, the capacity for feeling secure has been found to be challenging for children who have experienced early forms of trauma in the form of abuse or neglect (Barth, 2005; Chaffin et al., 2006; Haugaard & Hazan, 2004). Animals have been shown to help people feel more secure and more trusting (Lane, 1998; Mader, Hart, & Bergin, 1989; L. G. Melson, 2000; Voith, 1985). Relationships with animals have been associated with feelings of security in a number of studies (Lane, 1998; Mader et al., 1989; L. G. Melson, 2000; Voith, 1985). More research is warranted to specifically investigate by what processes emotional security is provided to children through companion animals. Is the mere

presence of a companion animal able to enhance a child's sense of perceived security in a stressful situation? What children may benefit most from a companion animal's presence? What characteristics or behaviors make an animal best-suited for this purpose? Based on this review of the current literature, it appears that the assumption that companion animals can play a role in emotional security is a reasonable one. A better understanding of this relationship could greatly help to inform practitioners who work with marginalized children, such as those in the child welfare system who are transitioning to new environments, to work with animals and other people in their environments and help them feel secure.

Affective Computing and the Rise of Social Robots

Another area of research relevant to this study is affective computing. It is an area that has received relatively little attention from human-animal bond researchers. Affective computing is defined by Picard (1997) as computing that relates to, arises from, or deliberately influences human emotion or other affective human phenomena. Picard has led a team of researchers at the MIT Affective Computing Lab in the area of "Things that Think." Some of this work has focused on autism, which has led to the development of the "social emotional toolkit" (http://affect.media.mit.edu/projectpages/esp/) and a robot called Shybot. The use of robots to evoke human emotion is not a new enterprise (Klein, Moon, & Picard, 2002; Picard, 1997). In explorations led by researchers in the field of human-animal connections, robotic artifacts have stimulated reactions in humans similar to those observed in relationships with live animals (Banks, Willoughby, & Banks, 2008; A. Libin & Libin, 2004a; G. F. Melson et al., 2005; Ribi, Yokoyama, & Turner, 2008).

Similar to the non-discursive interactions with animals, research with affective social robots has demonstrated the importance of non-verbal social cues to social interactions (Breazeal, 2003). The behavioral response to an interaction such as leaning forward and raising brows to relinquish the floor in a conversation, is part of the profoundly complicated interactions that constitute a social exchange. At what point does the sophistication of this social exchange graduate the participants to being a member of the social order? Cynthia Breazeal, designer of the social robot, Kismet, asks the critical question, "To what extent is the robot a full-fledged social participant?" (Breazeal, 2003) This question is important if these non-human companions are to help us play social roles as intimate as those that are traditionally reserved for "family members" and has important implications such as the development of emotional security. Scientists in the area of affective computing speculate that social robots will become more and more engaging and take on more roles that have typically been reserved for their living counterparts as technology becomes more sophisticated (Breazeal, 2003; Reeves and Nash, 1998). As social work practitioners who work with individuals who have been forced to accept dramatic changes in their social environments, we may be able to intentionally employ social robots to help people develop emotional security.

A much more recent phenomenon is the emergence of socially interactive toy robots designed to be companions in the same manner that companion animals are. This emerging class of social robots has made this type of agent more accessible to children, competing for time within the childhood experience. These robots, marketed as toys, are becoming increasingly more sophisticated. They can talk, respond to touch, and respond to voice commands (Francis & Mishra, 2008; Hansel, 2002). More recent developments

in socially affective robots are focused on the fine nuances of empathic response (Cramer, Goddijn, Wielinga, & Evers, 2010). Engineers are even building robots that can adapt their behavior to changes in their composition such as an “injury” that results in new self-modeling to achieve a goal such as locomotion (Bongard, Zykov, & Lipson, 2006).

Social robots in children’s environments

Nowhere is this trend more apparent than in the US toy industry. In 2003, the United Nations estimated that there would be an 800% growth in this industry in the next few years (Lund, 2003). For example, a Furby is an electronic robotic toy made by Tiger Electronics which went through a period of being a "must-have" toy following its introduction during the 1998 holidays, with continual sales until 2000. Furby sold 1.8 million units in 1998, 14 million units in 1999, and altogether in its three years of original production, Furby sold over 40 million units, and its speaking capabilities were translated into 24 languages. Furbys were the first successful attempt to produce and sell a domestically-aimed robot. A newly purchased Furby starts out speaking entirely “Furbish.” Furbish is the unique language that all Furbys use, but are programmed to speak less of as they learn more English (Lund, 2003).

Another line of toys, FurReal® Friends by Hasbro, has had parallel success to the Furby. In 2002, the FurReal® cat was one of the “must have” toys of the holidays (Hansel, 2002). The FurReal® engineers built on the experience of the Furbys and decided to make the toy appeal more to the emotional aspects of play such as friendship and nurturing, “things that stay with you for a lifetime (Hansel, 2002)”. The FurReal® friends have developed a complete line of animals with different ages, breeds and colors.

Following suit, the Zhu Zhu pets, robotic hamsters that retail for $8-10, were the most popular Christmas gift in 2009. Reuters states, “Demand for the low-maintenance pets that don't poop, stink or die is so high that toy stores can't keep up with orders” (Goldsmith, 2009). The 800% growth in this industry forecasted in 2003 seems to have some merit (Lund, 2003).

Implications for social robots and emotional development.

As children are spending more and more time with social robots instead of living creatures (Louv, 2005) it is important to understand how this change in our culture could affect child development. Some have even suggested that robots could replace their live counterparts (Tamura et al., 2004). Feelings of insecurity reportedly can be passed on from family members, and from generation to generation. It has been suggested that healthy attachment depends not only on security but on the ability to adapt a behavioral strategy to context (Crittenden, 2006; Parish-Plass, 2008). Pets as transitional objects often serve complimentary roles as attachment figures for children, not replacing primary attachment figures, but supporting them (Triebenbacher, 1998). With increasingly sophisticated robotic companions, children have new options for companions whose roles in the child’s social world introduce new dimensions to the development of emotional security.

Embodiment

Some consider social learning and imitation, gesture and natural language communication, emotion and recognition of interaction partners as the salient factors of a social agent (Fong, 2003). While these features can be programmed in a robot, the notion that this programming alone could create a social agent is not congruent with pragmatic

theories of social agency such as critical realism. The importance of having a mind and consciousness is foundational for humans to achieve realization as a social agent. According to Archer, "mind is emergent from neurological matter, consciousness from mind, selfhood from consciousness, personal identity from selfhood, and the social agency form personal identity" (Archer, 2000). The human brain is the primary organ that mediates all emotional, behavioral, social, motor, and neurophysiological functioning, and without a healthy appreciation of the brain's role in our development our work is likely to be ineffective (Perry, 2006). Who we are grows from our bodily capacities. Our sense of what is grows from our interpretation of our experiences and our environment (Lakoff & Johnson, 1999). This developmental model of selves coming into being could be seen as an onion, growing from the core of the embodied self, starting with neurological matter.

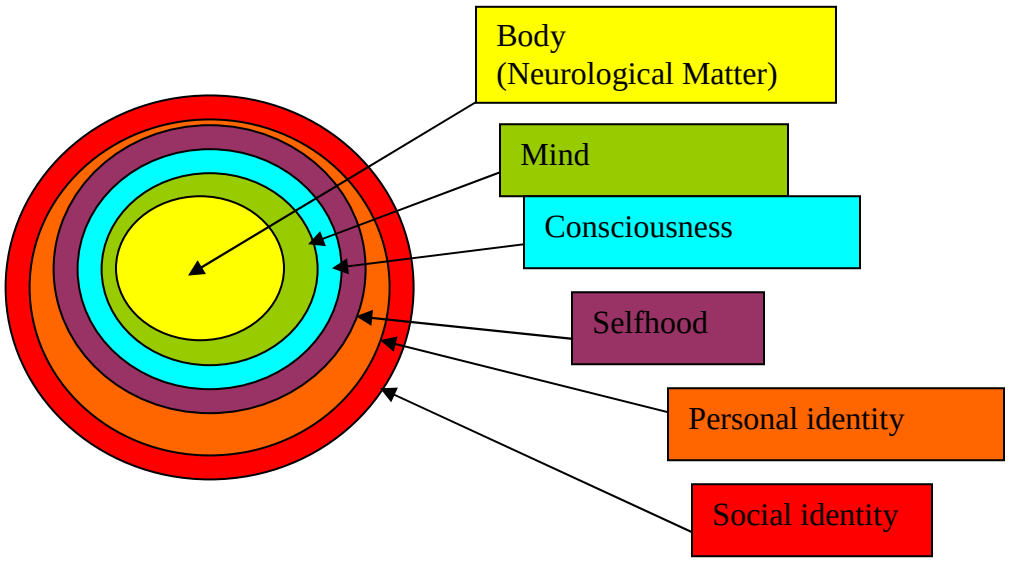


Figure 1. The stratified agent has many layers of engagement and develops sequentially, but relies on embodiment, from which all other dimensions of self emerge.

As soon as the human infant takes a first breath all experiences contribute to this growing agency and social identity. The more diverse the experiences with the natural world and animate others are, the more resilient the emerging self will be as the body develops through this process. Could there be a place for this emerging robotic agent in the social network that would also contribute to the biological agent's development? Mind, consciousness, selfhood, personal identity and social identity emerge. If the body fails to develop through a lack of physical or neurological stimulation, the body, from which other dimensions of self emerge, is compromised. Perhaps including companion animals or robotic agents into traumatized children's lives, could in effect help them re-build the emerging self on each stratified level of self. In turn, this would help create an agent capable of healthy personal and social identity.

Emotional stress and trauma impact neurobiology of children, particularly because of the plasticity of the brain in young humans (McEwen, 2008; Perry, 2006; Yorke, 2008). Research has shown that early experience plays a critical role in social and emotional development (Elbert, Heim, & Rockstroh, 2001). Animals raised in enriched environments show an increase in brain volume and thickness and increases in the number of synapses relative to animals that have been removed from the rich environment (Nelson, 1999). Plasticity of the brain can be both adaptive and maladaptive. Kindling is the process by which the brain becomes hypersensitive to stress and this response is fast tracked (Kramer, 1993). For children who have been in dangerous environments, a quick and aggressive response to stress may be adaptive for that environment, but inappropriate for non-threatening environments (Parish-Plass, 2008). Thus, a child who has been placed for adoption after being removed from an

abusive or negligent home could continue to experience the same kind of neurobiological reaction to a mildly stressful situation that he or she did in response to the initial trauma. In a sense, this child could become "brainstem-driven" (Perry, 2006) instead of being able to function using the higher parts of the brain.

The brain is organized and develops in a hierarchical fashion. All sensory input first enters the lower parts of the brain. These areas organize during development in a "use dependent" fashion, becoming the basis for learning and memory (Perry, 2006). The developmental process of the brain that relies on consistent feedback or action and reaction is parallel to the social theory model of critical realism that calls this process "double morphogenesis" (Archer, 2000).

Oxytocin as a neurobiological indicator of emotional security.

The following diagram is the result of groundbreaking research that tried to understand how this kind of co-action could occur in human/canine relationships. Odendaal proposed that there would be a biological, embodied response in both humans and canines in response to their engagement. In fact, his research has found that oxytocin levels increased significantly in both canines and people, both when people interacted with their own dogs or strange dogs while quietly reading and while in a novel situation (Odendaal, 2000; Odendaal & Meintjes, 2003). Oxytocin is a hormone that has been associated with human attachment and bonding (Carter, 1998; Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005; Panksepp, 1998; Turner, Altemus, Enos, Cooper, & McGuinness, 1999). This may be the closest neurobiological indicator of emotional security available and has become an intriguing tool for measurement of emotional security (Odendaal & Meintjes, 2003; Panksepp, 1998).

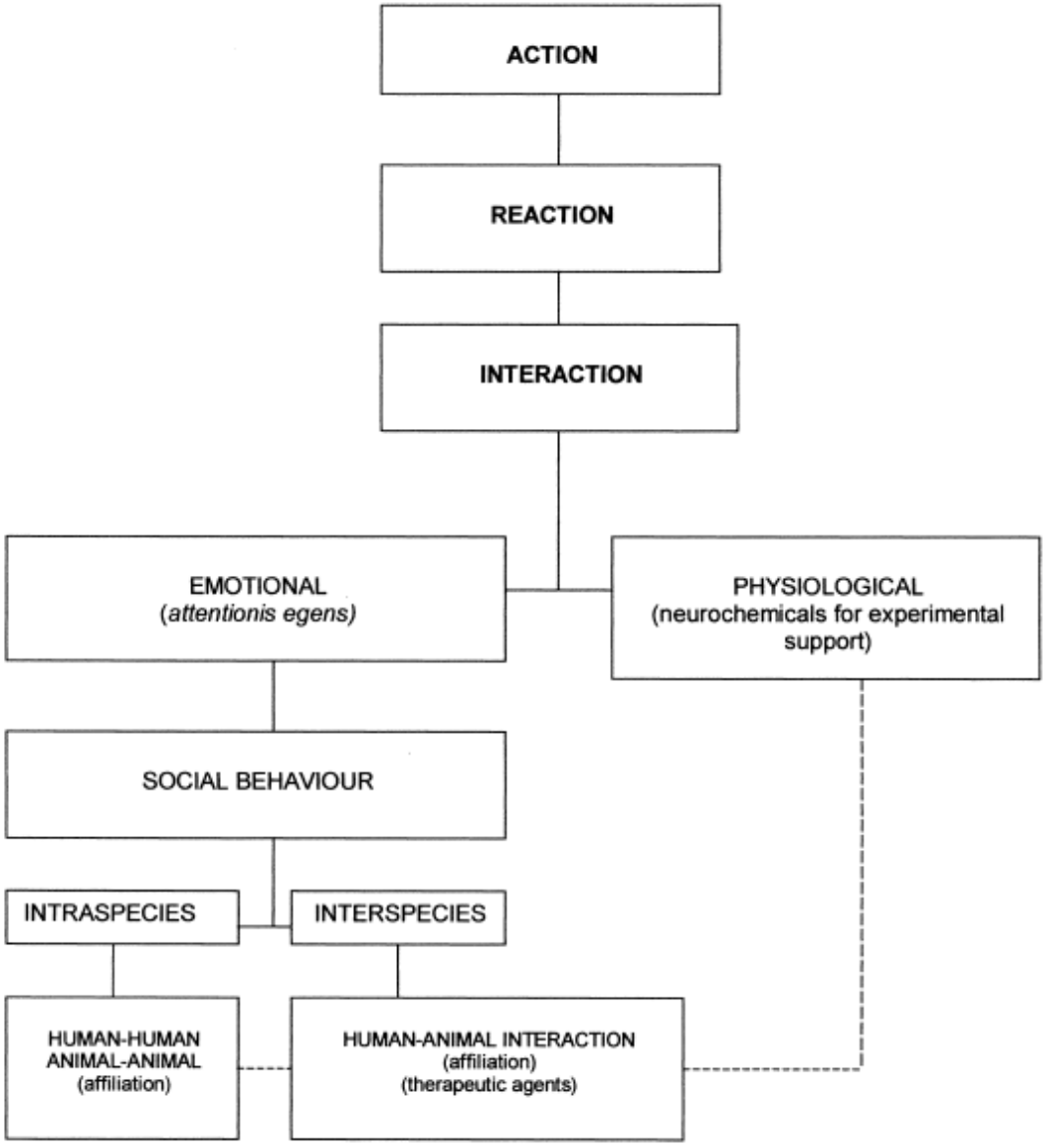


Figure 2. Human-animal interactions in human-human contact (Odendaal, 2000, p.277)

Because brain development and social experiences co-occur, it is difficult to distinguish how these social and biological changes influence one another and in turn affect behavior. However, recent research measures oxytocin being released in large "bursts" during infant suckling, suggesting that neurological consequences for behavior at a very young age, affect bonding (Rossoni et al., 2008). Oxytocin is a neuropeptide

that has been linked with human experiences of emotional security in a number of experiments (Carter, 1998; Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005; Rossoni, et al., 2008). In addition, positive experiences with animals have been empirically associated with higher levels of oxytocin (Odendaal, 2000; Odendaal & Meintjes, 2003).

Another study attempted to examine the effects of early experience on emotional development, and studied a sample of children who did not receive the kind of emotionally responsive care-giving typically received by human infants, because they were raised in a Russian orphanage. These researchers studied levels of oxytocin (OT) and arginine vasopressin (AVP), hormones associated with mammalian emotional circuitry (Carter, 1998; Panksepp, 1998). The children were then adopted and the researchers measured how levels of OT and AVP in the adopted children compared to children who were raised by their biological parents and had avoided the early trauma associated with separation from the biological mother and life in an orphanage (Fries et al., 2005). Previously institutionalized children had significantly lower levels of OT and AVP after interacting with their caregivers than did the children who had not experienced institutionalized care.

However, it is interesting to note that not all of the children who have experienced early trauma develop the same kinds of hormone reactivity over time (Fig. 3).

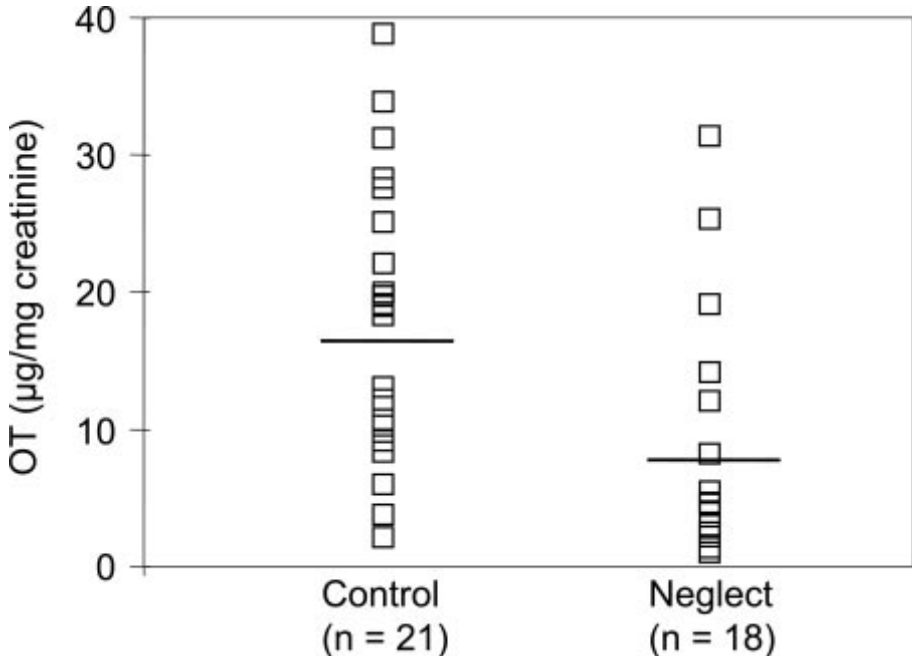


Figure 3. Control children had higher OT levels after the engagement with their mothers than early neglected children [F(1,37) =3.91, P =0.056]. (Fries et al., 2005, p. 17239)

Fries and his colleagues suggest that distinct differences in the environments of children who have experienced early neglect be explored (Fries et al., 2005). Could it be that positive engagement with appropriate companion animals is responsible for increased bonding ability on a neurological level? Would inclusion of these animals in environments of maltreated children create increased opportunities for re-programming the young, plastic brain of children who have compromised ability to feel emotionally secure? Do robotic animals programmed to mimic this behavior elicit a comparable response?

