Measuring Attachments between Dogs and their Owners

Submitted by Joanne Wilshaw to the University of Exeter as a thesis for the degree of Doctor of Philosophy in Psychology, September 2010

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I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

(Signature) ……

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**Abstract**

This thesis details the development and testing of a new scale for measuring human attachment to dogs which allows for the measurement of weaker attachment levels as well as stronger ones (the CDA scale). The correlation between dog-owner's scores on the CDA scale and their dog's actual attachment behaviour is assessed and discussed, as well as the dog-owners limited ability to predict the behaviour of their dog in a controlled situation (the Strange Situation Test (SST)) whereby the dogs meet a previously unknown person. The CDA scale was formed by utilising items from pre-existing scales (the Comfort from Companion Animals scale and the Lexington Attachment to Pets scale), trialed on the internet with a large self-selected sample of dog-owners and analysed and reduced using factor analysis. The CDA was completed with the addition of some negative items derived from a small sample of dog-owners who expressed drawbacks to keeping a dog. In addition 100 people living with dogs they did not consider themselves to be the primary carer of, and 100 people with dogs they considered to have behavioural problems also completed the CDA to allow for the assessment of reliability and validity, and for consideration of the possible links between human perceptions of attachment/dog behavioural problems and actual scores on the CDA. Dogs' attachment behaviour was assessed by cluster analysis of behaviours observed in the SSD: 51 dog-owner pairs took part in the study which revealed a number of secure-base behavioural categories analogous to those typically observed in human mother-infant interactions in Ainsworth's original (1969) SST. In addition five captive wolves were also observed in a modified version of the SST. Data from these observations is discussed in a case-wise manner and it is clear that captive wolves do not exhibit the suite of attachment behaviours (to their familiar handler) as previously observed in the dog study. However, the wolves' familiar handler was very adept at predicting the behaviour of his wolves in this situation.

These findings are important in furthering our understanding of human-canine attachments in general, but especially given the number of dog-owner pairings which appear to fail due to poor or misunderstood attachments. An effective attachment scale for people, and a valid measure and analysis of attachment behaviour in dogs is a further development in ensuring successful pairings of people with dogs in a variety of contexts such as pet dogs and service dogs.

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**The aims of this thesis and questions addressed by it.**

The development of scales used to assess the level and type of human bond to their companion animals, has meant that it is possible to determine the magnitude of perceived comfort and/or attachment that pet owners express when questioned. However, whilst several of the known scales indicate high levels of reliability and validity, there has been a tendency towards measurement of high level attachment, and while this may be due to the inherent problem of volunteer samples containing only people who are already interested in the issue at hand (in this case, only "animal lovers") it remains a "gap" in the research, given that there appears to be a relatively high number of, for example, dog-owners, who are not necessarily drawn to dogs but who got one "for their children", or "inherited" one from a family member, or who, for some reason, need a dog for purposes other than companionship (e.g., blind persons seeking a guide dog). The first aim of this thesis is therefore; to develop and test a scale of human attachment to dogs which is both reliable and valid, and which is capable of measuring weaker attachments as well as strong ones.

In more recent years there have been a small number of researchers interested in demonstrating the efficacy of Ainsworth's Strange Situation Test for use with canines. Their results indicate that the test is indeed a reliable activator of attachment behaviour in dogs, and that this finding is robust even in counterbalanced versions of the test. In addition, it has been shown that there are physiological correlates of the observed attachment behaviours exhibited in the test. However, owners' perceived bond between themselves and their pet has not been linked to observable attachment behaviour in their dogs. In other words, if a person feels attached to their dog does this necessarily mean that their dog feels attached to them? Hence, one question addressed by this thesis is**: Is there a correlation between owners' scores on attachment scales and their dogs' behaviour in the strange situation?** It follows from this that owners may or may not know what their dog will do in the Strange Situation. Thus, an associated question addressed by this thesis is: **Can dog-owners predict the behaviour of their dog in the strange situation?**

As the dog has evolved from the wolf, there has been much interest in the behaviour of wolves compared to domestic dogs. At least one study (Topal *et al.*, 2005) has shown that highly socialised wolves observed in the Strange Situation, do not show any preference for their familiar handler over a friendly stranger, even if they have been raised by that person from a very young age. This highlights issues surrounding the taming versus the domesticating of canines, but also raises questions about the underlying predisposition of dogs to attach to humans, and the underlying

predisposition of wolves not to. In order to provide some qualitative evidence of this, a further aim of this thesis is **to provide a case-wise study of captive wolves observed in the Strange Situation procedure, for the purposes of comparison with dogs in a similar context**: and answer the question: **Can a wolf handler with day-to-day physical contact with a small number of captive wolves predict their behaviour in the Strange Situation procedure?**

The subsequent chapters of the thesis are organised as follows; 1. Introduction: Attachment in dogs and humans; 2. Introduction: The modern domestic dog; 3. Study 1 – a modification of existing scales of comfort and attachment to dogs and pets; 4. Study 2 – an application of Ainsworth's Strange Situation procedure with companion dogs, and subsequent correlation with owners' scores on a questionnaire assessing their prediction of their dog's behaviour in the test; 5. Study 3 – an application of Ainsworth's Strange Situation Test with socialised wolves reported in a case-wise fashion in order to provide a qualitative description of the differences between wolf and dog behaviour in this procedure; 6. Conclusions to the research and consideration of further research possibilities in this area.

# CHAPTER 1: THE MODERN DOMESTIC DOG

## 1.1.What is a dog?

The purpose of this chapter is to give an overview of the modern domestic dog and its attachments with humans. Hence, the origins of the dog are detailed including recent genomic data, and the effects of domestication of canines by humans is discussed. The breeding of recognised "types" of domestic dog is considered along with the inherent sociability and trainability of dogs by people. In addition, a brief account of dogs as food, as a problem in society and as friends to people is given, illustrating the complex and varied position of the dog in modern human culture. Finally, this chapter considers the arguments surrounding the use of and definition of the term 'bonding' in relation to measures of attachment of owners to dogs (see chapter 3), dogs to owners (see chapter 4) and whether or not these measures to date indicate a relationship which can be meaningfully considered a bond.

Despite our close links with the dog, our efforts to ascertain its origins with any real certainty are on-going. The domestic dog (*Canis lupus familiaris* ) is only one of thirty-eight species which make up the family Canidae, which includes wolves, foxes and many wild dogs. Several members of the Canidae have been bred in captivity but *Canis lupus familiaris* is the only one that can be said to be truly domesticated (Clutton-Brock, 1992). Darwin (1868) summarised the early debate on the origins of the domestic dog when he wrote of the two main beliefs of the time, namely that all kinds of domestic dog have descended from wolves, jackals or an unknown extinct species, or that dogs are the descendants of several species more or less commingled together.

However, modern behavioural studies (Fox, 1971, 1975; Hall & Sharpe, 1978; Scott & Fuller, 1965; Zimen, 1981), studies of vocalisation and morphology (Hemmer, 1990; Lorenz, 1975; Wayne, 1986; Zimen, 1981) and much more recent and convincing genetic evidence (discussed later in this chapter) give us much greater certainty than Darwin and his associates could have had at the time, since all such studies indicate that the only real contender as the ancestor of *Canis lupus familiaris* is the wolf, *Canis lupus*. It is probable that early human hunters would have eaten wolves when possible, and used their skins as clothing. It follows that the occasional wolf pup would have been kept, perhaps as a source of food for a later date, and sometimes habituate to humans, and tamed. A tamed wolf is a far cry from the animal we now know as *Canis lupus familiaris* but it seems the overwhelming evidence is that it is the precursor of the dog (Zimen, 1981).

In terms of studying human social interactions with domestic dogs, it is very important indeed that we get their ancestry correct, or at least as correct as the evidence to date will allow. McBride (1995), highlights the need to be aware of animals under study as 'total organisms.' By this he means that a thorough understanding of not only physical attributes, reproduction, development, etc., is required, but also an appreciation of the animal's ancestral roots. Owner interactions with their dogs seem complex even in routine everyday events, for example, Johnston, (1990) and Mugford, (1992) cite evidence which strongly suggests that it is the dog owner's misinterpretation (such as believing their dog 'knows he's done wrong' when in fact he or she is simply responding submissively to their owner's angry tone of voice or body posture) of their companion animal's behaviour which leads to many of the dog behavioural 'problems' experienced by pet owners and animal trainers (Johnston, 1990; Mugford, 1992).

If *Canis lupus familiaris* has its ancestral roots in the wolf, then one has to specify which race of wolf (McBride, 1995). Much of the research has concentrated on the social behaviours of the Northern wolf (*Canis lupus occidentalis*) even though there are some major differences in the behaviours of this wolf when compared with other species of wolf. Until recently, comparisons have concentrated on the Northern wolf, the assumption being that the communicative skills of the dog are similar to the communicative skills of this species of wolf. In addition, at least one author has likened the behaviour of the domestic dog to the juvenile behaviour of Northern wolf pups (McBride, 1995).

However, recent research on breed differences in social communication shows that the 'signals' of the Northern wolf (specific facial expressions, body postures, vocalisations, ear and tail carriage) are not present in all breeds of domestic dog, and that even within the grouping *Canis lupus familiaris* there are few universal signals (Goodwin et *al*., 1995). The implication here is that the various breeds of domestic dog do not 'speak the same language', as Goodwin et al.(1995) put it. Potentially, it is the function of the signals which changes (contextually) rather than the signals themselves. This has some very important implications for the study of the dog-human relationship, given the possibility that different breeds of dog may therefore respond differently to the same signals received from their human associates (Goodwin et *al*., 1995).

It would seem reasonable to assume that fourteen thousand years of domestication has caused some evolutionary change in the domestic dog, in much the same way as pressures will have led to

evolutionary changes in the wolf (Mech, 1970). Effectively, such changes will have been directed by artificial selection (and some 'accidental' selection), for such traits as tame ability and care-soliciting behaviours. Gould (1977) has shown how paedomorphosis may have played an important role in creating an animal best suited to domestication. Juvenile wolf behaviour is more gregarious than adult wolf behaviour and a lack of species recognition in the would-be dog would be advantageous to humans wishing to interact socially with young wolves. In addition, an accidental but fortuitous side-effect of selecting an animal with juvenile behavioural characteristics is that the inflexibility of at least some adult motor patterns is reduced or even avoided altogether (Gould, 1977).

Many of the questions posed by the above research on the origins of the dog have been at least partially answered by advances in genomic research in the last fifteen years (Nash *et al*., 2001). Indeed the domestic dog has emerged as a premier species for the study of morphology, behaviour and disease because the huge variations which exist between breeds of dog, such as size, skeletal proportions, and a range of breed-specific behavioural traits, provide a unique resource for identifying genetic pathways. The domestic dog is the most recently evolved species in the dog family Canidae, but despite this family having a diverse chromosome complement ranging from 36 to 78 chromosomes, they can all be reconstructed through simple chromosome rearrangement from a common ancestral karyotype, allowing for direct comparisons to be made (Nash *et al*., 2001).