Researchers in Human-Robot Interactions (HRI) consistently discuss embodiment as a feature that is critical to this emerging class of potential social agents. The definition of embodiment in the HRI field seems to range across a continuum: the more the robot interacts with its environment in the same way living creatures do and perceives the same

things that humans find to be salient and relevant, the more embodied the agent becomes (Fong, 2003; A. Libin & Libin, 2004b; E. Libin & Libin, 2003). Thus, embodiment becomes not a question of neurological matter, but a question of function. In contrast, attachment researchers contend that the embodied agent of the mother is more important to the infant than the mother's function (Ainsworth, 1978; Bowlby, 1969; Gunnar, 2001).

Rationale for Sample Population

Children who have been adopted through the public child welfare system and currently reside in the state of Colorado were recruited for this study. Because the state system does not become involved with families unless the court determines that there is significant abuse or neglect, this study assumes that some type of trauma was part of the child's experience. Children in the system typically have suffered from trauma, including but not limited to, prenatal drug and/or alcohol exposure, domestic violence, physical abuse, sexual abuse, or most often, neglect (Cave, 2008; Vigil, 2008). Also, children who have been adopted from the system were typically removed from their families and parental rights terminated by the court. The adoption plan is usually not a voluntary one, but one that is implemented after a judge determines that it is not in the child's best interest to stay with biological parents. It may be that this kind of early experience and dramatic change in environment can increase the incidence of early trauma and result in compromised emotional security. In this sample, it was expected that a number of the children would have an official diagnosis of PTSD, implying that trauma is not only present, but clinically significant. It is difficult to measure how trauma occurred when access to records is impossible. Even adoptive parents who are given all available information usually know little about their child's early experience. Private adoptions

and international adoptions were excluded because although these populations of adoptees have many similarities, the assumption of early trauma was important to help detect a measurable effect of the intervention for this preliminary study. Most importantly, this population is especially vulnerable and any findings that could inform well-designed interventions would be worthy of investment.

Expectations for this population -Children, age 6-10 - are that they play cooperatively (Saracho & Spodek, 2003). Cooperative play is when children engage in groups, usually same-sex groups, with the play being goal directed. One example of cooperative play would be children sharing ingredients in a play kitchen and cooking dinner. The reason for choosing children who can play cooperatively for this study had to do with many factors. First, a child at this stage of development was able to negotiate a shared activity with a pet dog or robot and was interested in playing accordingly. More than 70% of US households with children have pets, which could be an indicator that they are enjoyable playmates (Melson, 2003). Of course, it could be that pet ownership is the social norm or that parents chose to own companion animals for other reasons as well. Regardless, the high prevalence of pet ownership is evidence that companion animals are an important part of the child's social environment.

Ages	30 ⇦ 15	15 ⇦ 8	8 ⇦ 3	3 ⇦ 1	1 ⇦ 0
Developmental Stage	Adult / Adolescent	Adolescent / Child	Child / Toddler	Toddler / Infant	Infant / Newborn
Primary/ *Secondary* Brain Areas	Neocortex / Subcortex	Subcortex / Limbic	Limbic / Midbrain	Midbrain / Brainstem	Brainstem / Autonomic
Cognition	Abstract	Concrete	"Emotional"	Reactive	Reflective
Mental State	Calm	Arousal	Alarm	Fear	Terror

Figure 4. State-dependent shifts in level of developmental functioning with shifts down the arousal continuum (Perry, 2006, p. 32)

The target population has likely experienced trauma and it is reasonable to assume that this population is more likely to have an elevated baseline arousal and therefore more commonly make decisions using a lower section of the brain. Also, children who have experienced trauma have a highly sensitized alarm response and can overact to social cues as threatening (Perry, 2006). The neuromodulator, oxytocin, targeted for proxy measurement in this study is released in the brain stem (Panksepp, 1998; Yorke, 2008). Children who have experienced trauma often have increased baseline level of arousal and increased reactivity in response to stressors. This plays a major role in the behavioral and cognitive problems exhibited by traumatized children (Perry, 2006).

By studying children from this age and population, this research aimed to gain insight into how engagement with either a pet dog or a robotic dog contributed to the development of emotional security that may not have previously occurred or was inhibited. Also, children in this age group had the ability to discuss the experience of playing with the pet dog or the robotic dog and were able to give insight to how their engagement related to understanding emotional security.

Two Conditions: Companion Selection

The purpose of this clinical trial was to examine the effects of play on emotional security with two different independent variables, a social robot or a companion dog. Many factors, including the ethical considerations for the dogs and their handlers, ethical considerations for the research participants, age specifications for the social robot, and practical considerations of the study informed decisions about the study's design.

Therapy dogs: Animal partners in the research.

The researcher required that all animals participating in this research were certified American Humane Association Pet Partners®. The researcher wanted to facilitate engagement under circumstances where the children would be safe. Dogs that are certified by the American Humane Association (AHA) have been evaluated and certified as therapy dogs and their handlers are able to help ensure that the environment where they are working is appropriate for the individual dog. Per AHA's guidelines, the handler was present with the child and dog at all times and the dog was kept on a leash in order to be certain that both the dog and the child were safe. The handler was trained according to Delta Pet Partners (Gammonley et al., 1997) and aware of stress signals that the dog might display. In addition to being aware of stress signals, the handlers were skilled at intervening if an interaction was somehow inappropriate for their dogs(Delta, 2006; Gammonley et al., 1997; McQuarrie, 2008). The research was conducted in a room with a one-way mirror. If at any time, the handler, researcher, child or parent of the child felt that the interaction was unsafe or inappropriate, the experiment was interrupted. This was emphasized in the consent and assent forms as well as to the parents and

children in person. This was to insure that the child, dog, handler, and parent were all comfortable with the procedure and to ensure that no maltreatment of any creature would be tolerated.

Animal welfare was also an important factor in choosing AHA dogs for this study. Per AHA's guidelines, all dogs involved with this research were in good health and current on all vaccinations. The handler of the dog was responsible for the dog during the experiment and no dogs were harmed as a result of this research (Delta, 2006; Gammonley et al., 1997; McQuarrie, 2008). Consistent with this value, during preliminary investigation to inform the research design handlers often described themselves as "support staff" for their dog, allowing their dog to do the work, while they were there to watch and guide the process. The handlers typically viewed themselves as responsible for their dogs but that the relationship between the child and dog was independent of their presence.

In addition to being AHA certified, the following three questions were developed as screening questions for AHA dogs. In order to be included in the study, handlers had to respond in the affirmative to all three questions: 1) Would you describe your dog as "calm"? 2) In situations where you have interacted with a child on a one-on-one basis, is your dog "engaging"? 3) Would you consider your dog "tolerant"? Handlers had to answer in the affirmative to each of these questions to fit the study criteria. There were ultimately six AHA certified therapy dogs selected for this study. All of the dogs were medium to large breeds, with two Labradors, one Bloodhound, one German Shepherd, one Springer-mix and one Golden doodle participating.

Social robot selection: "Biscuit."

The social robot chosen for this experiment was the FurReal® dog, "Biscuit" http://furrealfriendsbiscuit.com/). Biscuit is advertised for children ages five years and older (Hasbro, 2008). According to company information, it was designed to be an affective toy that elicits an emotional response designed to be similar to that of a real dog. The FurReal® engineers deliberately built the toy with the intent to appeal more to the emotional aspects of play such as friendship and nurturing, "things that stay with you for a lifetime" (Hansel, 2002). Unlike other studies that compare live animals and socially interactive robots such as AIBO®, Biscuit is the type of socially interactive robot that would be more likely to be a part of a child's experience, making it more ecologically valid. It is available at Target, WalMart, Amazon.com, and many other retailers that make it accessible to children. Millions of FurReal® friends have sold in the US alone (Hansel, 2002).

"Biscuit" is a social robot designed to be an interactive companion. "Biscuit" resembles an approximately six-month-old Golden Retriever/ Labrador puppy that would typically weigh about 40-60 pounds. "Biscuit" has characteristics of a young animal that have been found to trigger nurturing responses such as a disproportionately large head and large eyes that are common in mammalian young (Lorenz, 1959). "Biscuit" is covered in ½ inch fur. He is built to either sit or lie down. "Biscuit" does not move independently. "Biscuit" has nine sensors that sense touch, light, or sound. There are seven sensors that sense touch: one on the back of the head, one behind each ear, one on the back, one on the nose, one on the mouth, and one on the top of the left paw. There is

one sensor on the forehead that senses light and another on the bridge of the nose that senses sound (Hasbro, 2007).

With these sensors, "Biscuit" is programmed to be an engaging social companion. When pet on the upper back, "Biscuit" will move his head and neck and make contented sounds. If touched on the upper back for three seconds or more, "Biscuit" will either lie down or sit up, opposite of what he is currently doing. When pet under his ears, "Biscuit" will turn his head, tilt his ears and make happy sounds. "Biscuit" will move his head to the side that is activated and stay on that side as long as the sensor is being activated. If the sensor under "Biscuit's" left ear is held for three seconds, he will sit up and beg. When the mouth sensor is activated, "Biscuit" will chomp and "eat". When the sensor on the back of the head is activated, he will move his head and make puppy sounds. When pet on his nose, he will "sniff." When something is waved in front of "Biscuit," he will flinch, blink or "sneeze" as a result of the photo sensors being activated (Hasbro, 2007).

"Biscuit" is programmed to be a speech recognition product. There are seven commands that "Biscuit" will recognize and obey: sit, lie down, speak, sit up and beg, give me a paw, shake, and "do you want a treat?" (Hasbro, 2007). Biscuit is also programmed to respond in a puzzled manner if he is commanded to do something he is already doing. For example, if told to sit and he is already sitting, he will tilt his head and whine (Hasbro, 2007). With all these features, "Biscuit" is an intriguing social robot.

Research Questions and Hypotheses:

The proposed research builds on findings in the areas of human-animal bond research and affective computing order to investigate how live companion animals,

specifically a pet dog trained as a therapy animal or a social robot, a robotic toy dog, affect emotional security for youth who have been adopted from the child welfare system. The research will address the following questions:

1) **Do children who have been adopted engage with a therapy dog or social robot in ways that increase their emotional security?**

A behavioral test, "Reading the Mind in the Eyes", that measures a person's ability to detect subtle differences in social understanding and that has been linked to measures of oxytocin (Domes, Heinrichs, Michel, Berger, & Herpetz, 2007) was used to measure emotional security. In addition, a physiological anxiety score that has been used to measure emotional security (Davies & Cummings, 1998) was used. The following working hypotheses were tested:

H1: Physiological anxiety would decrease as a result of interacting with a therapy dog for fifteen minutes.

H2: Physiological anxiety would be unchanged as a result of interacting with a social robotic dog for fifteen minutes.

H3: Social understanding would increase as a result of interacting with a therapy dog for fifteen minutes.

H4: Social understanding would be unchanged as a result of interacting with a social robotic dog for fifteen minutes.

2) **Do children who have been adopted engage with social robots in similar ways as they do with therapy dogs?**

The researcher hypothesized that children will be less engaged with the social robot than with the companion animal.

3) **Do children who have been adopted prefer a social robotic dog or a live dog as a pet?**

The researcher hypothesized that children will prefer a live dog as opposed to a social robotic dog as a companion. Children will be drawn to the dog because of its ability to have an unpredictable and varied experience with the child as opposed to the limited behavioral repertoire of the social robot. The following questions, as they relate to the overall research question were addressed:

Q1: What is meaningful about companion robots or dogs to children as it relates to emotional security?

Q2: Are dogs considered social companions for children who have been adopted?

Q3: Are socially interactive robots such as Biscuit social companions for children who have been adopted?

Q4: Which companion, dog or robot, would adopted children prefer?

Chapter Three: Methodology

The main focus of this research was to examine the impact of a fifteen-minute engagement with either a dog or robot on the level of a child's feelings of anxiety and changes in their ability to read others' emotions, both indicators of emotional security. In this clinical trial, children were randomly assigned to one of two possible independent variables, a therapy dog or a robotic dog. This chapter presents the sampling strategy, measures, the research design and data collection protocol, consideration of human subjects, consideration of animal partners, and data analysis approach.

Sample

Forty three children, along with at least one parent participated in this study. Children were ages six to ten years old with the exception of two five year olds, and one eleven year old who were included because they had siblings who fit the age criteria and were participating. [Note: A rule was made that the age criteria would be expanded by one year for a sibling of a participant, only. This was done only on three occasions in order to accommodate families who traveled to the University of Denver for the study and who had children who wanted to participate. The inclusion of these children also supported an increased sample.] The sample consisted of 24 males and 19 females. 20 (46.5%) were Hispanic, 13 (30.2%) were Caucasian, 7 (16.3%) were African American, 2 (4.7%) were Native American, and 1 (2.3%) was Asian.

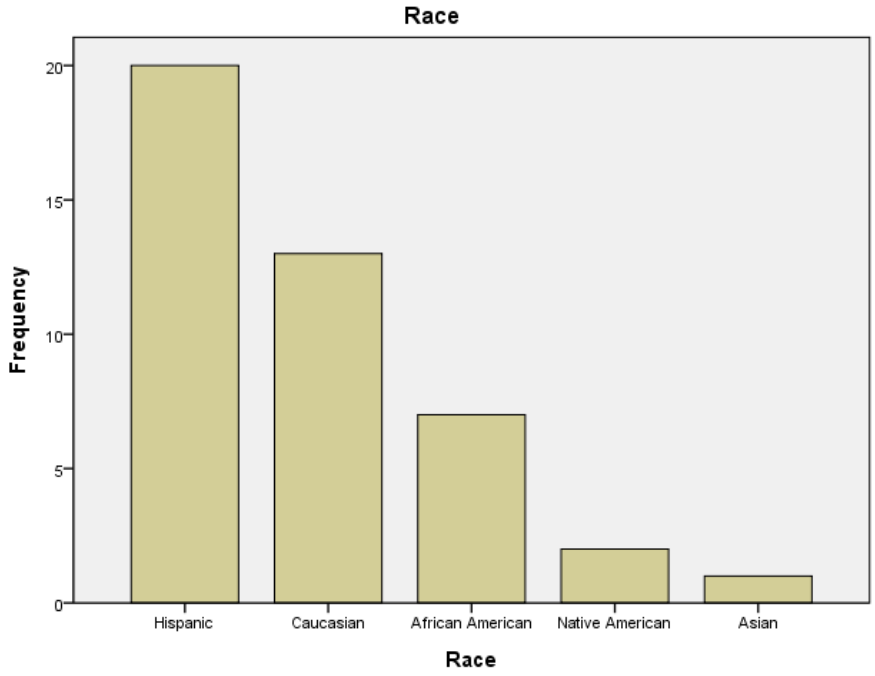


*Figure 5.*Description of Race for Sample Population

Of these forty-three children, thirteen children identified themselves as bi or multi-racial. Three identified Hispanic-Caucasian, one identified Asian-Caucasian, one identified Native American-Caucasian, three identified African American-Caucasian, four identified Hispanic-"Other," and one identified Native American-Asian-Caucasian. 48.8% of the participants reported they were from a trans-racial adoptive family.

As depicted in Figure 7, children came from a range of socio-economic backgrounds.

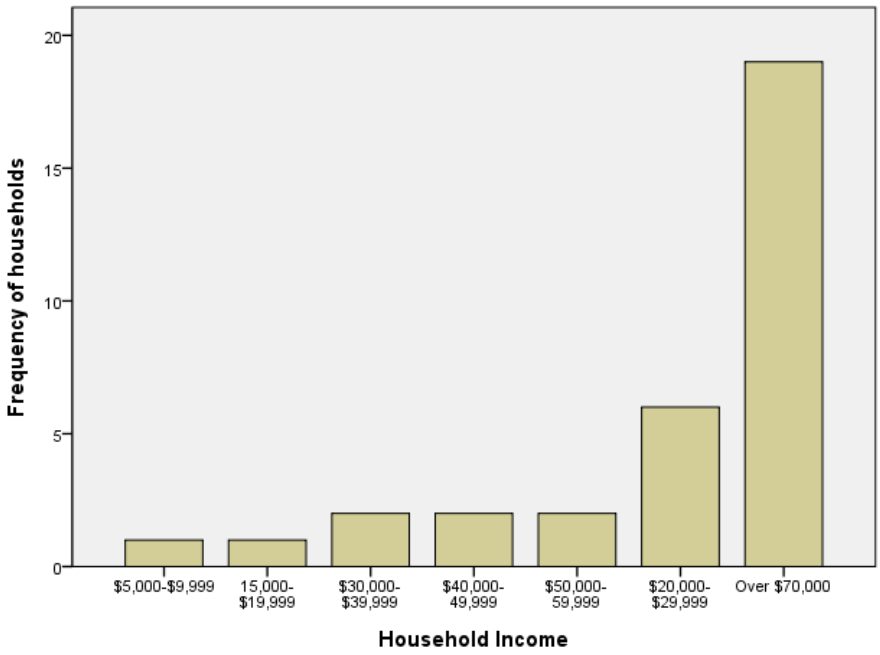


*Figure 6.*Description of Household Income for Sample Population

Of those who reported their Medicaid status, 87.9% (29 out of 33) participants reported that they had Medicaid. 51.5% (17 out of 33) participants' parents reported that their children had received a mental health diagnosis. These diagnoses included ADD or ADHD (n=12), PTSD (n=7), RAD (n=2), Anxiety (n=2), and FAS (n=2). 48.8% participants reported taking some kind of medication.

Thirty (69.8%) children currently own a dog. 11.6% reported owning a social robot. 23.3% of participants (n=9) responded "yes" to the question: "Has your child ever been cruel to an animal?"

Measures

Emotional security was defined as contextual (Ainsworth, 1978; Bowlby, 1969; Bretherton, 1985; Crittenden, 2006; Cummings & Davies, 1996; Waters & Cummings, 2000) and has been described as a dynamic process that changes with variations in the environment. Measures for this study were carefully chosen to capture the intra-personal as well as the behavioral manifestations of emotional security that could be created by engagement with either a companion dog or toy robot.

Reading the Mind in the Eyes Test (RMET).

In order to measure physiological responses, baseline measurements and post-test measurements of oxytocin in the children would be the most desirable indicator. As previously mentioned, oxytocin is a neuromodulator that has been associated with emotional security and the ability to form social relationships (Carter, 1998; Cho, 1999; Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005; Panksepp, 1998; Rossoni et al., 2008).

However, there were significant barriers to collecting oxytocin in this study. Reliable methods of measuring oxytocin are highly invasive (blood samples), would be traumatic for participants, and are cost-prohibitive. Only a few studies have reported oxytocin being measured via urine samples instead of blood serum in humans (Fries, Ziegler, Kurian, Jacoris, & Pollak, 2005; Nagasawa, Takefum, Onaka, and Ohta, 2009) and there remains great debate in the literature on the reliability of oxytocin measures that do not utilize blood serum (Anderson, 2006). Therefore oxytocin was assessed pre and post test through a proxy measure. The Reading the Mind in Eyes Test was developed to

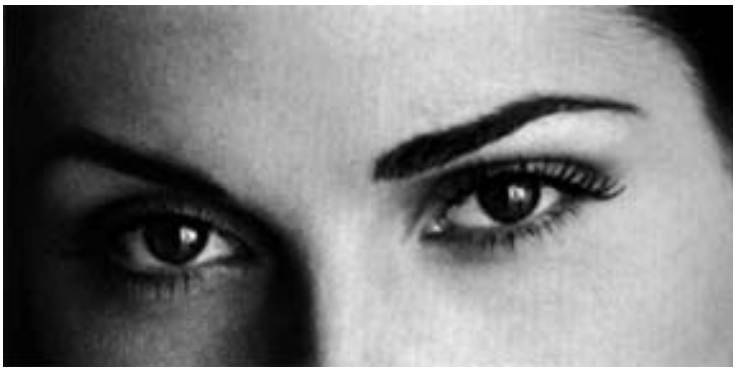
detect subtle differences in a person's ability to recognize emotions in another by expression in the eyes (Baron-Cohen, Jolliffe, Mortimore, and Robertson, 1997). The test has been used to distinguish subtle differences in the ability of people with high functioning autism or Asperger Syndrome to read social cues (Baron-Cohen, Jolliff, Mortimore, and Robertson, 1997; Baron-Cohen, Wheelwright, Hill, Raste, and Plumb, 2001). In a double-blind, placebo-controlled, within-subject design, 30 healthy volunteers were tested for their ability to infer the affective mental state of others using the Reading the Mind in the Eyes Test (RMET) after intranasal administration of 24 IU oxytocin (Domes, Heinrichs, Michel, Berger, & Herpetz, 2007). Domes and his colleagues found that performance on the Reading the Mind in Eyes test improved when subjects received oxytocin. These findings have been supported by additional research where subjects also received oxytocin, were administered the RMET, and performance improved (Rodrigues, Saslow, Garcia, John, & Keltner, 2009). Based on these findings, this study used the RMET as a proxy measure for oxytocin.

The tool had some limitations which have been addressed by revisions to the measure, improving the power of the test to detect subtle individual differences in social sensitivity (Baron-Cohen, Wheelwright, Hill, Raste, and Plumb, 2001). A child version of the test has also been developed and was used for this study (Baron-Cohen, 2001). This test has also been used with children between the ages of 6-10 years old in previous studies(Brent, Rios, Happe, & Charman, 2004; Dorris, Espie, Knott, & Salt, 2004).The Reading the Mind in the Eyes test requires participants to judge a person's mental state by looking at a photograph of eyes. Each item on the test is scored as either correct or

incorrect, for a possible score of one point per item (Baron-Cohen, 2001). The test has 28 pictures of eyes, 14 male and 14 female. Thus, possible scores on the test range from 0-28. An example of one of the test items can be seen in Figure 7. A study by Hallerback (2009) examined the psychodynamic properties of the child version of the test using the Bland Altman method. In the Bland Altman method, the smaller the range of differences in test means, the better the agreement. In a Swedish sample of 158 University students, the level of agreement was within the 95% confidence interval, a reliability result described by the authors as "fairly good" (p 139). However, the authors caution that the scores should provide only an approximation of ability, possibly due to linguistic issues involving the language used to describe each item. (Four items were omitted because they were found to have questionable validity in that sample.) Furthermore, cultural considerations and language differences make it essential to validate the coding manual for each culture. Because the test is free and widely used, there are great advantages to the RMET. Efforts to validate the test are under way at the University of Northern Colorado under the direction of Dr. Eric Peterson (personal communication, April 14, 2010). Comparing the results from this study to Dr. Peterson's forthcoming findings would utilize the most current psychodynamic properties available. In the Swedish study, there was no indication of learning effects when the test was repeated and the test score variation was found to be ± 4 (out of 24 possible) (Hallerback, 2009, p. 139). For the purpose of this study, the full 28 point scale will be used. Unlike the Hallerback study, children rather than University students will be taking the test. Also, since specific

cultural differences are not established, it may be that cultural effects noted in the Swedish study are not applicable to this sample.

surprised sure about something



joking happy

(*Correct Answer:* sure about something) (Baron-Cohen, 2001).

Figure 7. Example item from Reading the Mind in the Eyes Test (Child Version)

Revised Child Manifest Anxiety Scale-2 (RCMAS-2).

The Revised Child Manifest Anxiety Scale-2 (RCMAS-2) was used pre and post-test to evaluate the child's level of anxiety as an indicator or his or her emotional security before and after the play experience. The RCMAS-2 is a 49 item scale that measures anxiety on four dimensions, Physiological Anxiety, (12 items; e.g., "Often I feel sick in my stomach."), Worry/Over-sensitivity (16 items; e.g., "I worry about what is going to happen."), Social Concerns/Concentration (12 items; "A lot of people are against me."), and the Lie or Defensiveness (9 items; e.g., "I never get angry.") and provides a global anxiety measure (Reynolds & Richmond, 1978). The instrument is one of the most widely used for assessing childhood anxiety, and has been demonstrated to be reliable

across different gender, racial, and age groups (Chorpita, Moffitt, & Gray, 2005; Reynolds & Richmond, 1979; Reynolds & Paget, 1983). The RCMAS-2 has also been used to study emotional security (Davies & Cummings, 1998).

For the purpose of this study, the physiological anxiety sub-scale for anxiety of the RCMAS-2 was used pre and post test to measure embodied effects of emotional security. This subscale has had moderate test-retest reliability with an initial Cohen's kappa of .75 and a retest reliability of .73 (Reynolds & Richmond, 2008). The test-retest reliability was established with a 1-week interval, but this study requires that both the pre and post tests be administered the same day. There was no manner in which the effects of the changed time interval could be feasibly examined here, and this limitation is acknowledged.

1) Often, I feel sick at my stomach.
2) I have too many headaches.
3) I wake up scared sometimes.
4) I have trouble making up my mind.
5) Often I have trouble getting my breath.
6) I get mad easily.
7) It is hard for me to get to sleep at night.
8) My hands feel sweaty.
9) I am tired a lot.
10) I have bad dreams.
11) It is hard for me to keep my mind on my schoolwork.
12) I wiggle in my seat a lot.

Figure 8. RCMAS-2 Physiological Anxiety sub-scale questions

Revised Melson/ Trujillo engagement scale.

The Melson Global Rating scale was a one-item, seven-point scale used for previous research comparing a social robotic dog and therapy dogs (Melson et al., 2009). The scale was used in its original form for the first fifteen interviews. However, despite

multiple training sessions and viewing of recorded experimental sessions, the two raters failed to reach a satisfactory inter-rater reliability. Cohen's kappa was computed and ranged from .44 to .67, a result at the lower end of acceptability. Consultation with Dr. Melson about the issue led to the discovery that she and her team of researchers, in work funded by the National Science Foundation, had experienced similar problems with the reliability of the original draft measure and had subsequently collapsed the scale to a three point scale (personal communication, April 15, 2010).

Therefore, the scale was revised in this study in conformance with Dr. Melson's recommendation (Appendix D). The two raters were re-trained with the revised scale and this version was used to rate the participants on their level of engagement during their play. All sessions were videotaped and so that they could be coded for final analysis. Reliability of the revised scale was computed using Cohen's kappa and, the chance corrected percent agreement between raters was computed. Inter-rater reliability as indicated by the strength of agreement (k=.89) was high.

Semi-structured interview questions.

A questionnaire was developed to understand how the participants perceived their play experience with either the companion dog or the social robot. Questions that targeted concepts related to emotional security and social companionship were asked. These questions as well as additional probes designed to understand how companions affected the context shift that occurred with the introduction of the companion were asked. Prompts were given to help children expand on their answers.

After the first fifteen interviews, fifteen additional "yes" or "no" questions that were used by Dr. Melson and her colleagues as indicators of social companionship were added. These questions were desired because a social companionship score would be available by adding the number of "yes" answers for each interview respectively. Some of the children seemed to have difficulty answering questions about "Biscuit" or the AHA dog, so a way of simplifying the ideas of social companionship was desired. Permission for the additional questions was granted by the IRB on April 16, 2010. All subsequent interviews asked the original questions as well as the fifteen questions from the Melson (2009) study.

Demographics.

Finally, demographic data were provided by children's parents. Parents answered questions regarding age, race, gender, socio-economic status, and previous experience with pets. Questions about the length of time in the adoptive home as well as the age of the child at the initial removal from the biological home, number of placements prior to placement in the adoptive home, and mental health diagnosis were also asked (Appendix C).

Study Design

Clinical Trial

A fifteen-minute, child-directed exposure to either a therapy dog or the robotic dog, was carefully constructed in a clinical classroom at the University of Denver. The experimental condition was designed to give the child an opportunity to engage with the dog or robot, and a video introduction suggested ways that the child could engage. (The

development of this video is discussed extensively later in this chapter.)Fifteen minutes was chosen as an appropriate amount of time to ask children to spend with the dog or robot based on several factors. First, fifteen minutes is the half life of oxytocin, the neuromodulator associated with emotional security (Odendaal & Meintjes, 2003; Panksepp, 1998). Second, children of this age should be able to attend to a companion for fifteen minutes. A shorter amount of time might not allow the child time needed to fully engage with the dog or robot. The testing room had two chairs, a sofa, and an assortment of toys that were selected to facilitate engagement with the dog or robot, and some books. The introduction and conditions of the room were identical with one exception: either the child played with a companion dog or a social robotic dog.

The clinical trial was designed to test the following operational hypotheses:

H1: Physiological anxiety will decrease as a result of interacting with a therapy dog for fifteen minutes.

H2: Physiological anxiety will be unchanged as a result of interacting with a robotic dog for fifteen minutes.

H3: Social understanding will increase as a result of interacting with a dog for fifteen minutes.

H4: Social understanding will be unchanged as a result of interacting with a dog for fifteen minutes.

Rationale for Study Design

While the clinical trial was the main portion of this study, an initial qualitative investigation was warranted in order to explore the best way to construct an engaging

fifteen-minute play experience with either the companion dog or the social robot. Therefore, a mixed-method design that allowed for this initial exploratory work was chosen for the overall study framework. As Creswell describes, there are three considerations that play into the decision of what design to use: the research problem, the personal experiences of the researcher, and the audience for whom the report will be written (Creswell, 2003).

The pragmatic nature of this research problem positions the study to benefit from both quantitative and qualitative methods of inquiry. Quantitative methods were desired because it has been established that children interact with animals as social companions (Bryant, 1990; McNicholas & Collis, 2001) and that children interact with socially affective robots in similar ways as they do animals (Melson et al., 2009). However, these findings have not been tested specifically with children who have been adopted. In addition, quantitative methods allow for examination of this population in a standardized way that allows for some generalizations to be made to the population of children who have been adopted. This is especially desirable for this research because the goal was to inform interventions that could help these vulnerable children. Qualitative measures were also desirable in this study because of the subjective nature of an individual child's experience with a companion, dog or robot. Individual experiences were affected by multiple factors including past experiences, individual preferences, mood, and mental health status, to name a few. Because previous studies have not examined how animal companions specifically affect children who have been adopted, a qualitative approach

allows for exploration of variables that may be important to examine for this specific population (Morse, 1991).

The clinical experiences of the researcher also informed the study. This investigator has had nearly ten years of experience working with adoptive families and integrating animals into interventions to facilitate healthy relationships. Qualitative approaches allow for this experience to creatively inform the intervention and for dissemination of results in a meaningful way that could help adoptees and their families (Creswell, 2003). For example, the personal style of the project is reflected in the video introduction for the fifteen-minute play session.

Finally, the intended audience to whom this research will be directed is the adoption community, as well as the animal-assisted therapy community, in particular the American Humane Association, an organization that funded the research and regularly works with children who have experienced trauma. The main reason to conduct this study was to develop basic research that will provide empirical support for interventions that help vulnerable children. As a social worker committed to social justice and "meeting people where they are" in their personal environments, this community-based project supports core values of the social work profession as described by the NASW Code of Ethics (National Association of Social Workers, 1999). For all these reasons, the mixed method research design that Creswell (2003) termed an *Embedded Experimental Design* was selected and is shown in Figure 9.

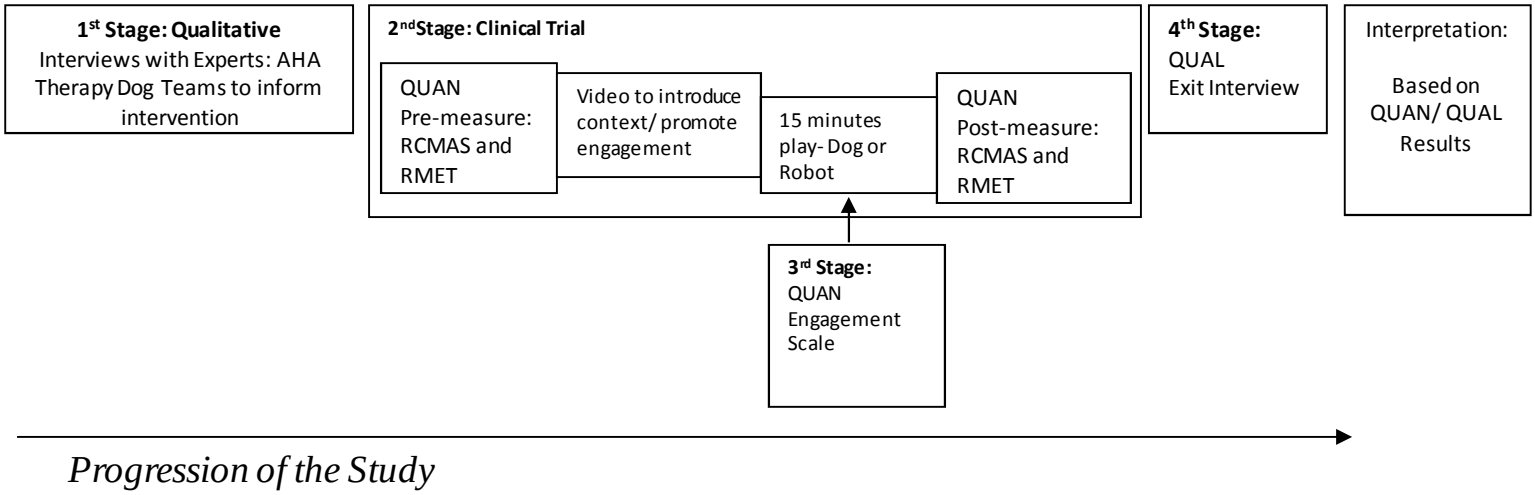


Figure 9. Embedded Experimental Design (From Cresswell, 2007, p. 68) and Current Study

1st Stage: Qualitative Interviews with Experts

As shown in Figure 7, the first stage of the study was designed to establish a protocol for the intervention. The first stage of the study was to explore answers for the following questions:

Q1: Which therapy dogs should be included in this study?

Q2: How do children interact with therapy dogs?

Q3: What tools are helpful in facilitating a therapeutic interaction between children and dogs?

Q4: What are the most important qualities of engagement with therapy dogs that relate to emotional security?

Rationale for consultation with AHA experts.

To answer these questions, experts who could speak to these issues were needed. American Humane Association (AHA) certified therapy dogs and their handlers were selected for several reasons: 1) AHA therapy dogs and their handlers deliberately interact with children in order to achieve a positive, healing, and emotionally fulfilling experience (McQuarrie, 2008; McQuarrie, 2010). 2) AHA therapy dogs and their handlers were able to safely interact with children for the purpose of this study. The dogs and handlers experience a rigorous training and screening process and are well-suited to work with children who have experienced trauma (McQuarrie, 2008). 3) The dogs and handlers already have experience with this population and were, as experts, able to identify what interactive behaviors were most likely to lead to feelings of emotional security. 4) The

dogs and handlers carry liability insurance, required by the University of Denver, for the purpose of IRB and IACUC approval (Woolum, 2008).

First, therapy dogs and their handlers from American Humane Association who were certified Denver Pet Partners were recruited via e-mail to participate in the qualitative phase. Participants who volunteered to be interviewed and who met the following criteria were included:

- The team was a certified Denver Pet Partner Team
- The team had at least six months of experience working with children who had experienced trauma
- The team was willing to participate in an interview, not to exceed one hour
- The team was able to travel to American Humane Association for the purpose of the interview

Assumptions.

The preconceptions of the researcher are acknowledged here as a means of trying to create objectivity and credibility for this project.

- Therapy dogs are often very predictable.
- Every child should have a dog.
- Traditional talk therapy is not very effective for children who have experienced trauma and working with therapy dogs is an excellent way to assist the therapeutic process for certain kids.
- It might be difficult for handlers to view their dogs objectively because they are therapeutic to them.

Description of expert participants.

There were twelve therapy teams who responded to the invitation to participate in the interviews. All twelve met the criteria and were interviewed. There were two men and ten women. The handlers ranged from age 28-65. The handlers represented a variety of volunteer and professional experience including: a mental health clinician, a teacher, administrative support professionals, parents, hospital staff, and retired persons.

The dogs represented were also diverse. There were 6 males and 6 females. All were neutered or spayed. The dogs ranged in age from 2-9. There were multiple breeds including Labrador retrievers, a Blood hound, a German Shepherd, a Golden Doodle, a Springer mix, a Dachshund/ Chow mix, an English Bull Dog, and other undetermined mixes. The dogs ranged from 34-72 pounds, making them medium to large in size.

Procedures for qualitative interviews.

During October, 2009, participants for the first qualitative portion of the study met the research team upon arriving at the American Humane Association and were escorted to a conference room. Participants were asked to sign a release (Appendix B) and given an opportunity to ask any questions they had about this portion of the research. When they were comfortable with proceeding, the interviews began.

The interviews were divided into four sections:

1) The purpose of the first section was to establish that the volunteers for these interviews were indeed experts and had the experience to offer insight into the interactive behavior of a child with a history of trauma and a trained therapy dog. All twelve of the handler/ dog teams had worked with children who have experienced trauma for at least

six months, although some of the experts were substantially more experienced than others (See Appendix C for a list of questions asked the handlers during the first section of the interview. See Appendix D for a description of qualifications of the handlers and dogs.) Participants were also asked to describe their dog's behavior as a therapy dog. They were prompted to focus their discussion on aspects of their dog's behavior that would promote the development of emotional security, specifically with populations of children who have been traumatized. Experts were asked to list the top three character traits that made their dog well- suited to work with children who had been traumatized for the purpose of promoting emotional security.

2) Next, the experts were asked to identify the places where children who have experienced trauma most often touch their dogs. Experts were asked to place sticker dots on a stuffed dog where children most likely touch their therapy dog during a session. The first group of seven experts received 28 stickers to identify touch points. Experts chose anywhere from seven to seventeen dots to demonstrate areas where their dogs were touched. This exercise is pictured in Figure 10.

Figure 10. Photograph of Touch Point Exercise

Because this experiment contrasts engagement of "Biscuit" the Hasbro toy and a therapy dog, the second group of five experts were given a limited number of stickers, seven, the same number of sensors that the toy has.