Extensive genetic analyses of the dog and other wolf-like canids clearly show that the dog is derived only from the grey wolf (*Canis lupus*), and not from jackals or coyotes (Nash *et al*., 2001: Vilà *et al*., 1997: Wayne *et al*., 2006). This means that the great diversity seen in domestic dogs today is due to the standing genetic variation existing in the ancestral population of grey wolves, as well as to any mutations which have occurred during the period of domestication in this species (Vilà *et al*., 1997). In addition, analyses of the mitochondrial genome, which is maternally inherited, show that one sequence clade contains the majority of dog sequences. Yet further analysis reveals that this clade originates from 40 to 135 thousand years ago (Vila *et al*., 1997). This far exceeds the date suggested by the archaeological record of 15,000 years ago for the first domesticated dog. Wayne et al. (2006) consider this evidence weak however because early dogs were perhaps not phenotypically distinct from their wolf parentage, and looked, to all intents and purposes, like grey wolves (Wayne *et al.,* 2006). The diagnostic phenotype of domestic dogs

beginning around 15,000 years ago might actually indicate a change in the selection pressures associated with the human transition from hunter gatherer to more sedentary lifestyles (Wayne *et al.,* 2006).

Pang *et al*., (2009) assert that the dog has a single geographical origin because the common homogenous gene pool universally shared by all dogs, only contains the full range of genetic diversity in all ten haplogroups, in genetic material derived from animals from south eastern Asia. Pang *et al's* (2009) detailed analysis of ancestral haplotypes asserts that the dog originates from southern China less than 16,000 years ago from some hundreds of wolves. Given the proximity of this date to the origin of sedentary hunter-gatherers/early farmers, it follows that the taming of wolves may have become a culturally important trait at around that time.

However, the idea that grey wolves from South-East Asia are the main source of genetic diversity for modern dogs has now been challenged by von Holdt *et al.* (2010) whose extensive genome-wide survey of many thousands of single nucleotide polymorphisms suggests strongly that dog breeds share a higher proportion of multi-locus haplotypes unique to grey wolves from the Middle East rather than from East Asia. A similar argument has emerged from the work of Gray et al., (2010) whose molecular analysis evidences the early evolution of small size in dogs from the Middle East. Pang et al's (2009) conclusion that the dog has its origins in southern China may actually be an artefact of their sampling technique which concentrated on the mitochondrial control region as the locus for which to evaluate the domestic dog. Webb and Allard (2010) have argued for the importance of surveying the complete control region rather than only the left domain.

Over the past 200 years humans have shaped the dog into something like 350 distinct breeds capable of a variety of specialised tasks such as herding, guarding, hunting, or being human companions or guides (American Kennel Club, 2006, cited due to the fact that The AKC is the largest purebred dog registry in the world, founded in 1884, and the frame of reference for many dog registries including the UK Kennel Club.). Morphological variation is even greater: the largest dog breed is typically 40 times bigger (heavier) than the smallest; coats can be differentiated in terms of colour, texture, thickness, curl and length; and tails can be flat, arching, plumed, curled, upright or down (American Kennel Club, 1998). There is more diversity within *Canis lupus familiaris* than within the rest of the entire canid family, and amongst mammals only the horse shows such a greater range of skeletal size (Kiley-Worthington, Wayne, 1986a,c). Purebred dogs as

defined by the American Kennel Club (both parents must have been registered in the same breed), are effectively members of closed breeding populations, which receive little genetic variation beyond that existing in the original founders (Ostrander *et al*.,2004). Such restrictive breeding practices ensure the survival of Canis lupus familiaris as a sub-species of wolf exhibiting enormous morphological and behavioural variety.

In conclusion, we have seen overwhelming evidence indicating that the ancestor of *Canis lupus familiaris* is the wolf, *Canis lupus* (Zimen, 1981). Fourteen thousand years of domestication by humans has caused some evolutionary change in the domestic dog making it the novel, intelligent and diverse animal we see today. Similarly, selection pressures have led to evolutionary changes in the wolf separating it from the domestic dog behaviourally and biologically as well as genetically (Mech, 1970.;Wayne *et al*., 2006).There are now approximately 350 distinct breeds of domestic dog capable herding, guarding, hunting, or being human companions or guides (American Kennel Club, 2006). Such a diverse behaviour range has meant that dogs are found living amongst humans all over the planet, in a variety of relationship types ( e.g. Scott, 1963; Serpell, 1983 .

**1.2. Relationships between humans and non – humans**

Some authors have researched the readiness of domestic dogs to ally themselves with humans (see Scott, 1963; Serpell, 1983). The process of primary socialisation determines who and/or what the puppy will respond positively (socially) to in later life (Scott, 1963). In addition, it is also at this time that the young dog identifies the species to which it belongs. If the puppy is exposed to more than one species within the socialisation process (generally thought to be between three and twelve weeks of age (Scott, 1963) then it will socialise with all of them.

A very important aspect of the early socialisation process is the fact that it seems to occur with or without the influence of positive and negative reinforcements and punishments (Scott *et al*., 1974). In short, strong affinities are formed to accompanying stimuli (i.e., humans or other species) whether or not that behaviour earns rewards for the dog. This then places the domestic dog in an unusual position when it comes to possible relationship types with humans (Scott *et al*., 1974). Human relations with dogs come in many forms from, ‘dogs as food’, to ‘dogs as members of the family.’ Some of these potential relationships will be examined here, with a special emphasis on the ‘social functions ‘of such relationships.

### 1.3. Dogs as food

It would appear that the consumption of canine flesh is very often accompanied by complex psychological justifications and/or responses. There are of course instances where edible dogs are viewed in relatively detached ways (see Thomas, 1983) and this has been likened to Western attitudes to foodstuffs such as poultry or pork. However, various authors have shown that in countries where dogs are frequently or even occasionally eaten, many individuals will only eat other people's dogs, and even then quite often it has to be a special occasion (Olowo Ojoade, 1990. cited in Serpell, 1995). The Sioux Indians still eat dogs, but the killing of them is always a ritual event in which the 'humanness' of the animal is 'considered' (Powers & Powers, 1986). A similar ritual has been observed in parts of Polynesia where dogs are revered, sacrificed, eaten, and grieved over within the same event (Luomala, 1960). Genetic analyses by Pang *et al*., (2009) conclude that the place and time of the emergence of the domestic dog coincide approximately with the origin of rice agriculture, suggesting that the dogs may have originated among sedentary hunter-gatherers or early farmers, possibly as a source of food and the numerous founders indicate that wolf taming was an important culture trait.

### 1.4. Dogs as 'outcasts'

Many historical and religious writings show how the domestic dog has been, and still is in many places, an outcast (e.g. Thomas, 1983). For example, in much of southern Asia stray dogs are seen as 'unclean' although there is what amounts to a religious taboo over killing them (Serpell, 1995). Similarly, several Hindu legends describe the dog's attempted defilement of heaven and its ultimate transformation into various goddesses whose job it has been to test the righteousness of human souls (Nivedita & Coomaraswamy, 1913).

In Britain in recent years, there has been a sharp focus on the nation's ambivalence towards domestic dogs. In 1989 an eleven year old girl was killed by two rottweilers on a beach in Scotland (bbc.co.uk/onthisday/1989). In the weeks which followed, the tabloid press was filled with stories of other, non-fatal attacks on children, adults and other companion animals. A public statement was issued almost as if there were a "national crisis" (Podberscek, 1994). A police constable in Kent was described as a 'hero' when he strangled a rottweiler to death after it had killed two pet rabbits (Podberscek, 1994).

After brief consultation with the relevant authorities, the Government drafted new legislation and

the Dangerous Dogs Act, 1991, came into being. Magistrates were required to order the destruction of any dog whose owner had not complied with the new regulations, including such things as: not muzzling a potentially dangerous dog, not keeping a potentially dangerous dog on a lead, or allowing a person under the age of 16 to be in charge of a potentially dangerous dog even if the dog in question had no history of aggression, and had never bitten or attacked anyone. The major problem with this legislation has been interpretation of the phrase 'potentially dangerous' when considering the 'likely' behaviour of dogs not actually listed as one of the recognised 'dangerous' breeds such as the pit bull terrier or the Japanese Tosa (Podberscek, 1994). Census information shows that the actual risk of suffering a fatal dog attack in Great Britain is actually very small. Drowning is sixty times more likely, and being struck by a falling object is twenty times more likely (Office of Population Censuses and Surveys, 1992; Podberscek, 1994).

However, it should be pointed out that many extreme events have a similar effect on public opinion. For example, when the murder of a child, James Bulger, in 1993 was linked in the press to the watching of violent videos, there was a response in the general public which was comparable to that surrounding the 'dangerous' dogs incidents.

A further possible interpretation of extreme human responses to dog attacks on people lies in the widely held view of dogs as faithful servants, companions or friends. It seems understandable that many individuals would find the prospect of their companion dog suddenly turning on them or their children, very disturbing. In addition, as Beck & Katcher (1983) point out, for many human individuals, their pet dog fulfils a child-like role in the family unit. If this 'innocent family member' then becomes murderous, there is, as Serpell (1995) puts it, ".. - a disturbance in the natural order - an unacceptable threat to the perceived security and stability of the entire community" (p. 253)

In summary, there are several examples (e.g. Nivedita & Coomaraswamy, 1913; bbc.co.uk/onthisday/1989.;Podberscek, 1994.; Beck & Katcher, 1983.; Serpell, 1995) of dogs becoming the objects of fear, mistrust and negativity in past and present times, in legend and in factual events (Nivedita & Coomaraswamy, 1913; bbc.co.uk/onthisday/1989). The dog inhabits a very different place in society, in law and in the cultural psyche depending on where you are in the world, being accepted as one of the family in some places such as Great Britain (Beck and Katcher, 1983), revered in others (Luomala, 1960) and feared and cast out in others (Thomas, 1983).

### 1.5. Dogs as Friends

Most domestic dogs in the Western world serve no significant economic function. In fact, for many people, their pet dogs cost them a substantial sum of money when feeding and veterinary bills are taken into account. Economic gain, then, is not the general purpose (Hart, 1990). The domestic dog in the Western world shares the home and life of its owner. They are, very often, given human - sounding names, and considered members of the family. They receive, and are described as giving, affection, even love, to their 'family.' Many writers have shown this relationship to be a mutually beneficial one in the sense that many dog owners report a greater sense of well-being and contentment when they live with a dog (e.g., Hart, 1990; Kiley-Worthington, 1990).

Canine displays of affection are strongly reinforcing to many humans, and given that the domestic dog is a naturally socially affiliative species, this then is a very good reason, from a human point of view, for keeping a dog as a friend (Mader *et al*.,1989). Dogs actively seek out their owners, and initiate social behaviours such as greeting rituals. The dog does not show disappointment if their owner has not been successful at work today, or does not conform to a particular physical standard of appearance. Instead, he or she indicates, through such behaviours as tail wagging, hand licking, etc., that he or she is 'pleased' to see them. For many dog owners this indicates an affectional bond which is unconditional, and this in itself can be reinforcing for the relationship (Cantazaro, 1984; cited in Serpell, 1995).

In addition, no animal species possesses the power of speech and one major consequence of this is that they do not criticise, blame or belittle (at least not verbally; Serpell, 1986). Thus, they can be at once affectionate, and subordinate without question and without verbally contaminating a positive relationship. Such a relationship may be less threatening to some human individuals than a similar relationship with another human (Serpell, 1986).

However, there are many similarities between friendships with dogs and friendships with people. For example, many pet owners describe their animals as having similar status to at least some of their human companions (Beck & Katcher, 1983).. Such relationships often involve confiding in and generally talking to dogs, as well as seeking them out in times of stress. The sense of being loved and needed can help to combat loneliness and depression. Similar elements in human relationships are believed to be very important for health in terms of 'social support' (Beck & Katcher, 1983).