3) Experts were then asked to model with their therapy dogs how children who have been traumatized typically interact with their dogs. Experts were asked to pretend they were in a session with a child and demonstrate how the child would touch his or her dog. Experts all got on the floor and proceeded to touch their dogs, describing how children would interact as they went. Experts also proceeded to demonstrate or describe the tools they use to facilitate the interaction. Many experts described typically carrying a bag for visits, containing items they deem useful for facilitating the interaction of the dog and client. These items were recorded by the researcher.

4) Because the experience of emotional security is contextual, engagement is a prerequisite (Crittenden, 2006; Cummings & Davies, 1996). Therefore, experts were

presented with fifteen items from the Khan, Melson, Beck and Roberts (2009) from items related to "engagement" (Appendix C). Originally, there were seventeen items; two items related to cruel interactions were dropped from the original KMBR coding book because the experts from AHA would not tolerate any cruelty toward their animal partners. These included "thumping" and "throwing" an animal (Khan et. al., 2009). This was also advantageous for this q-sort because a number of items divisible by three were needed for a uniform distribution of the cards (Brown, 1986).

Each statement was assigned a number randomly (1-15). Following the Q-sort methodology procedures (Brown, 1986), experts were encouraged to review all the cards and then asked to place the cards into three piles according to which they believe were most, somewhat, and least likely to result in the experience of emotional security. Thus, experts were forced to place five cards in each group (Brown, 1986). According to Q-sort methodology, the experts were given no outside support or guidance (Thomas & Watson, 2002).

Data from these interviews with the experts were analyzed (see discussion at the end of this chapter) and findings (see discussion of findings in chapter 4) were used to create a video that introduced either the dog or the robot.

2nd Stage: Clinical Trial

The second stage of the study was to conduct the clinical trial (Figure 7). The following describes how participants were recruited, enrolled, consented, and their experience throughout the experiment.

Data collection protocol.

With concern for all living beings, human and non-human, involved in this study, the following protocol was designed. The protocol was approved by the Institutional Review Board (IRB) for the protection of human subjects at the University of Denver. The protocol was also approved by the Institutional Animal Care and Use Committee (IACUC) for the protection of animals in research at the University of Denver.

Recruitment procedures.

Children residing in the Denver metro area who have been adopted from a public child welfare agency were recruited. According to Colorado TRAILS, a state-wide database used to track children who have been in the child welfare system in Colorado, there were a total of 10,014 young people between birth and 21 who had been adopted as of November 1, 2010. Of those children, 1762 of them were from Denver County and 491 of them were between the ages of 6-10 years old (Smith, 2009).

Convenience sampling was used to target people in the Denver Metro Area who would meet the criteria for the study. This was accomplished in a number of ways. Denver Human Services included a flyer in a routine mailing to families who had finalized adoptions in March, 2010 (Appendix A). Hard copies of the flyer were distributed to all of the families. Participants contacted the researcher via phone or e-mail to schedule a one-hour appointment at the University of Denver.

Flyers were also distributed electronically from March-May, 2010. E-mails of the flyer were sent to multiple adoption list serves. The research opportunity was posted in the Adoption Exchange's monthly newsletter in April, 2010. It was also distributed by

the Colorado State Department of Human Services to every adoption supervisor in the state. In addition, flyers were sent to the Aurora Mental Health adoption support group, the Colorado Coalition of Adoptive Families e-newsletter, and multiple child placement agencies including Synthesis, Adoption Alliance, and Catholic Charities.

Inclusion criteria.

In order to qualify for the study, a participant had to meet the following criteria:

1) The child was between the age of six and ten years old.
2) The child had been living in his or her adoptive home for a minimum of six months.
3) The child's adoption has been finalized and he/ she was in the full custody of the adoptive parents.
4) The child and one parent were able to travel to the University of Denver to participate in the study.
5) Both the child and the parent were willing to consent and assent to the conditions of the experiment (i.e.: random assignment of either play with the dog or robot).

Exclusion criteria.

Children were excluded from the study if any of the following conditions were met:

1) The child was unable to participate in the exit interview.
2) The child was unwilling to participate.

3) The child demonstrated cruel behavior toward the dog or robot. (If this occurred, the experiment was to be stopped.)

Enrollment.

Once families contacted the PI, they were screened to ensure that they met the criteria for the study. If families agreed to participate, they were scheduled for a one-hour appointment at the University of Denver. Families received an e-mail with instructions on what to expect, where to park, and a copy of the consent and assent forms to review. (If participants did not have e-mail, a hard copy of the materials was sent to them.) This occurred for only two participants.

Participants were randomly assigned to either the live dog or the control condition by the PI at the time the appointment was made by rolling a dice. Even numbers were assigned to receive the robot intervention and odd numbers received the live dog.

On the day of the appointment, participants were instructed to park at the University of Denver parking garage adjacent to Craig Hall where the Graduate School of Social Work is located. Participants were given a code to access the garage so that they would not have to pay for parking. As participants left the garage, signs were posted directing them to the study area.

Consent and assent procedure.

Participants were greeted by the PI who sat down with them in a designated room and reviewed the consent and assent forms in detail. (Appendix B) Any questions that the participants had about the research were answered. Once consent and assent were obtained and the forms were signed, the children were introduced to a research assistant.

Experimental procedure.

The research assistant then led the child and the parent to the pre-test area, a quiet room with a table and chairs for the child and parent. The parent was instructed not to interact with their child or to help them with the testing questions. Parents were asked not to engage the child whenever possible. The parent also received a parent questionnaire to complete. If parents had questions about the survey, they directed those to either the PI or the research assistant.

Meanwhile, the Reading the Mind in the Eyes Test (Baron-Cohen, 2001) was administered to the child by the research assistant. The research assistant was blind to the treatment that each child received. Per the instructions of the RMET, the following instructions were read to each child (Note: Words in italics are instructions for the administrator.):

> In this folder I've got lots of pictures of people's eyes. Each picture has four words round it. I want you to look carefully at the picture and then choose the word that best describes what the person in the picture is thinking or feeling. Let's have a go with this one (*practice item*). Look at this person. Do you think he is feeling jealous, scared, relaxed or hate? *(Point to words as they are read. Make sure child picks one of the options and give encouraging feedback without revealing whether they are right or wrong.)* OK, let's have a go at the rest of them. You might find some of them quite easy and some of them quite hard, so don't worry if it's not always easy to choose the best word. I'll read all the words for you so you don't need to worry about that. If you really can't choose the best word, you can have a guess. *(Precede with the test items in exactly the same way as the practice item.)* (Baron-Cohen, 2001)

The research assistant completed the RMET by showing the child all 28 pictures of eyes and marking the child's answers on the form provided. (Appendix C)

Next the physiological anxiety sub-scale of the Revised Child Manifest Anxiety Scale-2 (RCMAS-2) was administered. The scale consists of twelve yes or no questions.

The research assistant made the following statement before the questions were administered:

> Now I have some questions for you about how you feel or things you do. Please answer "yes" or "no" to each question. There is no right or wrong answer. If you aren't sure, just make your best guess.

The research assistant recorded the child's response on the form provided. (Appendix C).

When both measures were complete, the PI introduced either the dog or the robot, depending on what condition the child was randomly assigned. The research assistant showed the child a brief instructional video (3 minutes) made for the purpose of this study. [NOTE: The video was the product of the initial inquiry with the AHA experts. For purposes of this study, this is referred to as "Stage one" in Figure 7.] In the video, the child observed the PI interacting with either a therapy dog or the robot and was told what to expect in age-appropriate language. The video was an instructional video that modeled the five aspects of engagement that experts deemed most important to the development of emotional security during the first qualitative phase of this study. The child also saw the toys that experts found helpful for engaging a child in play that were available to them during the fifteen minutes. Several books, selected in cooperation with AHA that represented different reading abilities, were also available to the children (McQuarrie, 2010). The video concluded with inviting the child to play with or read to the dog or the robot that was now directly in front of them.

As described in the video, a visual timer was set for the child for fifteen minutes. Any questions that the child had were answered and then the child was left to play freely. In the case where a live dog was present, a handler was with the dog to support the dog

and monitor the safety of the dog/ child interaction. Per American Humane Association's guidelines for their therapy teams, dogs remained on a leash and under the handler's control throughout the entire time. The handler would allow the child to engage in play with the dog in any way he or she choose as long as it was safe for both the child and the dog. The handler was instructed to intervene in the play if the interaction was unsafe, abusive or inappropriate. Because the study related to the context of the child animal/robot engagement, the handlers were asked to refrain from directing the child's play or suggesting activities for the child. Instructions were given to the handlers to them to help guide their presence in the room (Appendix A).

In a similar fashion, a research assistant was present with the child during the engagement with "Biscuit". The research assistant was instructed to intervene only if a child was interacting with the robot in a way that would be interrupted as unsafe, abusive, or inappropriate if "Biscuit" were a live dog. For both conditions, if the play was disrupted or redirected by the handler or the research assistant, the behavior was noted. If any child or animal had continued to behave in a manner that was considered to be unsafe, the experiment would have been discontinued immediately.

At the conclusion of the fifteen-minute play session, the child met with another research assistant and repeated the RMET and the RCMAS-2 physiological anxiety sub scale exactly as described prior to the exposure. The policy for this study was that the testing administrator assistant needed to be different person than the handler or "robotic dog handler" who supervised the fifteen-minute engagement session.

Meanwhile, the parent completed the parent survey during the fifteen-minute session. (Appendix C) Following the conclusion of the play session and the post-tests, the PI checked to see if the questions were complete. If there were missing items, the PI asked the participants if this were a mistake. Participants were not forced to answer questions. When all tests were completed, the child and the parent were led out of the study room.

Stage 3: Measurement of Engagement

The third stage of this study was designed to answer the following question:

Q1: How do children engage with the companion during the fifteen minutes of play?

Engagement was of primary importance to this study and the Melson et al. (2009) global scale of engagement was to be used to determine if children was engaged during the play session. The theoretical basis of this study relies on children being engaged to create a relational context with either the dog or robot where they could experience feelings of security (Cohen, 2002; Crittenden, 2006; Cummings & Davies, 1996; Davies & Cummings, 1994). Because engagement is a condition of context, the introductory video was designed to instruct children how to engage with the selected companion.

Engagement was then measured in three five-minute sections using the Revised Melson Engagement Scale. Therefore, each participant received three ratings for engagement, one for the first five minutes of their play experience, one for the second five minutes of their play experience, and one for the third five minutes of their play experience. Scores were assigned by a research assistant from viewing a video recording

of the play experience. The two research assistants who were involved with the engagement scoring were trained as previously described in the measurement section. Random inter-rater reliability checks were conducted to ensure that the raters achieved a Cohen's kappa of at least .80. Finally, a total engagement score was calculated for each participant by adding the three engagement scores.

Stage 4: Qualitative Semi-Structured Interviews

The final stage of this study was designed to answer the following questions:

Q1: What is meaningful about companion robots or dogs to children as it relates to emotional security?

Q2: Are dogs considered social companions for children who have been adopted?

Q3: Are socially interactive robots such as "Biscuit" social companions for children who have been adopted?

Q4: Which companion, dog or robot, would adopted children prefer?

The PI conducted the final child interview (Appendix C). Children were seated at a round table in the office of the Institute for Human-Animal Connection. Children were asked to reflect on the play experience they just had and to answer the questions with this experience in mind. Questions such as, "Would having a friend like *"Biscuit"/Name of AHA dog* change how you deal with new situations?" were asked. These questions as well as additional probes designed to understand how companions affect the context of the environment as it relates to emotional security described the contextual shift that occurred with the introduction of an animal/ robotic animal. Additional prompts were given to help children expand on their answers.

When the final interview was complete, children were given a miniature stuffed dog and a coloring book. The coloring book illustrates how children can interact with dogs safely. Children were reminded that not all dogs are therapy dogs and that they should be careful when interacting with dogs they do not know. Parents received a $25 gift certificate. The parent and child were escorted to the exit door and thanked again for their time.

Data Storage Procedures

All cases were assigned a number and kept in a file separate from the actual data associated with each parent and child. Each form associated with data collection had a place for the case number to be recorded. Research assistants marked the number of each case on each paper as data were recorded.

Parent and child questionnaires were kept in a separate folder for each family. Data files were stored in a locked cabinet in the Institute for Human-Animal Connection. The list linking the identifying information to the child/ family data was kept in a separate locked file on a password-protected computer, also in the Institute for Human-Animal Connection office.

Analytic Approach

The following section outlines how the data for this study were analyzed. The first section describes how the data for designing the intervention from stage one of the study were analyzed. Then, the analytic approaches for the intervention data are discussed.

Data to design the intervention.

The data from the qualitative interviews were collected in order to develop the intervention for the clinical trial (stage two, three, and four). The following four questions were addressed:

Q1: Which therapy dogs should be included in this study?

Q2: How do children engage with therapy dogs?

Q3: What tools are helpful to facilitate a therapeutic engagement?

Q4: What are the most important qualities of engagement with therapy dogs that relate to emotional security?

Q1: Which therapy dogs should be included in this study?

In order to determine how to select therapy dogs for the clinical trial, experts had been asked to list the three most-desirable characteristics of a therapy dog for working with traumatized children. Adjectives used to describe the therapy dogs were organized in Excel and given a value of importance (3 being most important and 1 being least important) and collapsed to reflect the most common traits that are desirable for working with traumatized children.

Q2: How do children engage with therapy dogs?

Next, the places where children who have experienced trauma most often touch therapy dogs were analyzed in two ways. First, places where experts noted that children touched their therapy dogs by placing stickers on the stuffed dog were recorded in Excel. Two pie charts were created. The first chart reflected the group of seven experts who

received 28 stickers to identify touch points. These experts chose anywhere from seven to seventeen dots to demonstrate areas where their dogs were touched. The second pie chart reflected where the group of experts who received seven stickers, an equal number of touch sensors in Biscuit, thought it was most important to touch their therapy dogs.

The pie charts of the first group and the second group were similar (see stage one findings in chapter 4) so additional analysis of this point was conducted. Video of the experts demonstrating engagement with their therapy dog was independently coded by a research assistant. The first three sections of the dog that the expert touched were recorded for each of the interviews.

Q3: What tools are helpful to facilitate a therapeutic engagement?

Next a list of all the artifacts that experts described using or showed using to facilitate engagement with their therapy dogs was recorded. Items that were used by at least three experts to facilitate engagement were chosen for the intervention.

Q4: What are the most important qualities of engagement with therapy dogs that relate to emotional security?

An initial issue for this study was to determine what experts considered to be important qualities of engagement that related to emotional security. The first event in the embedded experimental design used in the study was directed toward answering this question by engaging experts in a Q- sort procedure. The purpose of this procedure was to identify engagement behaviors that experts rate as critical to their judgment of having observed the experience of emotional security. The plan was to use these items as part of a protocol that would facilitate engagement for the fifteen-minute experimental exposure.

In the current study, the use of the q-sort analysis was employed to examine correlations among experts across a sample of items drawn from the KMBR coding book. The q-sort factor analysis was used to group the experts who gave similar rankings. In q-sort methodology, the q-sort principal component extraction identifies agreement among groups of experts (Brown, 1986). Q-sort is useful for testing theories on small sets of individuals intentionally chosen for their presumed knowledge of some significant characteristics (Kerlinger, 1986). This analysis was used to determine what the majority of experts agreed were the salient features of children's engagement with therapy dogs. The findings from this data set were used to establish the engagement protocol, presented to the children in the study as a video that introduced either the therapy dog or the social robot.

Clinical trial data.

Exploratory data analysis.

The first step in the data analysis was to conduct an exploration of the data (EDA). Before the data was even entered, it was reviewed for inconsistencies, double coding or other obvious errors (Morgan, Leech, Gloeckner, & Barrett, 2004). A data dictionary was created and data were entered into SPSS for analysis. To ensure that the data were clean, several steps were taken. First, records were randomly selected and reviewed for accuracy with the SPSS files. Second, the minimum and maximum values for each variable in the descriptive output were compared with the allowable ranges of values in the data dictionary (Morgan et al., 2004). Third, the means and standard deviations of the variables were examined to see if they were reasonable. Fourth, missing

data were investigated. If possible, data were recovered, but all missing variables were explained. In some cases, questions were added later in the data collection process and some items were left blank by participants.

An additional check was performed for the two dependent variables, the RCMAS and the RMET. For both scales, both pre and post intervention, scores were hand calculated and checked against SPSS calculations for accuracy. To do this, items were entered individually, but then totaled using SPSS. This total was subtracted from the hand-calculated total. The variable created had to be zero to indicate that the scores were entered correctly. If a record's score was not zero, the entry was examined until the error was found.

Following Tukey's model for Exploratory Data Analysis, visual representations of the variables were created (Tukey, 1977). The variables were examined to determine if there were trends that might represent the sample or if additional hypothesis should be tested. Next, the SPSS file was split and the group of children who played with the social robot was compared to the group of children who played with a therapy dog. No significant differences were found between the groups for age, gender, whether or not children currently own a dog, time they have lived in the home, number of placements prior to being placed for adoption, history of animal cruelty, whether or not they are on medication, have a mental health diagnosis or use Medicaid. Table 1 presents the descriptive statistics for the groups.

Table 1.

Descriptive statistics for dog and robot groups

	AHA Therapy Dog (n=22)	Biscuit (n=21)
Mean Age (years)	8.09 (6-10)	7.57 (5-11)
Gender	15 males 7 females	9 males 12 females
Trans-racial family?	61.5%	46.2%
Currently own a dog?	77.3%	61.9%
Currently own a social robot?	4.5%	19.0%
Parental report of animal cruelty	27.3%	19%
Number of Placements Prior to Adoption	1.64 (0-5)	2.10 (0-6)
Mental Health Diagnosis?	45.5%	33.3%
Currently taking medication?	40.9%	57.1%
Medicaid	93%	83%
Mean Total Engagement	6.27	7.29
Mean RMET Pre-Test Score	14.36	13.65
Mean RMET Post-Test Score	14.63	13.40
Mean RCMAS Pre-Test Score	6.23	6.52
Mean RCMAS Post-Test Score	5.73	6.33

Statistical tests were performed to test assumptions such as normal distribution, kertosis, skewness, adequate variability, pre-test group equivalency. Assumptions for t-tests and mixed-effect regression, the analyses planned for this study, were met.

Hypothesis testing.

Univariate, bivariate, and multivariate analyses were performed to test hypotheses about the relationships of the variables. The following hypotheses were tested accordingly.

H1: Physiological anxiety will decrease as a result of interacting with a therapy dog for fifteen minutes.

In order to test this hypothesis, a paired samples *t*-test of the RCMAS scores pre and post for the group that received the therapy dogs was run.

H2: Physiological anxiety will be unchanged as a result of interacting with a robotic dog for fifteen minutes.

In order to test this hypothesis, a paired samples *t*-test of the RCMAS scores pre and post for the group that received the social robot was run.

H3: Social understanding will increase as a result of interacting with a dog for fifteen minutes.

In order to test this hypothesis, a paired samples *t*-test of the RMET scores pre and post for the group that received the therapy dogs was run.