In human relationships, support may often be inappropriate, and it may fluctuate in quality and/or quantity according to the perceived needs/emotional state of the individuals involved (McNicholas *et al*.,1995). Relationships with companion animals have no such 'hidden' costs or conditions. The relationship is not likely to suffer as a consequence of the human's need to seek social support; neither is the behaviour of the companion animal likely to change in terms of predictability, strength or constancy towards their human companion (McNicholas *et al*.,1995).

In discussing the concept of dogs as friends to humans, it is necessary to reverse the concept in order that we may also gain some insight into the various ways in which animals may perceive humans (Hediger (1965). This is a difficult undertaking given that it is not possible to gain direct knowledge about the perceptions of non-humans. However, many theorists believe that non-humans' perceptions can be reasonably inferred from their behaviour. Hediger (1965) has described five different ways that non - humans may perceive humans; as predator, as prey, as part of the environment without social significance, as a symbiont, and as a member of the animal's own species. These will be discussed in a later section.

### 1.6. Human Contact with Animals

The near-constant presence of dogs in human experience, had led to beliefs about the almost inseparable nature of our attachments to them (White, 1991). Few other species, even of companion animals, evoke such beliefs. Contact with non-companion animals is generally considered rather differently. This may be more to do with the familiarity of some species, notably dogs and cats, than with the nature of the contact or 'bond' in itself.

Kiley-Worthington, 1990 (cited in Dawkins, 1990) describes the relationships some animal trainers report between themselves and various animals in their care; and this shows them to be comparable to the relationships reported by pet owners. For example, many dog owners report strong positive emotions felt when interacting with, or even just thinking about, their pet, and similar positive emotions were reported by trainers of cetaceans at Sea World, Orlando, Florida (Kiley-Worthington, 1995). This may indicate that human contacts with various animals in various ways form part of a continuum of human-animal interactions rather than completely different relationships with different species (Kiley-Worthington, 1995).

For many domestic pets, human contact will have formed a part of everyday life from a very young age, and sometimes quite literally from birth. Early life experiences can have very great and lasting effects on behaviour, and on preferences, for both humans and dogs (Freedman *et al*., 1961).. For example, if puppies are raised in litters which have no human contact at all for fourteen weeks, they are fearful of humans and behave as though 'wild' (Freedman *et al*., 1961). It would seem that environmental factors need not be extreme to have far reaching effects, since even subtle effects can influence the dog's behaviour in later life. This will be discussed further later in the chapter.

The Guide Dogs for the Blind Association report that their most 'successful' Guide Dogs are those which were puppy-walked by individuals with more than one child in the home. Dogs raised in kennels after the age of three months have a tendency to become 'nervous', and consequently become unsuitable as Guide Dogs, and in several cases, may be unsuitable even as domestic pets (Pfaffenberger *et al*.,1976). In addition, Guide Dogs seem to be more successful (in this example, this means more obedient) if they have had experience of being able to run free in open country. Interactions of various kinds, i.e., with the environment and with other living things, therefore, would seem to play an important part in the future tendencies of Guide Dogs (GDBA, 1999).

Wolfle (1987;1990) has argued that human social contact with dogs may actually be more motivating than canine-canine contact in some cases. Evidence to support such a claim is sparse, but many studies show that the presence of humans does affect dogs' behaviour and physiology. For example, kennelled dogs increase activity when humans are present (Campbell *et al*., 1988), and withdrawing regular human contact can result in 'people-shy' dogs (Fox, 1986).

It would seem, therefore, that positive human contact with canines, and vice-versa, strongly affects behaviour, and those interactions may well be beneficial to both parties. The dog's natural tendency to socialise means that as little as five minutes of human contact per week is enough to ensure that the dog will react positively to humans in later life, although it should be noted that the strength of attachment increases with prolonged contact (Wolfle, 1990).

### 1.7. Social Tendencies of Domestic Dogs

The effects of social contact between humans and non–humans, as described above, are relatively easy to pinpoint, or at least to infer. However, the behaviour of many animals may be affected by

olfactory, auditory and/or visual cues left by a concealed field worker (Estep & Hetts, 1992). This in turn might affect and/or alter the behaviour of the investigator without anyone really noticing. The olfactory and auditory senses are particularly sensitive in the domestic dog; consequently, any contact between dogs and humans has to be considered, not only in terms of what it might mean to the human involved, but also from the point of view of the dog, given the dog's social tendencies. For instance, a dog may at times appear almost 'telepathic' to an on looking human; jumping up at the door and becoming excited in advance of their owner's return, but from the dog's point of view it is simply that his/her exceptionally sensitive hearing detected the specific note made by the engine of the owner's car well in advance of any auditory detection possible by another person, and/or that his/her superior olfactory sense meant that he could smell his/her owner's signature scent well before he was visible (Estep & Hetts, 1992).. The dog's excitement is driven by his attachment to his/her owner, and inherent sociability with humans in general.

Similarly, visual cueing is well illustrated if we consider the case of 'Clever Hans' the horse that could apparently do maths, indicating the correct answer by pawing the ground. Careful analysis of the situation revealed that Hans was actually responding to subtle cues (unintentional ones) given by observing humans when he had given the correct number of pawings (Pfungst, 1965; cited in Davis & Balfour, 1992). This example is often cited to show how unconscious cueing of animals in experiments or studies can invalidate the results. However, what the Clever Hans example has also shown us is that the horse can respond specifically to the subtle body movements of another species, presumably interpreting what is inferred by such movements. It seems entirely plausible to assume that the same is true of canines (Benson, 1992; cited in Davis & Balfour, 1992).