H4: Social understanding will be unchanged as a result of interacting with a social robot for fifteen minutes

In order to test this hypothesis, a paired samples *t*-test of the RMET scores pre and post for the group that received the social robot was run.

3Q1: How do children engage with the companion during the fifteen minutes of play?

EDA was conducted on the engagement scores for each of the conditions.

Q1: What is meaningful about companion robots or dogs to children as it relates to emotional security?

The qualitative data were examined using structural coding for themes that could inform this topic.

Q2: Are dogs considered social companions for children who have been adopted?

A social companionship score was calculated using the Melson questions. A EDA exploration of the data was conducted.

Q3: Are socially interactive robots such as "Biscuit" social companions for children who have been adopted?

A social companionship score was calculated by adding the number of positive responses to the Melson questions.

Q4: Which companion, dog or robot, would adopted children prefer?

Children were asked directly if they would prefer a real dog or a robot. Totals of their responses were calculated and compared.

Q5: Is there a combination of factors that predicts scores on RCMAS and RMET both singly and in combination?

Linear mixed-effect regression models based on age and gender were tested for best fit using R, a statistical software package, to determine if there were any additional effects on social perception or anxiety that were not detected with t-tests. Additional covariates such as history of animal cruelty, number of placements, gender of the handler,

Medicaid status, mental health diagnosis, and engagement were tested and removed singly and in combination but did not improve the fit of the model.

Chapter Four: Findings

This chapter presents both the qualitative and quantitative findings from this research. Starting with what has been referred to as Stage 1 (Figure 9); findings that informed the design of the intervention are discussed. Then, the findings from the clinical trial are presented.

Expert Interview Findings Used to Inform the Intervention

The first step involved conducting interviews with certified therapy dog/ handler teams who have experience in counseling children who have experienced trauma. As previously described, the purpose of the expert interviews was to answer the following questions:

Q1: Which therapy dogs should be included in this study?

Q2: How do children engage with therapy dogs?

Q3: What tools are helpful in facilitating a therapeutic engagement between children and dogs?

Q4: What are the most important qualities of engagement with therapy dogs that relate to emotional security?

Q1: Which therapy dogs should be included in this study?

Experts listed three adjectives describing their therapy dogs that they judged to be most important to the developmental of emotional security. These qualities were listed in an Excel spread sheet and structural coding was used to identify categories from the

responses that the experts provided (Saldana, 2009). Because experts were asked to list them in order, a value of three was given to the "most important", two to "next most important", and one to "important" qualities. The values were used to help distinguish the relevance of each of the qualities of the therapy dogs to the experience of emotional security.

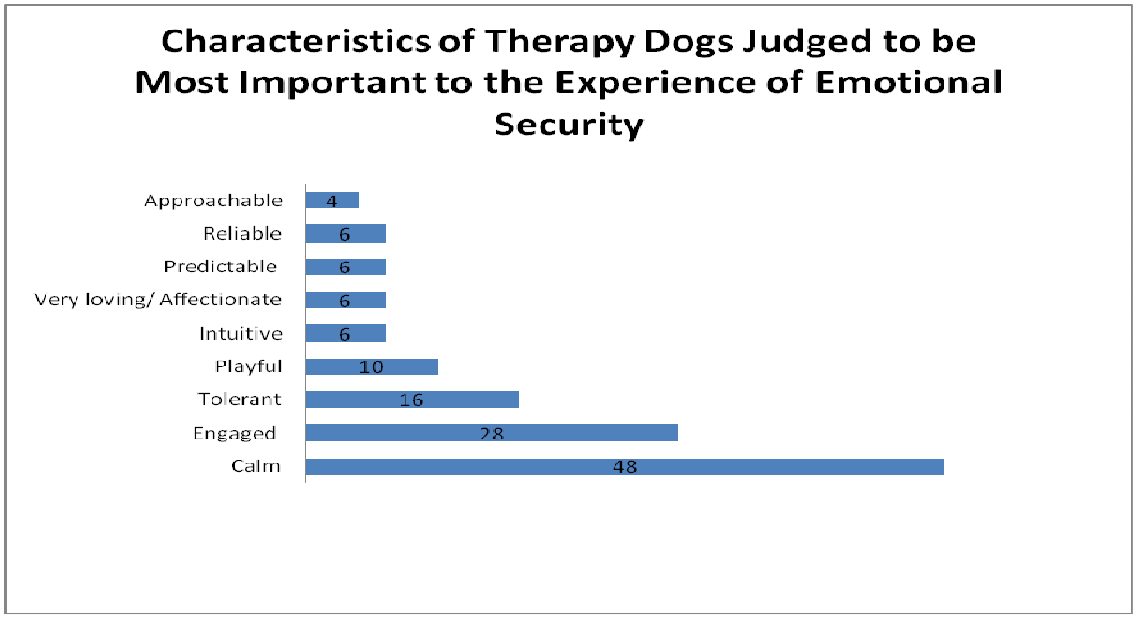


Figure 11. Description of Desirable Traits

As shown in Figure 11, the top characteristics were "calm," "engaged," and "tolerant" the following three questions were developed to screen therapy dogs for this study. Handlers had to respond in the affirmative to all three questions to be considered for participation: 1) Would you describe your dog as "calm"? 2) In situations where you have interacted with a child on a one-on-one basis, is your dog "engaging"? 3) Would you consider your dog "tolerant"?

Q2: How do children engage with therapy dogs?

The following charts (Figure 12) describe places where experts noted that children who have experienced trauma touched their therapy dogs. Two pie charts were created. The first chart reflects the group of seven experts who were given 28 stickers to identify touch points. These experts chose anywhere from seven to seventeen dots to demonstrate areas where their dogs were touched. The second pie chart reflects where the group of experts who received a number of stickers equal to the number of touch sensors in Biscuit (7) thought it was most important to touch their therapy dogs.

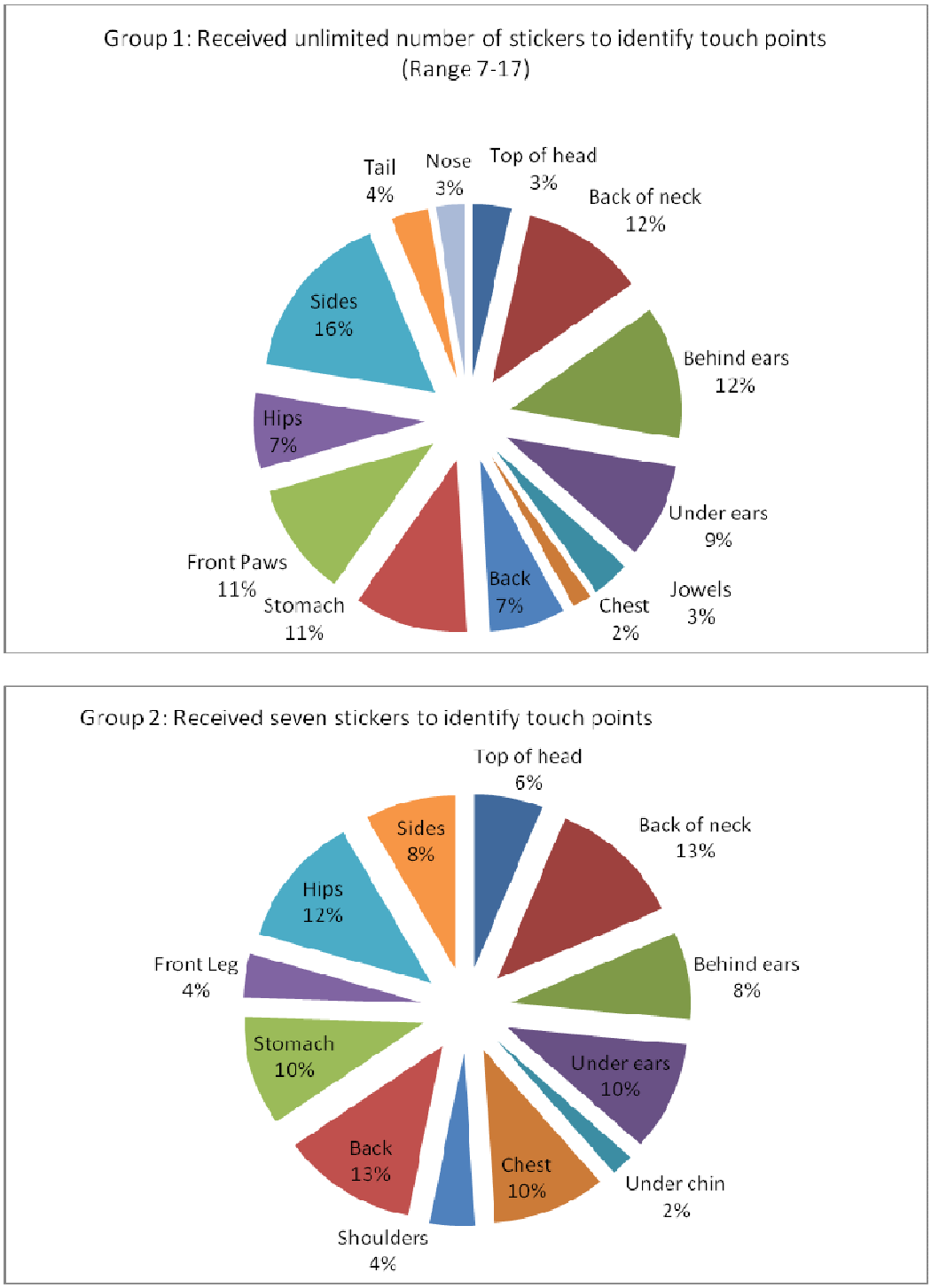


*Figure 12.*Expert Opinion: Where do children touch therapy dogs as it most relates to the experience of emotional security?

The pie charts of the first group and the second group were similar. Video of the experts demonstrating engagement with their therapy dog was recorded as they demonstrated the primary areas of touch and independently coded by a research assistant. The first three sections of the dog that the expert touched were recorded for each of the interviews. The most common pattern was to first touch the head, second the ears, and then to stroke the dog down the back. This was modeled by this researcher in the video used to model engagement with either the therapy dog or the robot prior to the play period.

Q3: What tools are helpful to facilitate a therapeutic engagement?

The following items were used by at least three experts to facilitate engagement and therefore, were selected to be included in the intervention:

- Dog Brush
- Stethoscope
- Bandanas and different collars (For dress up)
- Extra leash
- Blanket
- Balls
- Squeaky toys
- A clicker for training
- Dog Books
- Towel (to prevent hair being dropped on the floor)

These items were used for both the play with the social robot and with the therapy dog. Use of the items was modeled by the PI in the pre-engagement video.

Q4: What are the most important qualities of engagement with therapy dogs that relate to emotional security?

Principal component analysis indicated that there were three factors or three groups of experts who similarly rated the statements from the KMBR coding book. No rotation was necessary for an interpretable solution. The number of factors was determined by examining the screeplot which was based on eigenvalues.

The first group that was extracted contained ten of the twelve experts. The second and third groups only contained one person each. The five qualities of engagement that were judged by the first group to be most important to emotional security were distinguished by the normalized Q factor score and used in the next step of constructing the protocol.

As indicated by the analysis, there was a high level of agreement among the experts as to which qualities of human-animal engagement were most likely to be associated with the development of emotional security. According to this group of ten experts, the following five behaviors were rated the most frequently as the most salient to the development of emotional security from the KMBR coding book:

1. Talking to therapy dog NOT a directive or a question – can't say the child expects a response. (e.g., "I know you want to kick the ball"; "Good dog") Note: Includes vocalizations (whistling, clucking, etc.) that express engagement.

2. Arms Around – Reasonably clear that the child has their arms around therapy dog as in hugging.

3. Petting – Back and forth or stroking motion, generally with the pads of finger(s) or palm of hand, but also may be with knuckles or fingertips. (NOTE: must be reasonably clear that the child is petting.)

4. Verbal Engagement – Child engages in socially interactive verbal monologue with therapy dog

5. Visual Engagement — Child attempts to look at face level, and in doing so, child head below own shoulder level. (Note: Includes child "locking on" in face-to-face gaze at therapy dog for at least 1 second) (Khan et. al, 2009).

Based on these findings, an engagement protocol was developed that directed children to interact with the therapy dog or Biscuit in a way that most facilitates feelings of emotional security. The following script was identical for both videos with the exception of references to either the "robotic dog" or "therapy dog."

> Welcome to the University of Denver! Thanks for coming and for being a part of this study: Pet Pals for Kids. Today you get a chance to play with a therapy dog/ robotic dog, like this one. Some kids wonder what you can do with a therapy/robotic dog. You can talk to him. You can say things like: "Good dog!... or, I know you want to kick the ball, or what a good boy, or you're a pretty dog!" Another thing you can do is hug a dog, like this. Another thing you can do is pet your dog. You can hold your hands flat, start under its ears, kind of move around to behind the dog's ears and then go down its back. Some kids like to tell their pal a story. They can be great listeners. You can talk to them and tell them pretty much anything. You can put your head down low, below your shoulders and look them in the eye, like this. You'll also have some toys to play with. We picked out some special things for you. As you can see we have a bandana, so you can play dress up, a ball. We have some squeaky toys. This is a little lamb. We have a stethoscope. Some kids like to play doctor. Another thing we have is an extra leash, so you can use that if you like. We also have a brush so you can brush your pal. We also have a clicker, so you can train your pal… and an extra blanket. We also have some books so you can read to your pal if that's something you like to do. We have all kinds of books, books where you can just look at the pictures, or chapter books. So it doesn't matter if you are a really good reader or just getting started. So you might be wondering how long you are going to be here. You get to play for fifteen minutes. We have special timers so you can see how much time you have left. The red shows fifteen minutes and when it's all gone, you're done! That's all you need to know for our study today. Remember your mom or dad is right here if you need them and our research assistant is in the room to help

you feel safe. If you have any questions, please ask us, and thanks again for coming.

Clinical Trial Findings

The following hypothesis and questions were tested:

H1: Physiological anxiety will decrease as a result of engagement with a therapy dog for fifteen minutes.

A paired samples *t* test indicated that levels of physiological anxiety were not significantly different as a result of engagement with a therapy dog , (t = 1.53, df = 21, p=.14).

H2: Physiological anxiety will be unchanged as a result of engagement with a robotic dog for fifteen minutes.

A paired samples *t* test indicated that levels of physiological anxiety were not significantly different as a result of engaging with a robotic dog, (t = .433, df= 21, p=.67).

H3: Social understanding will increase as a result of engagement with a therapy dog for fifteen minutes.

A paired samples *t* test indicated that levels of social understanding were not significantly different as a result of engagement with a with a therapy dog, (t = -.312, df =21, p=.76).

H4: Social understanding will be unchanged as a result of engagement with a robotic dog for fifteen minutes.

A paired samples *t* test indicated that levels of social understanding were not significantly different as a result of engagement with a robotic dog, (t = .289, df= 19, p=.78).

3Q1: How do children engage with the companion during the fifteen minutes of play?

Children engaged with therapy dogs and robotic dogs in much the same manner. The pattern of engagement was consistent with children maintaining a similar engagement with the therapy dog or the robotic dog throughout the session (Figure 13). On the revised engagement scale, children on average scored between a "moderate" and "high" level of engagement for both the social robot and the AHA therapy dog, meaning that children intermittently to persistently engaged with the dog/ robot throughout the session by playing interactive games such as fetch, touching or stroking, and maintaining eye contact. (For a more detailed description of the measure, see Appendix C.) An independent samples *t*-test revealed that there were no statistically significant differences between levels of engagement with the dog or robot for the first, second, or third five-minute periods, nor for the total engagement score calculated for each group.

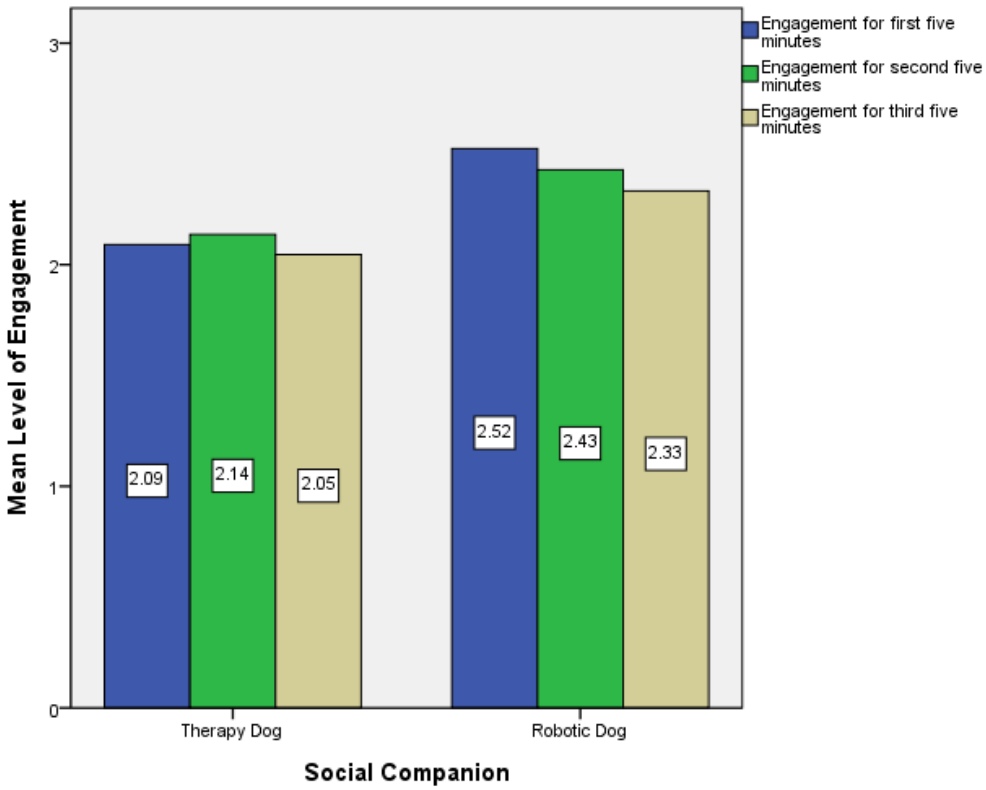


*Figure 13.*Comparison of Engagement for Children with a Therapy Dog or Social Robot

Q1: What is meaningful about companion robots or dogs to children as it relates to emotional security?

Two questions on the semi-structured questionnaire were intended to address the children's conceptualization of social companions as they relate to emotional security. 68% of children who played with the therapy dog and 62% of children who played with the robotic dog responded "yes" to the question: "Would having a friend like this change how you deal with new situations?" With additional probing, children were able to expand on their reasoning. One child who played with the dog reasoned, "He helps me be calm and makes me happy." Another stated, "She could come find me if I get lost." Children who played with "Biscuit" attributed calming qualities and companionship to

their playmate as well, “it would help me. If I get upset, I could hug him.” Another child explained, “He would help keep me safe. He would give me company. Being alone is unsafe.”

91% of children who played with a dog and 90% of children who played with “Biscuit” responded “yes” to the question: Do you think having “Biscuit”/ Name of AHA dog as a pet would help you be safe? Seven children who played with a dog cited reasons of protection: “If a stranger came, Gidget [name of AHA dog] would growl and bite and scratch.” “He [referring to another AHA dog] would bark and would hear the doorbell. He would start barking if people were here. He’s protective.” “If I had him as a pet, he would keep strangers away, guard the house at night, and make me feel safe with weird noises.”