During World War two some dogs showed an inexplicable ability to detect mines which had been buried under tide flats, thus removing all olfactory and visual cues. One possible explanation is that they were responding to subtle cues from their trainers who knew where the mines had been buried (Benson, 1992; cited in Davis & Balfour, 1992). Similarly, recent study shows that some non-verbal features of experimental dog trainers can moderate dogs' responses to verbal commands, thus illustrating the dogs ability to 'read' the body of a human in conjunction with familiar verbal commands (Fukuzawa *et al*., 2005). Evidence of genetic predispositions related to the domestication process in the emergence of social cognitive abilities has come from studies comparing the behaviour of domestic dogs with that of wolves. In problem-solving situations, it seems, dogs are prepared to direct their gaze at humans in order to take direction such as hand

gestures (pointing), or even use the direction of human gaze as a clue to the whereabouts of hidden food, whereas wolves on the whole are not (Hare *et al*., 2002; Miklosi *et al*., 2003). This can be explained if we consider the different factors relevant to the survival of wolves and domestic dogs which have occupied very different natural habitats from at least the change in human habit from hunter-gatherer to agriculturist (Semyonova, 2003), whereby dogs were evolving towards a co-existence with humans and human settlements and wolves were not (Semyonova, 2003).

The domestication of the dog, just as for many other species, is an example of artificial selection by humans coupled with some 'accidental' selection. This has involved the adaptation of the dog, in a number of ways, to the human environment (Savolainen *et al*., 2002), and it is highly likely that this process has altered not only the morphology of the dog, but also its behaviour and behaviour control systems (Coppinger & Coppinger, 2002). Various studies show evidence for the relatively high levels of social competence of dogs when interacting with humans: these include communication (Agnetta et al., 2001; Miklosi et al., 2000; Miklosi et al., 1998; Soprani et al., 2001, 2002), cooperation (Naderi et al., 2001, 2002) and social learning (Kubinyi *et al*., 2003). Recent studies show that while dogs are keen to look at humans, and to use human directional gestures in problem-solving situations, wolves are not (Hare et al., 2002; Miklosi et al., 2003). This lends support to the hypothesis that genetic predispositions selected for in association with the process of domestication, have led to the emergence of social cognitive abilities in dogs, including the tendency to attach quickly to humans.

If aspects of the dog's social system are influenced by genetic predispositions, then this may make social bonding with humans *genetically* more likely (Voith, 1985). Animals which do not have large and complex social systems may be less likely than dogs to treat humans as conspecifics. In addition, canine species are characterised by a prolonged period of parental care, and this contributes to the likelihood of inter-species bonding (Voith, 1985). It has even been argued that humans have selectively bred the domestic dog in such a way as to facilitate human - animal bonding; neotenic physical and behavioural traits ensure that the dog retains infantile traits such as playfulness, and an appealing face. Such infantile traits may superficially resemble those of the human infant, and this stimulates parental care-giving responses and a potential overlap in the communication systems of both species (McFarland, 1987).

Further to this, it appears that dogs are able to organise their social groups to include other species

despite the differences which exist between the species involved. Some specific dog behaviours vary according to the species with which the dog is interacting. For example, a dog playing with another dog does so differently compared to the play behaviour it exhibits with a human (Rooney, 2000). Additionally, this also lends weight to the argument that there is no logical basis for interpreting dog behaviour with humans as if dogs themselves perceive humans as conspecifics (Semyonova, 2003). Dog-owner bonds are very diverse with some dogs being together with their owner since puppy-hood whilst others have joined their owners when fully adult after a string of different owners and domestic situations. 1f, as the research suggests, social experiences are very important in canine attachment to humans (Gasci *et al*., 2001; Topal *et al*., 2005), the owner's previous experience with dogs, and the dogs' own social experiences and learning are likely to have an effect on the dogs' attachment behaviour patterns.

A dog's tendency to be socially affiliative to a human further stimulates the human tendency to 'parent' some animals. Many Guide Dog trainers feel that their dogs are sensitive to their moods, and often respond accordingly, for example, becoming unwilling, or even fearful when the trainer is in a 'bad mood'(personal communication, Guide Dogs for the Blind Association, Exwick, Exeter, Oct,1998). Similarly, the experienced trainer is aware of the dogs' moods, and may be prepared to accept a less than satisfactory performance on a given day, if the dog appears to be 'out of sorts' (personal communication, Guide Dogs for the Blind Association, Exwick, Exeter, Oct,1998). Such anecdotal evidence illustrates the complexity of exchanges between species with highly developed social tendencies.

To summarise, it would appear that there are three main factors influencing the domestic dog's interactions with humans. Firstly, there is the genetic predisposition to live in complex social groups which show extended parental care. Secondly, the potential overlap in the communication systems of the dog and the human which make the perception of the other as conspecific or symbiont, more likely. And finally, the dog's prior experience with humans; prolonged sensory contact leading to positive perceptions of humans later on in life.

### 1.8. Defining Bonding and Attachment

Given the tendency of dogs to attach readily to humans, and the tendency of humans to strike up a bond with their dogs, it is imperative that these terms are carefully defined. Much of the literature in this area either fails to define what is meant by 'bond' altogether, or the terms 'bond' and

'attachment' are used interchangeably as if they mean the same thing. Even where definitions are offered, there may be little agreement between writers.

For some, bonding is a mutual state requiring the input of two parties, whereas for others, bonding can be one-sided, involving, say, the attachment of an animal to a particular place, or an object like a toy (Cairns, 1966; Wolfle, 1985). Cairns (1966) has shown how attachment may be viewed in two ways; as behaviour which maintains proximity between animals, and as an internal process which directs the maintenance of proximity (or behavioural disruption resulting from separation). Others do not necessarily see a bond or an attachment as a form of interaction at all, since it need not be mutual. For example, a domestic dog may have formed an attachment to its owner, but this does not mean that the dog owner is necessarily attached or bonded to his or her pet .