In contrast, five children who played with “Biscuit” cited reasons of protection: “He would save me from bad people.” “He would be a watch dog.” “He is a guard dog.” “Yes, because he [Biscuit] has sharp teeth and claws.” “He really likes me and he won’t let anyone hurt me.” Children who played with “Biscuit” wondered out-loud about Biscuit’s ability as a toy to protect them, “Yes. It depends if he were real. Well, he is real, just battery powered.” “A real dog could protect me more than Biscuit.” “It wouldn’t be safe, but easy to use.”

Q2 and Q3: Are therapy dogs or social robots considered social companions for children who have been adopted?

A social companionship score was calculated by adding the number of positive

responses to the questions from the Melson, et. al study (2009). Possible scores on this measure ranged from 0-15. Results are shown in Figure 14. Children who played with "Biscuit" and therapy dogs scored between twelve and fifteen points for both social companions. This indicates that children felt there was *mutual admiration* between themselves and "Biscuit" or the AHA dog (Do you like X? Does X like you?), *mutual friendship* (Can X be your friend?/ Can you be a friend to X?), *shared enjoyment* (Can you play with X?/ Can X play with you?), that they could *comfort* each other (If you were sad, would you feel better with X?/ If X were sad, would X feel better with you?; If you were going to sleep, would you want to cuddle with X?/ If X were going to sleep, would X want to cuddle with you?).

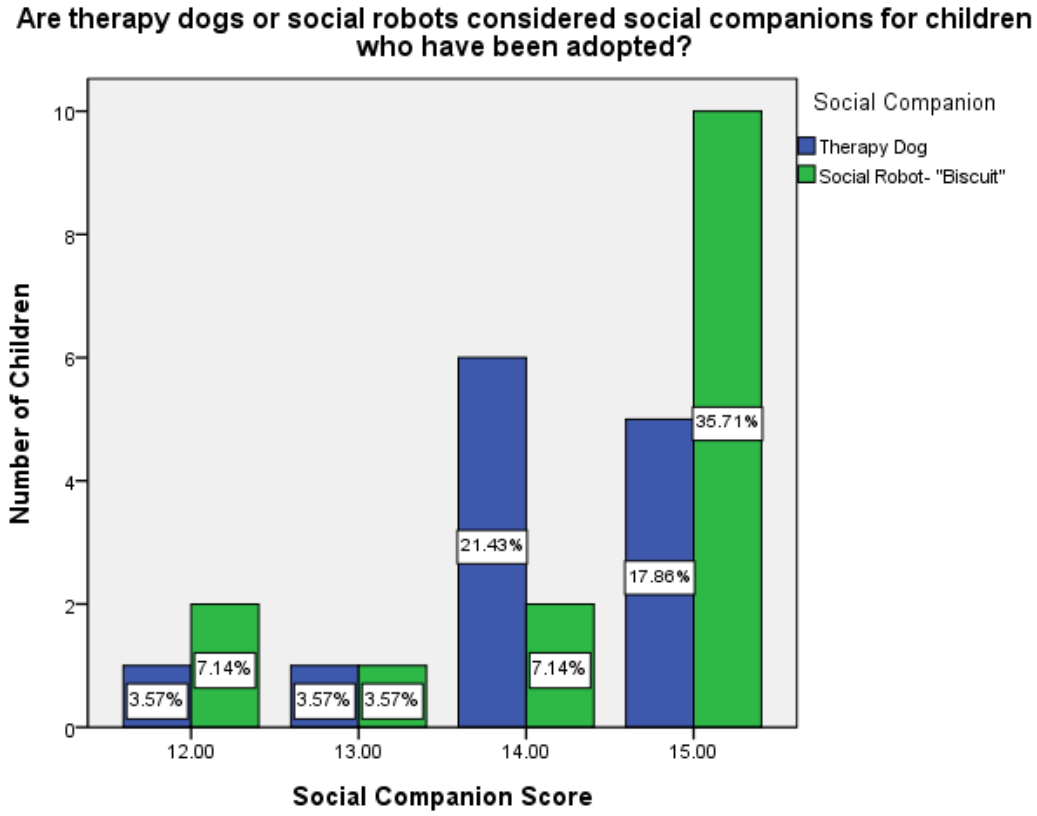


*Figure 14.*Social Companionship of Therapy Dogs and "Biscuit"

Q4: Which companion, dog or robot, would adopted children prefer?

Children were asked directly if they would prefer a living dog or a robotic dog as a pet. 65.1% (n=28) children said they would prefer a living dog. 34.9% (n=15) said they would prefer a robot.

Q5: Is there a combination of factors that predicts scores on RCMAS and RMET?

A linear mixed-effect regression model was run using R, a statistical software package, to determine if there were any additional effects on social understanding or anxiety that were not detected with t-tests. Fitting linear mixed-effects models while

employing the Bayesian Information Criterion (Schwarz, 1978) uniformly, the following findings emerged. In a step-wise fashion, models of increasing complexity were fit to explain scores of social understanding. The best fitting model showed that for boys only, there was a significant effect of total engagement on social understanding ($p<.01$). For each positive unit change in total engagement, social understanding score decreased by 1.16 units. No such effect existed for girls. While insignificant, the model fit was improved with the additional covariate of age. Race, trauma history, history of animal cruelty, Medicaid status, diagnostic status, preference for a real or robotic dog as a companion, number of moves, gender of the handler present, and length of time in the adoptive home did not improve the fit.

Table 2

Best fit model for boys on social understanding (RMET)

	Value	Std. Error	DF	t-value	p-value
(Intercept)	17.49	3.92	24	4.46	0.0002
Age	0.41	0.43	21	0.94	0.3575
Total Engagement	-1.12	0.39	21	-2.90	0.0086

When males and females were combined in a single best-fitting model, no significant effect for engagement or gender or any other covariate was found.

In a similar fashion, mixed-effect models were constructed to explain anxiety scores. When analyzing boys or girls independently, there were no significant associations with anxiety scores on any of the following covariates: age, gender, Medicaid status, diagnosis, current medication, history of animal cruelty, gender of the handler, or preference for a real or robotic dog.

Finally, exploration of the data was conducted to see if there were relationships between physiological anxiety and social understanding. The best model that contained both social understanding and anxiety is pictured in table 3.

Table 3

Best-fit model for boys on physiological anxiety

	Value	Standard Error	DF	t-value	p-value
(Intercept)	12.28	2.21	22	5.56	0.0000
Age	-0.49	0.27	21	-1.81	0.0847
RMET (Social Understanding)	-0.19	0.07	22	-2.89	0.0086
History of Cruelty	-5.17	2.43	21	-2.13	0.0451
RMET: History of Cruelty	0.36	0.17	22	2.05	0.0526

Age was included in the best-fit model because it improved the BIC score, but was not significant in the model for boys on physiological anxiety. However, for boys only, there was a significant relationship between social understanding and physiological anxiety ($p<.01$). For each unit increase in social understanding, there was a decrease in physiological anxiety by 0.19 units. Also, there is a significant relationship between parental report of animal cruelty and physiological anxiety ($p<.05$). If a history of animal cruelty was reported, anxiety scores decreased by 5.17. There was a significant interaction effect for history of cruelty and social understanding on physiological anxiety ($p=.05$).

Because history of animal cruelty had a significant effect in the best fit model, additional exploration of what cruelty meant in the nine cases where it occurred was

conducted and contrasted with the total engagement score. Table 4 summarizes by gender, the average levels of engagement with the reports of animal cruelty provided by parents.

Table 4

*Parental Description of Animal Cruelty for Boys and Girls Contrasted with Levels of Engagement**

Total Engagement Score	Boys	Girls
Low		She squeezes on cats kind of hard. – Age 9
Medium	Some kicking. –Age 6	
High	He killed some puppies, has hurt dogs, and plucked off a bird's feathers. – Age 7	Just learning boundaries, good touch, soft, gentle, etc… –Age 8
	He has acted out sexually to animals. Caught him licking dog's genitals when he was first placed four years ago. He will still touch dog's bottom with his hand if we are not watching. – Age 8	She killed a kitten last summer. She had PTSD from our other cat being killed by a fox. We went through the grieving process… Later got two kittens. She got first pick. She later decided she wanted the other. We told her, "no." So she stomped and kicked it to death and then hid it behind her brother's bed. –Age 7
	He was playing with friends and accidentally killed a rabbit after throwing a rock to scare the animal. –Age 6	When we first got the kids, she drowned a pup in the toilet. She would also hold the cat to the point of getting scratched. –Age 8
		When we first adopted her, she would hit our dog—bit him once. We even considered getting rid of him because she was mean to him. Took a couple of years and now she is very kind to him. – Age 10

*no significant correlation between engagement and cruelty exists

In summary, age and gender had a significant effect on social understanding for boys only. Physiological anxiety, again for boys only, was affected by age, social

understanding, and history of animal cruelty, but not engagement. These findings are confounded and additional research is warranted.

Chapter Five: Summary and Future Directions for Research

This chapter concludes this study with a discussion of the findings, that children who have been adopted from the child welfare system engage with a robotic dog and therapy dogs in similar ways and that they consider both the social robot and therapy dogs as good candidates for social companionship. For boys only, engagement had a significant effect on social understanding as measured by the Reading the Mind in the Eyes Test; social understanding decreased with engagement with either the dog or robot. Again for boys only, physiological anxiety, as measured by the Revised Children's Manifest Anxiety Scale, decreased with social understanding. For boys, animal cruelty had a significant relationship to physiological anxiety. Future research ideas, such as the development of a human-animal social understanding scale and longitudinal examination of the effects of animal cruelty are also identified.

Social Companions for Children who have been Adopted

With the rise of animal-assisted therapy and social robots emerging as possible clinical adjuncts, this study examined how therapy dogs or robotic toy dogs could influence the development of emotional security for children who have been adopted. It is important to understand if animals or robots are considered social companions because according to the definition of emotional security employed for this study (see chapter 1), social companions can provide a basis from which emotional security emerges. Replicating previous research, children were asked a series of *yes* or *no* questions related

to social companionship (Melson, 2009). Children were asked to reflect on the fifteen minute exposure they had just experienced when responding to the questions. A social companionship scale was created by summing the positive responses. Positive responses received a value of one. Thus, children rated the potential social companionship of the dog or robot on a scale from 0-15. All of the children considered the robotic dog or the therapy dog a companion that would receive a 12-15 on the described scale. Figure 15 summarizes these scores. The robot, "Biscuit," and the therapy dogs were seen as good candidates for social companionship. There were no significant differences in the ways that children viewed the social robot or the therapy dogs in regard to social companionship according to the scale described.

This is an interesting finding because scholars in the area of affective computing speculate that robots will be become better social companions as they become more sophisticated (Breazeal, 2003). However, Biscuit has a relatively limited social repertoire compared to that of a live dog. He responds to only a handful of commands. Biscuit does not walk. He responds to touch with only two different sounds. Therapy dogs are living beings with a much richer social-behavioral repertoire. They are able to respond differentially to all types of stimuli and in ways unique to their own personalities. They can also initiate engagement and companionship.

It could be that the measure described to examine social companionship is not sensitive enough to detect the nuances of social companionship between the two companions. *Yes* or *no* questioning may have significant limitations in this case. During the administration of the child interview (Appendix C), children would sometimes answer

"yes" or "no" to a question, but then when probed with a follow up, for example, "Does Biscuit like you?.... How do you know?" it became evident that children might not have fully-understood the question or thought about it in a sincere way before responding. Children would say things like, "Wait, can you explain that again?" "What do you mean?" or "I don't know." Still, the pattern of response appeared to be similar for both children who had played with "Biscuit" or a therapy dog.

There were two questions designed specifically for this study that addressed emotional security and social companionship. 68% of children who played with the therapy dog and 62% of children who played with the robotic dog responded "yes" to the question: "Would having a friend like this change how you deal with new situations?" Also, 91% of children who played with a dog and 90% of children who played with "Biscuit" responded "yes" to the question: "Do you think having *"Biscuit"/ Name of AHA* dog as a pet would help you be safe?" Responses to these two questions were again, very similar. However, the brief explanations children provided indicated that children believed there could be differences in the quality of social companionship that a dog or robot could provide. This study was focused only on *if* these agents were social companions. Many of the families who participated in the research emphatically explained that relationships with live animals were critical to their son or daughters' success in their home. Findings that animals and social robots are both social companions does not qualify the *kind* of social companionship that each would provide a traumatized child. A future direction of research is to develop a more sensitive measure for social companionship that would be able to detect the differences children perceive

between the types of companions. Additional questions as well as multiple options for response would be a better way to measure social companionship.

Finally, children were asked one question related to preference, “Some kids would like to have a real dog, but other kids would like to have a robot. Which type of kid are you?” 65.1% (n=28) children said they would prefer a living dog. 34.9% (n=15) said they would prefer a robot. While both the social robot and therapy dogs were considered good candidates for social companions, living dogs were considered a preferred companion for children who have been traumatized.

Patterns of Engagement

Children engaged with both the social robot and the therapy dogs in similar ways. Engagement was measured with the Revised Melson/ Trujillo Engagement scale (Appendix D). Children were rated for levels of engagement three times, for the first, second, and third five minute periods of the total fifteen minute exposure. Engagement scores for each of the five minutes and the total fifteen minutes were compared and no significant difference in pattern or level of engagement with either Biscuit or the therapy dog existed (Figure 13). Findings that children engage with therapy dogs and the social robot, “Biscuit” from this study concur with other studies that also demonstrate children engage with social robots in similar ways as they do with their living counterparts (Kahn Jr, Friedman, Perez-Granados, & Freier, 2006; Melson et al., 2009; Tanaka, Cicourel, & Movellan, 2007).

The video introducing the exposure to Biscuit and the therapy dog was identical, so children had a standardized introduction to the exposure. This was done with the

assumption that any differences observed related to engagement would be able to be attributed to the inherent qualities of each of the companions. Because no differences were observed with the current measure of engagement, one possibility is that the video may have instructed children to engage in such a way that altered how they would have engaged with the companion in a non-experimental setting.

Social Understanding and Engagement for Boys who have been Adopted

For boys only, engagement was found to have an effect ($p < .01$) on social understanding as measured by the RMET, but not in the direction anticipated. While accounting for age, the more engaged boys were with *either* the therapy dog or the social robot, the less they were able to detect subtle social differences. For each positive unit change in total engagement, social understanding score decreased by 1.16 units.

The methodology of this study could partially explain this finding. Handlers were instructed to limit their interactions with the child and let the child direct the play with either the dog or the robot. This was done in order to maximize the observed effect of the dog/robot-child engagement. Also, the pre-engagement video that the children watched instructed them in exactly how experts believed engagement with their therapy dog contributed to positive changes. It could be that this introduction intensified the dose of engagement to a degree that would be unnaturally high. The video instructions might have also encouraged engagement in ways that would not naturally occur. The video, established to instruct children to engage in this experiment for the purposes of measurable effect, may have actually altered the effects. Because the video was identical for both companions, dog and robot, the assumption of this investigator was that

differences in levels of engagement could be attributed to the agency of the dog or the robot. However, the effects of the video on engagement might have been different for the dog or the robot. There was no way to measure the effect of the video in this study.

It could also be that in order to better understand the subtle social differences in human behavior, that engagement with humans, not robots or animals, is necessary. The RMET is in itself a testimony to how nuanced our human behavior is. Dogs are also complex in their signals to each other and to humans (Udell & Wynne, 2008). Thousands of years of domestication and shared communication have given humans and dogs a unique appreciation for each other, but perhaps the beauty of the human-animal relationship is to respect that which is specific to each species. Embodied anthropomorphism could be the assumption that our physiological response to one species is translated to embodied response in another. It may also be the case that exposure to therapy dogs actually increased understanding of subtle dog communication signals. Further research could use dog communication signals such as tail position, eye contact and posturing (Sanders, 1999) to develop a human-animal social understanding scale. A "Reading the Mind in the Behavior of Dogs Measure" is a future direction for research.

The Role of Animal Cruelty for Boys who have been Adopted

Even though the LINK® between violence towards people and violence towards animals is well-documented (www.americanhumane.org), the level of violence towards animals observed in this sample of six to ten year olds was startling. Because the sample was self-selected, there could have been a selection bias. 21% of children who

participated in this study had been cruel to animals. Contrasted with the prevalence rate of a normative group of children, age six to twelve, from the Ascione (2003) study (n=540) of 3.1% , the prevalence rate observed in this study is seven times greater. At the same time, the prevalence rate of animal cruelty found in this study is consistent with previous prevalence reports of cruelty to animals for children with sexual abuse history or psychiatric concerns. In the Ascione study referenced, children with a history of sexual abuse (n=481) were found to have a prevalence rate of 17.9% and children with psychiatric concerns (n=412) a rate of 15.6% (Ascione, Friedrich, Heath, & Hayashi, 2003).

As discussed in the previous section, in the best fit model for social understanding for boys, engagement, *but not cruelty*, was significant ($p<.01$). This finding is consistent with the only available study that examined both constructs of cruelty and engagement where engagement was found to be unrelated to cruelty history (Dadds et al., 2004). If there is no relationship between cruelty and engagement and understanding social differences, then engagement is not the appropriate target for interventions that seek to build empathy for boys. As Dadds and his colleagues suggest, nurturance might be an appropriate behavior targeted for intervention (2004). Barring any methodological influences that might affect this outcome such as the pre-engagement video in this study or the possible confusion of nurturance and "absence of cruelty" in the Dadds study, interventions focusing on promoting social understanding may find promise with emphasizing nurturing behavior.

Animal cruelty in this study was collected by parent report as a dichotomous variable. While experts in animal cruelty suggest that a dichotomous measure may be sufficient for some studies, the fact that animal cruelty had a significant effect for boys who have been adopted suggests that this topic should be explored in more detail (Ascione& Shapiro, 2009). Another concern is that because animal cruelty was represented by parental report as opposed to self-report or multiple measures, it could have been underrepresented. In one study of 6-13 year old children, parents reported higher rates of cruelty in the younger (6-9 year olds) than the older (10-13 year olds) children and reported more cruelty for boys than for girls. According to the parents, cruelty was more prevalent in young children, especially boys, and reduced with age. However, both age groups self-reported rates of cruelty that were higher than the parent reports (Dadds et al., 2004).

Because no definition of cruelty was provided for parents when they were completing the question, "Has your child ever been cruel to an animal?" there was room for much interpretation. Parents were asked to describe the cruel behavior if they answered, "yes." All nine of the parents who reported cruelty provided anecdotal comments that gave some insight into what the cruel behavior was (Table 4). Both boys and girls had committed serious acts of violence, resulting in animal casualties. It is notable that both cruelty history for boys and girls appear to be comparable, but that there was no main effect of cruelty for girls. This may be due to the small sample size of this study or it may indicate that the experience of cruelty has a different kind of lasting impression on social functioning for boys. However, conclusions about gender should

not be made based on observations from this sample. Like other studies that have observed effects based on gender, ambiguity about the definition of abuse, and the cultural considerations surrounding gender make it difficult to interpret gender-specific findings as they relate to animal cruelty (Herzog, 2004; Arluke, 2002).

Future research would benefit from providing parents and children a question that included a definition of animal cruelty such as the definition provided by Ascione, "Cruelty to animals is defined as a socially unacceptable behavior that intentionally causes unnecessary pain, suffering, or distress to and /or death of an animal" (1993, p. 228). Both parents and children should be asked this questions, and if either parent or child indicated that animal cruelty had occurred, an additional assessment of the cruelty such as the Children and Animals Assessment Instrument (CAAI; Ascione, 1997) or the Children and Animals Inventory (CAI; Dadds et al., 2004) should be conducted. Both measures include nine theory-driven aspects of cruelty that have been identified to be important aspects of this phenomenon: *the severity, frequency, recency, diversity across and within categories, sentience, covertness, isolation and empathy* (Ascione, 1997). This would allow findings from this population of children who have been adopted to be compared with other samples of children and could generate mature insight into the nature and meaning of cruelty towards animals and its implications for emotional development. Because children who have been adopted from the system have presumably been removed from undesirable and often violent environments then placed in homes that are considered safe, details about the timing of the cruel behavior, severity and how the behavior has changed over time could help inform interventions focused on

fostering empathy. Longitudinal designs to study children who have been in high-risk environments, but are then placed in safe environments would generate this kind of knowledge. Animal cruelty has been established as an early sign of conduct disorder (Ascione, 2005). Animal cruelty has been a criterion for conduct disorder in the DSM since 1987 (Arluke, 2006; F. Ascione & Shapiro, 2009; American Psychiatric Association [*DSM-IV-TR*], 2000).Violence towards animals should always be taken seriously as a matter of ethics. However, because violence towards animals could be a warning of future violence towards people, it warrants a heightened level of scholarship and concern (Ascione, 2005).

Physiological Anxiety and Boys who have been Adopted

The best fit model that explained physiological anxiety included social understanding and was significant for boys only (Table 3). Boys who had a history of animal cruelty were less anxious the more their social understanding increased ($p<.01$). If a history of animal cruelty was reported, anxiety scores decreased by 5.17 units ($p<.05$). It could be that because of the cruelty history, boys who participated had heightened anxiety prior to the experiment, knowing that they could potentially engage with a living dog.

It is important to note that exposure to a living dog or robotic dog helped to decrease anxiety for boys. Emotional security as measured by the absence of anxiety (Chapter 1) is an area of investigation that may hold promise with interventions utilizing a robotic dog or therapy dog for boys who have been adopted from the child welfare system.

Limitations

As a preliminary inquiry, there are multiple limitations that must be acknowledged. First, the sample size is relatively small. In order to get an adequate number of children to participate, the age range included 5 to 11 year olds. Developmentally, there are significant differences in this range of children.

Also, it was impossible to test for any novelty effect that the dog or robot could have had. 69.8% of the children owned a dog and11.6% or 5 children in the total sample owned a robot. There were not sufficient children who did not have a dog or robot in either or both groups to analyze the effect that a novel companion could have on the fifteen minute exposure. Also, there was limited information collected about the children's dog or robot experience. There are approximately 74.8 million dogs and 88.3 million cats in the United States; thirty-nine percent of U.S. households own at least one dog, while thirty-four percent of U.S. households own at least one cat (American Pet Products Manufactures Association APPMA, 2008). With more than 70% of US households with children owning a pet (Melson, 2003) and with the popularity of robotic animals (Goldsmith, 2009) it may be that neither companion was novel to this sample of children. It could be that because pet dogs are so common for children, even if they do not personally own a dog, that children have established expectations of how to engage with dogs. Another possibility is that children readily apply expectations they have of engaging with a live dog to "Biscuit" because that behavioral framework seems the most appropriate one they have to apply when engaging with a social robot that looks like a dog. However, future research needs to include additional questions that assess the

potential novelty effect that either companion could have. A larger sample would allow for statistical control of this potential effect.

This sample also included a large percent of children who were taking various medications. These medications could have altered the children's ability to perform on either or both of the measures. There were 23 different types of medications that parents of children in this sample reported their children taking. Future studies could consider having a control group of children who were not prescribed any medication. However, excluding children who are on medication could possibly limit the participation of children who are more troubled or who are cruel to animals. Therefore, larger sample sizes may be the best available alternative, allowing future research the ability to control for this factor.

There were also limitations to the measures chosen for emotional security. The idea that oxytocin would increase as a result of engagement with a therapy dog (Odendaal, 2000; Odendaal & Meintjes, 2003) and that this release of oxytocin would produce a measurable effect on social understanding as evidenced by an *improved* performance on the RMET (Domes, Heinrichs, Michel, Berger, & Herpetz, 2007), was not supported by these findings. In the study that linked oxytocin levels to improved understanding social differences on the RMET, adult men, ages 21-30 improved on the most difficult items (Domes, Heinrichs, Michel, Berger, & Herpetz, 2007). It could be that more mature men had developed the ability to detect the subtle differences as a result of more life experience. Although the child version of the RMET was used, the ability of children between the ages of 6 and 10 to understand the most difficult items on the

measure may be a function of their lack of life experience. Also, unlike the Domes (2007) study, there was no way to control for the dosage of oxytocin that the dog/ child engagement would have produced, if at all.

The best way to measure oxytocin would be to do so directly. As assays improve, and non-invasive methods of assessing this kind of physiological response are available to researchers, new insights into how humans and social companions communicate in embodied terms will be made. The use of oxytocin as a physiological measure is still a very new idea to researchers (Anderson, 2006) and the ways this neuromodulator affects change on a cellular to behavioral level would be well-suited for an interdisciplinary research team that could combine expertise from endocrinology, psychology, medicine and social work.

Finally, it is important to note that this sample of children adopted from the child welfare system is a non-normative sample. Any observations from this study should be interpreted with caution. Findings would apply only to children who have been adopted from the system and the confounded nature of the results warrants further caution in applying the findings to social work practice.

Robots versus Dogs: The end of a divisive dichotomy?

This study initiated from a desire to investigate the development of emotional security among 6-10 year old children who had been adopted by exposing them to an experimental condition during which they had the opportunity to engage with either a live dog or a robotic dog. Establishing animals and robots are part of the social environment is fundamental to utilizing the social environment for change. In this study, children had

no difficulty in engaging with either the live or the robotic dog. Findings from this study, that children engage with social robots in similar ways as they do with therapy dogs, and that engagement with the non-human, social robot or therapy dog, at least for boys, diminished social understanding for this sample, may be quite useful for social work intervention design in the future.

The definition of emotional security employed for this study is built on the premise that engagement is fundamental to create a context from which a relationship is formed. From this initial engaged human-human relationship is born our ability to be social beings. Humans carry this engagement blueprint to other relationships, expecting non-living things to operate like the living (Reeves & Nass, 1998). The boundaries from living to non-living and social to non-social seem to be less and less distinct with increasingly sophisticated technology. As other researchers in the field have pointed out, we lack the language to describe the new technological genre, that of the social robot, to describe agents that engage our social selves (Kahn Jr. et al., 2006; Melson et al., 2009). But perhaps it is not the social robot that engages us. Rather, humans are the social beings that consistently impose our social order on others, robot or animal.

Gestalt therapy is a good example of an experiential approach that utilizes the relational capabilities of humans by artificially constructing a social situation in order for therapeutic practice to occur (Yontef & Jacobs, 2011). A social worker using this tradition might ask a client to role play, speak to an empty chair, or imagine an entire social situation. In essence, social workers invite humans to do the same kind of experiential exercise with the introduction of an animal or a robot in the social

environment. Participants are invited to import their own social expectations to the relationship. Social work practices are intended to intervene with the social world of the human in his or her environment. This is the primary responsibility and focus of the profession.

When a child who has been living in the child welfare system is placed for adoption, the social worker must consider the environment and the roles that non-human agents play in the child's life. When the addition of non-human animals as part of the child's environment occurs, this necessitates another dimension of ethical concern. Social workers must consider how to facilitate the development of emotional security in the context of the child's environment. The following questions may help to guide such decisions: Does the adoptive family have any pets? Has the child been cruel to an animal in the past? How can the child engage with the animal in ways that will help him or her feel emotionally secure? What role will pets play? Is the situation safe for the child? Is the situation safe for the animal? How should parents participate in the process?

It may be inappropriate, under certain circumstances where animal abuse and cruelty exists, to include animals in practice without appropriate supervision. Practitioners in human-animal interventions must be guided by a strong sense of ethics. Social workers in the field of human-animal intervention will model to clients how to be humane, thoughtful and kind. Inviting a live animal to be a part of a healing practice has many critical implications. There may be an appropriate role for social robots in such situations. If social workers thoughtfully apply technology to practice, it enhances our ability to enact change.

Implications: How can this knowledge inform social work practice?

As humans enter their social worlds as hyper engagers, social workers must also be willing to engage all that is within the environment. Humans have unique relationships and social expectations for people, animals, and robotic artifacts. There are distinct social expectations for human-human relationships, human-animal relationships, and emerging human-social robotic relationships. Social workers are challenged to understand the implications of human engagement with each of these broad categories, understanding that each individual person, animal, and specific social robot will develop its own role in the social order. Social workers will be well-served to think creatively about engagement with and the implications of each of these relationships as interventions are constructed for specific social problems. In the case of animal cruelty alone, if social robots can facilitate healing in lieu of placing an animal in harm's way, we should welcome this alternative rather than be deterred by the characteristics of the robot's agency. In fact, as technology improves and we can create companions for specific therapeutic goals or specific environments (child interviewing centers, shelters, courts, certain homes) where animals may not always be practical or possible, we are more prepared as healers to have a meaningful impact.

These findings may also inform current understanding of human-animal therapeutic interventions. If the goal of a human-animal intervention is to increase human-human social understanding, evidence from this study suggests that for boys, the best practice models may not be those that emphasize the human-animal bond. Rather, models that emphasize human-human connection with the robot or animal as a focus of

joint attention or social lubrication would be preferred. The idea of social lubrication (Fine, 2006), previously discussed in chapter two has been an underpinning of the entire AAT field.

As humans, we are entering a richer social environment than we have ever known. The esteemed role that companion animals play in modern society, the rise of social robots, and the interactions of these relationships with our incredibly complicated human-human relationships gives social workers a whole new canvas from which the art of practice will emerge. Future social work practice must include scholarship of all that is social, all of our environment.

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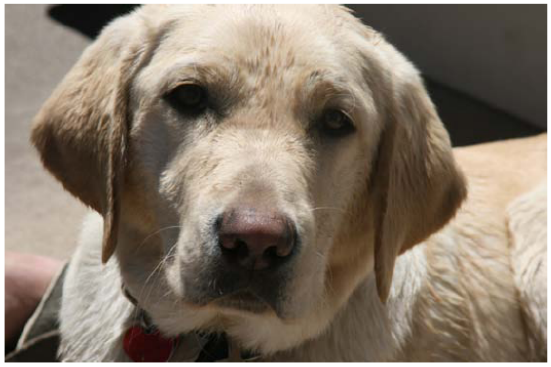
Appendix A- Recruitment Materials

Recruitment Flyer

Attention Adoptive Families!

I am looking for kids and parents to help with my research project. The goal of this research is to learn how kids can have better relationships. Sometimes pets can help kids feel safe and make good adjustments. I want to find out how this works. If you meet the following criteria, you can help!



- Have a child age 6-10 who has been adopted who is available, willing, and able to participate in the study.
- Your child has lived with you for at least six months and the adoption has been finalized.
- Your child will play with either a live dog or a robotic dog.
- Your child will play in the presence of a research assistant and a parent.
- Your child is able to participate in a brief interview (5 minutes).
- Your child and one parent must be able to travel to the University of Denver and participate in the experiment (not to exceed one hour).

You will be paid (a $25 gift certificate) for your time. Also, your child will receive a stuffed toy dog and a coloring book.

Please e-mail or call for more information or to set up an appointment.

Thank you!

Kate Trujillo, LCSW

Adjunct Professor and PhD Candidate
University of Denver
Graduate School of Social Work

720-732-9627
Kate.Trujillo@du.edu

This study is funded by the generous support of American Humane Association.

AMERICAN HUMANE
Animal-Assisted Therapy

This study was approved by the University of Denver's Institutional Review Board for the Protection of Human Subjects in Research on 10/13/2009.

Participant letter

Welcome!

Thank you for agreeing to participate in this study.

You are scheduled for a one hour session at:

____:____AM / PM on _____, 2010.

Please meet the research team at the University of Denver Graduate School of Social Work.

Address: Craig Hall, 2148 South High Street Denver, CO 80208

Link to Campus Map-Craig Hall

Directions:

- From I-25, take the University Boulevard Exit and go South.
- Turn Right (West) on Evans Street.
- You will follow Evans through the DU campus for a few blocks.
- Turn left on High Street and take your next immediate left, you will see a parking garage (Lot 301). This is the most convenient place to park for Craig Hall.

Parking:

Park on the first floor of the garage and note the space number. At the pay station, insert space number, number of hours of parking desired, and when asked for a coupon number enter **9627**. Craig Hall is located adjacent to the parking garage. Once you get to Craig Hall, please look for signs directing you to the study room.

Location: Room 234 in Craig Hall; The Institute for Human-Animal Connection

Attached, you will find additional information about the study and procedures. This will be reviewed with you in person prior to testing.

If you have questions or are having difficulties finding us please feel free to call the number provided.

Thank you for your participation!!!

Kate Trujillo, LCSW
Adjunct Professor and PhD Candidate
University of Denver Graduate School of Social Work
720-732-9627

kate.trujillo@du.edu

Instructions for handlers

Instructions for handlers:

Thank you so much for participating in the study! This study specifically examines the interactions between the child and the dog, so here are a few tips for your time with the child:

- Try not to direct the child's play. For example, if the child wants to brush the dog, please help facilitate that activity. If the child seems to lose interest in brushing, try to resist the urge to suggest another activity, but wait to see what the child does. This can be tricky, especially if you know something that you think would be fun for your dog and the child. However, the study is looking to see how the child might engage with the dog independently, so wait and see if the child can discover this!
- When you talk to the child, ask questions about what he or she is doing or what they are thinking. Questions like, "Are you pretending? What's happening now? What do you want to do next?" are all good ways to help the child.
- Some children might be afraid of dogs or chose not to interact with your dog for whatever reason. If this happens, do not try to engage the child with the dog! For example, if the child gravitates toward a book, then the child should read.
- Under all circumstances, please keep your dog on a leash and follow AHA's protocol for dog safety. If you feel that there is anything that could be inappropriate for you or the dog, you should intervene.

Thank you again for your help today!

Sincerely,

Kate Trujillo, LCSW
Adjunct Professor and PhD Candidate
University of Denver Graduate School of Social Work
720-732-9627
Kate.Trujillo@du.edu

Appendix B- Consent and Assent Forms

Expert Interviews- Informed Consent

Intervention Development:
Understanding the Interactive Behaviors of Therapy Dogs as Related to Emotional Security for Children

Through this study, we hope to understand what interactive behaviors therapy dogs possess that could contribute to the development of emotional security for children. This study is being conducted by Kate Trujillo as part of her dissertation research at the University of Denver, Graduate School of Social Work.Your participation is completely voluntary but it is very important.

We are asking you to participate in an interview with your pet partner that will not exceed one hour. During that time, you will be asked specific questions related to your pet's behavior. Photographs will be taken of your dog and observers will be taking notes about your dog's behavior. Finally, you will be asked to identify where your dog is most frequently touched during a therapy session. Again, participation is voluntary and if at any time you do not feel comfortable with a question or wish to withdraw your consent, you may do so.

Several steps have been taken to insure your confidentiality (privacy). First, all data associated with this study will be coded and will not have your name associated with it. Data will be kept in a locked file. Only this consent form will have your name on it, and it will be kept separate from the interview notes, pictures, and observation data. All information will be reported in summaries, where your responses will be combined with those of other participants.

There are, however, two exceptions to the promise of confidentiality that we are legally obligated to discuss. If information is revealed about suicide, homicide, or child abuse and neglect, it is required by law that this be reported to the proper authorities. In addition, should any information contained in this study be the subject of a court order or lawful subpoena, the University of Denvermay not be able to avoid compliance with the order or subpoena. Such circumstances are highly unusual. Further, we have tried to avoid asking you any very sensitive questions because we want you to feel free to respond to all the questions. If, however, there is a question that you'd rather not answer, you do not need to respond. Yet, please understand that your feedback is the most valuable when it is complete. Thank you very much for your participation.

If you have any questions at all about this study, please feel free to contact me (Kate Trujillo, University of Denver, 2148 S. High St., Denver, CO 80208, (720) 732-9627 or email at kate.trujillo@du.edu). If you have any concerns or complaints about how you were treated during the research sessions please contact Dr. Dennis Wittmer, Chair, Institutional Review Board for Human Subjects, University of Denver, (303) 871-2431, or Sylk Sotto-Santiago, Office of Sponsored Programs at (303) 871-4052 or write to either at the University of Denver, Office of Sponsored Programs, 2199 S. University Blvd., Denver CO 80208-2121. Thank you again.

You may keep this copy for your records.

"I have read and understand the above description of the pilot study, Understanding the Interactive Behaviors of Therapy Dogs as Related to Emotional Security for Children. I have asked for and received a satisfactory explanation for any language I did not fully understand. I have had the chance to ask any questions I have about my participation. I agree to participate in the study, and I understand that I can withdraw my consent at any time. I have received a copy of this consent form." (Please sign below.)

_____ _____
Signature Date

_____
Print Name

_____I agree to be audio taped.

_____I do not agree to be audio taped.

_____I agree to be photographed.

_____I do not agree to be photographed.

_____ _____
Signature Date

Please provide contact information. This information will ONLY be used to contact you to send the results of this study or voluntary follow-up research opportunities.

Mailing Address: _____Zip Code: _____

E-mail Address: _____Telephone Number: _____

To be completed by the researcher:

Participant #_____

Informed Consent

Emotional Security for Adopted Youth
Informed Consent Form

Through this study, the goal is to learn about how relationships with pet dogs or toy robot dogs can facilitate the development of feelings of security for youth who have been adopted. This study is being conducted by Kate Trujillo as part of her dissertation research at the University of Denver, Graduate School of Social Work.Your participation is completely voluntary but it is very important. Your participation will help us understand how children feel secure in adoptive families.

You will also be asked to come to DU with your child once for one hour. You will be asked to complete a short questionnaire that asks about your child and his/ her history, experience with pets, and experience in your family. It will take you about 10-15 minutes to complete the questionnaire. At that time, your child will be asked to play in a comfortable room for fifteen minutes with either the therapy dog or the toy dog. There will be a trained research assistant with your child in the room to monitor safety. This research assistant will be a certified handler of the dog who knows the dog and its behavior. The interaction will be video taped and saved for analysis, for this research only. You will able to observe your child the entire time that he/ she is at DU. If you or your child are uncomfortable with the situation at any time or chose to stop participating for any reason, you may do so and still receive the gift card for coming.