Part of the problem with the terminology here is the fact that both 'bond' and 'attachment' are in common English usage; this in itself makes them difficult to define objectively. Scott (1963), however, points out an essential difference between the terms when he distinguishes mutual attachment between two or more individuals in social situations, and asocial attachments, such as site attachment involving only one individual; and bonding, which, he says, implies a metaphorical tie between just two individuals.

So attachments may be one- or two-sided, whereas bonds require the input of two individuals. In both cases, it seems that connections are made with what is familiar to the animal, even if what is familiar is negative (see previous information under 'Dogs as outcasts'). Ironically, a common side-effect of strong bonds between owners and their dogs, and strong attachments between dogs and familiar places, is 'problem behaviour' in the dog (Scott, 1963). In fact one way in which bond or attachment strength may be measured is in observing distress behaviour when the animal is separated from its human companion, or is moved from a familiar place (Scott, 1963). Overly 'strong' bonds and/or attachments are a predominant feature of common problem behaviours such as excessive barking, destructive behaviours, house soiling, and self-mutilation. And yet, techniques used to increase the dog's independence (of humans) are often inappropriate for the dog owner who wishes to maintain the bond or attachment, given that one of the main reasons for keeping a pet dog is to provide a satisfying and mutually inter-dependent relationship (Scott, 1963).

However, not all strong attachments necessarily result in problems. Johnston (1995), uses the term

’attachment figure’ to refer to the individual involved in what he calls the ’secure relationship’ which develops between a mother and her offspring’ or between a puppy and his or her puppy–walker, or a dog and trainer and Guide Dog Owner. This sense of security, Johnston (1995) goes on to say, then buffers the puppy or dog against environmental stress, and causes the dog to exhibit proximity-seeking behaviour. The quality of such an attachment affects the dog’s ability to become both effective and confident as a guide for a blind person.

If the process of defining terms which describe feelings of affection or emotions is viewed philosophically, we might find ultimately that assigning an operational definition to ’bonding’ or ’attachment’ is to impoverish what we really mean when we say that we are strongly ’attached’ or ‘bonded’ to our animals. Indeed, Hempel (1965) has written extensively on the inadequacy of operational definitions, stating that such definitions narrow the meaning of words almost to the point of their having no actual meaning outside of the experimental setting; i.e., in the real world.

However, a researcher needs to give some kind of indication as to what he or she means when they use a particular term. Perhaps operational definitions should be allowed some flexibility to allow for changes in context, sex of individual, previous experience, and so on; especially in view of the fact that many concepts, attachment and bonding included, do not cease to exist simply because there is no overt behavioural indication of them present at a given time. In addition, other species may express bonds and attachments in ways we either do not recognise, or do not fully understand (Masson & McCarthy,1996). In short, a flexible operational definition, something of a contradiction in terms, is rather difficult to construct if it is to maintain meaning outside of the experimental set up. This does not however imply that the terms ‘bonding’ and ‘attachment’ are essentially indefinable; only that their use should be very carefully considered; many definitions of everyday concepts such as “justice” or “peace”could be considered somewhat “fuzzy” as they may mean very different things to different individuals but this does not make them useless in daily parlance, in fact quite the opposite may be true.

The work which follows here shall assume the following definitions:

Attachment

Behaviour which maintains proximity between animals with the goal of minimising occurrences of separation). The behaviour need not be mutual or interactive (see; Cairns, 1966) .

Bond

A dyadic behaviour/state between animals which is mutual and interactive. In humans bonding is characterised by emotions such as trust and affection (see; Scott, 1963).

Attitude

A learned tendency in humans to evaluate people, issues, objects or events in a particular way. The evaluations have emotional, cognitive and behavioural components and may be implicit or explicit.

### 1.9. The Relationship Between Bonding and Dominance

Dominance as a concept, like the terms discussed above, can be very difficult to define, and yet similarly, it is a word in common English usage; this gives it what might be termed 'surplus meaning.' Some writers see the establishment of a 'dominant' position over animals in one's care as essential if an *obedient* animal is the desired outcome (Mech,1999).

However, this conceptualisation of the so-called dominance-submission conflict between humans and their dogs may well be flawed. Certainly, it is not too difficult to rank members of a wolf-pack in terms of frequency of agonistic encounters or success in obtaining an initial resource like food (Mech,1999). Consequently, you could then construct a pattern of behaviours within the pack, but this does not mean that groups of wolves or dogs, or even people, involve themselves in a continuous dominance-based conflict with each other. It is more likely that much canine behaviour is the product of complex and more familiar social processes such as attachment (Lockwood, 1979).

In special cases, such as that of service dogs, the dog is, in many situations, being asked to take charge and make some very important decisions. It seems unlikely that the Guide Dog's trainer has somehow taught the dog to juggle dominance and submission in relation to the prevailing conditions at any given time. Instead, the answer may lie in the dog's attachment to its owner, and vice-versa. Dominance is unnecessary and out-dated in the face of the Guide Dog's "nearly insatiable desire to please", as Bruce Johnston (1995, p104) puts it. In feral dogs, or wolves, the leader of the group is one whose affiliations with other individuals allow stimulation of activity; skill in the use of cognitive activities such as problem-solving, or foresight determine leadership and thus dominance is a separate and un-correlated issue (Mugford, 1992).

### 1.10. Measuring Attachment and Bonding

Measuring the strength of an attachment or bond is no simple matter. Measurement will depend on the researchers' operational definitions, and on whether or not the definitions are adequate enough

to truly represent the apparent complexity of some bonds/attachments. Consequently, any measures of attachment within a study are necessarily the product of the researchers' views, and of the human/non-human behaviour in that particular study. A possible measure, or test of preference/attachment, borrowed from studies of animal welfare, is the choice chamber, or at least something principally like it whereby an animal is placed in an apparatus which allows it to choose a route, foodstuff, bedding type, etc., so that researchers can observe what an animal does when given specific choices (Seligman, 1967).