Several steps have been taken to insure your confidentiality (privacy). First, questionnaires will not have your name or your child's name on them, but will be assigned a number to identify your information with your name that will be kept in a secured office in a locked file at the University of Denver. Only this consent form will have your name on it, and it will be kept separate from your questionnaires. Second, once handed in, questionnaires will be placed in a locked file that will be kept at the University of Denver. Your questionnaires will remain in the possession of the researcher and will *not* be seen by anyone else. All information will be reported in summaries, where your responses will be combined with those of other participants. It will NOT be possible to identify any individual from any summary information reported by the researcher.

There are, however, two exceptions to the promise of confidentiality that we are legally obligated to discuss. If information is revealed about suicide, homicide, or child abuse and neglect, it is required by law that this be reported to the proper authorities. In addition, should any information contained in this study be the subject of a court order or lawful subpoena, the University of Denvermay not be able to avoid compliance with the order or subpoena. Such circumstances are highly unusual. Further, we have tried to avoid asking you any very sensitive questions because we want you to feel free to respond to all the questions. If, however, there are questions that you'd rather not answer, you should feel free to leave those questions blank. Thank you very much for your time in completing this information.

You could help other families by being a part of this study. We are very interested in you and your life and you may also enjoy talking about your experiences. If you would like a copy of the results of the study, we would be happy to give you one. You will receive a $25 gift card for participating in this study. Potential risks of being involved in the study include the possibility that discussing feelings that may be upsetting. If this occurs, we will refer you to a professional counselor that lives close to your home. Payment for assessment and treatment would be your responsibility.

If you have any questions at all about this study, please feel free to contact me (Kate Trujillo, University of Denver, 2148 S. High St., Denver, CO 80208, (720) 732-9627 or email me at kate.trujillo@du.edu). If you have any concerns or complaints about how you were treated during the research sessions please contact Dr. Susan Sadler, Chair, Institutional Review Board for Human Subjects, University of Denver, 303-871-3454, or Sylk Sotto-Santiago, Office of Sponsored Programs at (303) 871-4052 or write to either at the University of Denver, Office of Sponsored Programs, 2199 S. University Blvd., Denver CO 80208-2121. Thank you again.

You may keep this copy for your records.

"I have read and understand the above description of the **security for adopted youth research**. I have asked for and received a satisfactory explanation for any language I did not fully understand. I have had the chance to ask any questions I have about my participation and my child's participation. I agree to participate in the study, and I understand that I can withdraw my consent at any time. I have received a copy of this consent form." (Please sign below.)

_____

Please Sign Here Date

_____

Please Print Your Name Here

_____

Please Print Your Child's Name Here

___ I agree to be audiotaped.

___ I do not agree to be audiotaped.

___ I agree to be videotaped.

___ I do not agree to videotaped.

Signature _____ Date _____

_____ I would like a summary of the results of this study to be mailed to me at the following postal or e-mail address:

Please provide contact information. This information will ONLY be used to contact you to send the results of this study or voluntary follow-up research opportunities.

Mailing Address: _____Zip Code: _____

E-mail Address: _____Telephone Number: _____

To be completed by the researcher:

Participant #_____

Youth Assent

Pet Pals for Kids

Would you like to play with a dog or a dog robot? Would you like to help other kids who have been adopted? You can help us! By playing with a dog or with a robot dog and answering some questions, you can help us learn about what helps kids feel safe.

So what will it be like if you decide to do it? You will come to the University of Denver for about an hour. You and your mom or dad will be able to ask any questions you may have about the day. When you are sure that you are comfortable with what we are going to do, you and your mom and dad will be asked some questions about your family and your feelings. You don't have to answer any questions that you don't want to answer. Then, you get to play with either a robot dog or a real dog. You will be in a room where your mom or dad can see you or be with you and there will be one other person there to make sure that you are safe with their dog or the robot dog. There will be some toys for you and the dog or the robot, some books and a comfortable place to sit. We will let you have some time to play (about 15 minutes). Then, we will ask you a few more questions. Again, you don't have to answer anything you don't want to answer. You can leave any time you want. The door to the room where you will be playing will be unlocked and you can go to your mom or dad or they can come to you anytime, if they are not already there. If you don't feel comfortable, we want you to tell us. There will be another room next to the one where you will be playing where you can talk about why you wanted to leave with your mom or dad or with us. If you decide to leave early, you will still get to keep the coloring book and the stuffed dog for coming.

All information gathered for this study will be kept confidential. This means that we respect your privacy and that only the researcher will have access to any of your personal information. A number will be used on all paperwork in place of your name. Only the researcher will have the list that matches this number with your name, and this list will be kept in locked file in a secure office. Your name will never be mentioned in any reports. The only time that the University of Denver might not be able to avoid releasing your information is if we are ordered by the court to do so. Also, this interview does not ask questions about suicide, homicide, child abuse or neglect but if information about these things is reported during the interview, we must report it to the proper authorities.

You could help other kids by being a part of this study. We are very interested in you and your life and you may also enjoy talking about your own experiences. If you would like a copy of the results of the study, we would be happy to give you one. You will receive a stuffed dog and a coloring book for participating in this study. Potential risks of being involved in the study include the possibility that discussing feelings that may be upsetting. If this occurs, we will arrange for support from a professional counselor that lives close to your home.

If you have any questions at all about this study, please feel free to contact me (Kate Trujillo, University of Denver, 2148 S. High St., Denver, CO 80208, (720) 732-9627 or email me at kate.trujillo@du.edu). If you have any concerns or complaints about how you were treated during the research sessions please contact Dr. Susan Sadler, Chair, Institutional Review Board for Human Subjects, University of Denver, 303-871-3454, or Sylk Sotto-Santiago, Office of Sponsored Programs at (303) 871-4052 or write to either at the University of Denver, Office of Sponsored Programs, 2199 S. University Blvd., Denver CO 80208-2121. Thank you again.

You may keep a copy of this page for your records. Please sign below if you understand and agree to participate in the study. If you do not understand any part of the information presented above, please ask for more information.

"I have read and understand the above description of the study, *Pet Pals for Kids*. I have asked for and received a satisfactory explanation for any language I did not fully understand. I have had the chance to ask any questions I have about my participation. I agree to participate in the study, and I understand that I can withdraw my consent at any time. I have received a copy of this consent form." (Please sign below.)

_____ _____
Signature Date

_____
Print Name

_____I agree to be audio taped.

_____I do not agree to be audio taped.

_____I agree to be photographed.

_____I do not agree to be photographed.

_____ _____
Signature Date

Please provide contact information. This information will ONLY be used to contact you to send the results of this study or voluntary follow-up research opportunities.

Mailing Address: _____Zip Code: _____

E-mail Address: _____Telephone Number: _____

To be completed by the researcher:

Participant #_____

Appendix C- Measures

Questions for Consultation with AHA Experts

The following eight questions with additional probes when needed were asked:

1) Tell me about your work with children.
2) In general, do you believe that the children you work with have a history of trauma?
   a) Explain your answer.
3) Please describe how your dog behaves as a therapy dog.
4) How consistent do you think your dog's behavior is?

   Follow up: How would you rate it?
   Not at all Not very Somewhat Fairly consistent Very consistent
5) How do you think _____ (dog's name) helps these children relax?
6) Can you give me an example of a time when your dog helped a child to feel safe?
   a) Do you remember exactly what your dog was doing?
7) Has there ever been a time when you felt like your dog was NOT therapeutic?
   a) How was he/ she behaving?
   b) Were there other factors that contributed to that situation?
8) What would be the best possible treatment situation for a child who has experienced trauma?
9) This study relates to how companions can help children develop emotional security. Is there anything else you can think of about your dog that you want to mention?

Q-Sort Items- KMBR Coding Book

The following statements were taken from the Khan, Melson, Beck and Roberts, 2009 coding book from items related to "engagement".

1. Proximity: adjusting interpersonal distance in order to maintain engagement

2. Non-Exploratory Touching – Caring, affectionate, or concerned touching of therapy dog. Includes paw shaking, pat, tap. Child may touch therapy dog with hand, or with shoulder, hip, or other body part, by leaning into dog.

3. Petting – Back and forth or stroking motion, generally with the pads of finger(s) or palm of hand, but also may be with knuckles or fingertips. (NOTE: must be reasonably clear that the child is petting.)

4. Gentle petting – Relative awareness of the strength and relation of the petting to the artifact/dog.

5. Rough petting – Unintentional, unregulated, spastic, or unreflective petting.

6. Scratching – With fingertips or fingernails (e.g., quick movements back and forth, as one would scratch a under the chin).

7. Kissing – There must be face to face physical contact, not 'kissing at' (as in calling)

8. Picking up or carrying off of floor or out of lap (if in lap), where the weight of dog is supported by the child's hands, arms, or body (but NOT in lap).

9. Dog is either placed (by the child) in the child's lap or is in the child's lap, where the weight of therapy dog is supported by the child's lap or legs.

10. Arms Around – Reasonably clear that the child has their arms around therapy dog as in hugging.

11. Verbal Engagement – Child engages in socially interactive verbal monologue with therapy dog

12. Salutation – Verbal greeting to therapy dog. (e.g., "Hello, THERAPY DOG").

13. Talking to therapy dog NOT a directive or a question – can't say the child expects a response. (e.g., "I know you want to kick the ball"; "Good dog") Note: Includes vocalizations (whistling, clucking, etc.) that express engagement.

14. Visual Engagement — Child attempts to look at face level, and in doing so, child head below own shoulder level. (Note: Includes child "locking on" in face-to-face gaze at therapy dog for at least 1 second).

15. Picking Up Toy – The child picks up and/or holds a toy in response to therapy dog intentionally or unintentionally moving the ball.

Reading the Mind in the Eyes Test (Child Version)(Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., and Plumb, I., 2001)

Due to the length of this measure it is not included in this appendix. Below is a description of each question. The answers are in bold. For a more complete description of this measure and a copy of the measure itself, please visit http://www.autismresearchcentre.com/tests/eyes_test_child.asp

M	P	jealous	scared	relaxed	hate	SCORE
F	1	hate	surprised	**kind**	cross	
F	2	unkind	cross	surprised	**sad**	
M	3	**friendly**	sad	surprised	worried	
M	4	relaxed	**upset**	surprised	excited	
M	5	feeling sorry	**making somebody do something**	joking	relaxed	
M	6	hate	unkind	**worried**	bored	
M	7	feeling sorry	bored	**interested**	joking	
M	8	**remembering**	happy	friendly	angry	
F	9	annoyed	hate	surprised	**thinking about something**	
M	10	kind	shy	**not believing**	sad	
M	11	bossy	**hoping**	angry	disgusted	
M	12	confused	joking	sad	**serious**	
F	13	**thinking about something**	upset	excited	happy	
M	14	happy	**thinking about something**	excited	kind	

F	15	**not believing**	friendly	wanting to play	relaxed	
F	16	**made up her mind**	joking	surprised	bored	
F	17	angry	friendly	unkind	**a bit worried**	
M	18	**thinking about something sad**	angry	bossy	friendly	
F	19	angry	daydreaming	sad	**interested**	
M	20	kind	surprise	**not pleased**	excited	
F	21	**interested**	joking	relaxed	happy	
F	22	playful	kind	surprised	**thinking about something**	
F	23	surprised	**sure about something**	joking	happy	
M	24	**serious**	ashamed	confused	surprised	
M	25	shy	guilty	daydreaming	**worried**	
F	26	joking	relaxed	**nervous**	sorry	
M	27	ashamed	excited	**not believing**	pleased	
M	28	disgust	hate	**happy**	bored	

TOTAL _____

The Revised Children's Manifest Anxiety Score: Second Edition

Physiological Anxiety Subscale

1) Often, I feel sick at my stomach.	Yes	No	_____
2) I have too many headaches.	Yes	No	_____
3) I wake up scared sometimes.	Yes	No	_____
4) I have trouble making up my mind.	Yes	No	_____
5) Often I have trouble getting my breath.	Yes	No	_____
6) I get mad easily.	Yes	No	_____
7) It is hard for me to get to sleep at night.	Yes	No	_____
8) My hands feel sweaty.	Yes	No	_____
9) I am tired a lot.	Yes	No	_____
10) I have bad dreams.	Yes	No	_____
11) It is hard for me to keep my mind on my schoolwork.	Yes	No	_____
12) I wiggle in my seat a lot.	Yes	No	_____

TOTAL _____

Child Interview

(To be administered by PI following the 15 minute play session.)
NOTE: “X” is the name of the AHA Therapy Dog or Biscuit.

Do you like X?
YES NO
Notes:
_____
_____

Does X like you?
YES NO
Notes:
_____
_____

Can X like anyone X wants?
YES NO
Notes:
_____
_____

Can X be your friend?
YES NO
Notes:
_____
_____

Can you be a friend to X?
YES NO
Notes:
_____
_____

If you were sad, would you feel better with X?
YES NO
Notes:
_____
_____

If X were sad, would X feel better with you?
YES NO
Notes:
_____
_____

Can you play with X?
YES NO
Notes:
_____
_____

Can X play with you?
YES NO
Notes:
_____
_____

If a friend came over and you were playing with your friend, would X feel left out?
YES NO
Notes:
_____
_____

If a friend were playing with X, would you feel left out?
YES NO
Notes:
_____
_____

If you were going to sleep, would you want to cuddle with X?
YES NO
Notes:
_____
_____

If X were going to sleep, would X want to cuddle with you?
YES NO
Notes:
_____
_____

If you were home alone, would you feel better with X?
YES NO
Notes:
_____
_____

If X were home alone, would X feel better with you?
YES NO
Notes:
_____
_____

What do you think it would be like to have a pal like “Biscuit”/ Name of AHA Dog?
_____
_____

What would be the good things?

_____
_____

What would the bad things?

_____
_____

Would having a friend like this change how you dealt with new situations? How?

_____
_____

Have you ever had a friend like "Biscuit"/ Name of AHA Dog? Tell me about it…

_____
_____

How did you feel when you were playing with "Biscuit"/ Name of AHA Dog?

_____
_____

What were you thinking about when you were playing with the "Biscuit"/ Name of AHA Dog?

_____
_____

Do you think having "Biscuit"/ Name of AHA Dog as a pet would help you be safe? What is your reason?

_____
_____

Do you think there is anything else that is important about "Biscuit"/ Name of AHA Dog that you would like to tell me?

_____
_____

Some kids would like to have a real dog, but other kids would like to have a robot. Which type of kid are you?

_____
_____

Would you like to have the dog/ robot a lot or a little?

_____
_____

What are your reasons for your choice?

_____
_____

Parent Survey

Please complete the following as it relates to your child who has been adopted:

Age: _____ (years old)

Gender:
- Male
- Female

Please mark all that apply:
- Caucasian
- African American
- Native American
- Asian
- Hispanic
- Other_____

Experience with pets:
Does your child currently have a dog?
- Yes
- No

Has your child ever had a dog?
- Yes
- No
- Don't know

If yes, when? _____

For how long? _____ (years and months)

Is your child afraid of dogs?
- Yes
- No
- Don't know

Does your child have a companion robot such as "Biscuit?"
- Yes If yes, please describe: _____
- No
- Don't know

Has your child had any other experience with a robot such as "Biscuit"? If so, please describe.
_____
_____

Has your child ever been cruel to an animal?
- Yes
- No

□ Don't know

If yes, please describe:
_____
_____
_____
_____

Family History:

How many places did you child live prior to being placed with you for adoption? _____

How long has your child lived with your family? _____
(years and months)

Do you consider yourselves a trans-racial adoptive family?
□ Yes
□ No

Medical Information:
Does your child take any medication?
□ Yes If yes, name and dose: _____
□ No

Has your child been diagnosed with any mental health disorder (ADHD, PTSD, RAD, Etc.)?
□ Yes If yes, what is the diagnosis? _____
□ No

Does your child have Medicaid?
□ Yes
□ No

Please tell us about your family's annual income.

Under 4,999 ___
5,000-9,999 ___
10,000-14,999 ___
15,000-19,999 ___
20,000-29,999 ___
30,000-39,999 ___
40,000-49,999 ___
50,000-59,999 ___
60,000-69,999 ___
Over 70,000 ___

How many people live in your home?
Adults: _____
Children: _____

If it is easier to state monthly income than yearly, about how much money to you earn a month?
_____

****

Finally, what was your main reason for coming to participate in today's study?

_____
_____
_____
_____
_____
_____
_____

Do you have any other thoughts you would like to share?

_____
_____
_____
_____
_____
_____
_____

THANK YOU!

Appendix D – Melson/ Trujillo Engagement Measure

Melson/ Trujillo Revised Global Rating Scales for Children's Behavior toward robot/dog

Draft 1 by Gail F. Melson
Revised by Kate Trujillo, (June, 2010)

General notes: For each scale, scores range from one (1) to three (3).

1= Low
2= Moderate
3= High

Engagement: Behaviors or verbalizations that indicate willingness, desire, or expectation of interaction. Examples include: rolling ball toward dog/robot, showing dog/robot ball, asking or directing dog/robot to do something, like kick ball, fetch ball, come, etc., reacting to behavior of dog/robot, such as rollover, kick ball, or hand sniff with some related child behavior.

1. **LOW:** No interactive behaviors or verbalizations, either in "response" to behavior by dog/robot or as initiation of behavior, *with expectations that dog/robot will respond*. For example, failure to respond to perceived interactive bid: when dog/robot kicks or "attempts" to kick ball, child does not react by offering ball, picking up ball, or laying ball down in front of dog/robot. Another example: Dog rolls over, as if for rub, child sees this, may look at dog, but does not touch dog. Child never greets dog, asks dog anything or commands dog. Child never initiates some behavior that would indicate an expectation of a response; for example, picking up ball and rolling it, tapping knees while looking at dog, and saying: "Come!" Interactive behaviors (see above) occur only once or twice in session. There is no persistence after first try. For example, child rolls ball to dog/robot and dog/robot does not kick or "attempt" to kick ball, and child does not use ball again (rolling, offering, showing) to engage dog/robot. Interactive behaviors occur occasionally (less than twice) but overall child is not engaged in interactive behaviors during the session. There is little persistence when child does try to engage dog. Child is more likely to be reactive than initiate.

2. **MODERATE**: Interactive behaviors occur intermittently throughout session. Child sometimes persists. Child does not respond to some behavior that could be interpreted as an "attempt" at interaction. Child may sometimes show inappropriate or ineffective interactive behaviors, for example: Following dog/robot kick ball, child picks up ball, and hits dog/robot on the head with the ball. May throw the ball once or twice. Interactive behaviors or verbalizations throughout the session. Child responds when dog/robot has made interactive bid and also initiates. Behaviors are appropriate and tuned to the dog's behavior. For example, when Canis rolls over "for rub," child begins to rub tummy.

3. **HIGH:** Interactive behaviors or verbalizations are sustained and of high intensity throughout. There is frequent persistence (child rolls ball to dog/robot and dog/robot "attempts" to kick but misses, child rolls ball again.) Child seems to strongly desire response from dog/robot. For example, if the child is playing ball, the ball is thrown more

than three times. Child speaks directly to dog/robot throughout the session (at least three times in one five minute period) and often supplies "responses" (scaffolding). Child maintains gaze on dog/robot for more than 50% of the session. Child is physically touching dog/robot directly or using a touch activity such as brushing more than 50% of the session. Child may hug dog/robot.