Spencer (1880) proposed a link between an animal's choice of environment, their subjective feelings, and their welfare in such an environment. Negative feelings, such as pain and fear, he argued, may have evolved in order to make living in inappropriate (harmful or detrimental) environments less likely. Similarly, positive subjective feelings such as pleasure and safety, would ensure that animals lived in environments which were best for their survival. Experimental psychologists have taken up this idea by training various animals to behave in certain ways in response to positive and negative reinforcers, and to punishment (Ferster & Skinner, 1957). The animal makes an informed choice (based on learning the consequences of the actions available), such as whether or not to press a lever, or enter a nesting box knowing that it will then have to stay there for several hours. Whether or not the animal repeats the action for some reward, or repeats the action to avoid a negative stimulus, tells us something about the animal's preferences in the given situation (Radner & Radner, 1989).

A modification of this could tell us something about the strength of a dog's bond to a particular human. Will the dog choose to remain in the company of humans at the cost of spending time with other canines, or gaining access to food? Will socialised dogs operate mechanisms which allow them to at least see, or hear, or smell particular humans? There are many possibilities for such a technique. However, the main problems of choice tests also need to be carefully considered; namely that an animal's short-term preferences may be very different from its long-term preferences; changes in context, time of year, health, temperature etc., may seriously affect an animal's choices in any given study; and the fact that animals, including humans do not necessarily choose what is 'best' for them. We have discussed how dogs may well become attached or bonded to a human who does not behave positively towards them. Consequently, a dog may choose to be in the company of someone who is actually detrimental to their well-being (Scott et al., 1974: see previous section on Relationships between humans and non-humans).

### 1.11. Anthropomorphism; arguments for and against

> *The error into which anthropomorphism can lead us is to see bears through our own emotions: we fear them, so we see them as angry and hostile. The equal and opposite error into which the fear of anthropomorphism can lead us is to refuse to recognise that bears can feel their own emotions (Masson & McCarthy, 1996, p 56-7).*

The above quotation, in this instance with reference to black bears, illustrates some of the problems associated with anthropomorphism, or the lack of it. Many psychologists have been trained to avoid anthropomorphisms to such an extent that for some it becomes difficult to express what they mean without *resorting* to expressions describing human-like emotions which they know, in many cases would make their study inaccessible to many of their colleagues, even though what they want to say is actually best expressed in terms usually reserved as descriptors of human behaviour. As Breland and Breland (1966, p. 12) put it:

*It is virtually impossible to describe the actions of an animal without some human bias - a dash of anthropomorphism seems to be inevitable, simply because we are human and must see animals through human eyes and human experiences.*

For many, the subjective emotions of animals are not respectable fields of study, and anthropomorphisms are a form of scientific blasphemy - this attitude may simply be an historical artefact rather than an example of good practice (see Masson & McCarthy, 1994). Much anecdotal evidence suggests that although many scientists regard anthropomorphism as an ethological 'sin', it would appear to be almost irresistible outside the confines of academia. For example, the domestic dog owner, who also happens to be an experimental psychologist, may statistically analyse the frequency of certain behaviours in his or her research canines F1, F2 and so on, and yet return home to a pet dog which they genuinely believe is 'pleased to see them', or looks 'guilty', because something got chewed up in their owner's absence.

An excellent example of this 'double-edged sword' comes from two pieces of work by John Mackinnon in 1974. He published a paper in *Animal Behaviour*, and also published a popular book entitled, "*In search of the red ape*" (his research was about orang-utans). In the *Animal Behaviour* article none of the apes he observed have been given names, and much of their behaviour is described 'functionally.' In contrast, in "*In search of the red ape*," the animals are identified as

individuals, they have personalities, and incidents occurring between them read as mini-dramas rather than as clinical *behaviour*. Both these publications make reference to the same animals indulging in the same activities. The difference is in the reporting style rather than in what actually happened. If descriptions seem human-like, the inclusion of inverted commas serves to put a distance between human behaviours and animal behaviours which appear human-like.

Ferry (1984) has suggested that scientific writings which avoid anthropomorphism, and popular writings which do not, are appealing to different levels of awareness rather than inherently telling different stories. Her suggestion is that scientists invite us to listen critically to their arguments and we are given space to disagree with their ideas and findings, whereas writers of nature books unveil a drama which does not demand that our argumentative faculties are ever really engaged.

Fear of anthropomorphism means that the academic's use of inverted commas instructs the reader to suspend criticism, it justifies the use of risky terms and avoids offending, or losing the belief, of the academic reader. What it also does, however, is punctuate the differences between humans and non-humans, rather than highlighting any similarities (Masson & McCarthy,1994). Research with canines, like research with other species, might actually benefit from some anthropomorphic description, in that anthropomorphisms can reveal a great deal about the biases and views of the writer, as well as about his or her philosophical assumptions. Given this viewpoint, the term anthropomorphism, could be defined as the 'inappropriate attribution of human qualities to non-human animals.' Epstein (1987) suggests that the *appropriate* attribution of human characteristics to non-human animals could conceivably be called 'anthropozoism', which suggests the objective search for commonality between humans and other species rather than the erroneous imposition of inappropriate qualities and characteristics. In the chapters which follow, the consequences of dog-owners' tendencies to anthropomorphise the behaviour of their dogs will become clear in the inaccuracy of their predictions about what their dogs will do in a given situation.

**1.12 Conclusion**

This chapter has given on overview of the domestic dog today from its ancestral past to its contemporary position in human societies. Human manipulation of the grey wolf into the most diverse phenotype in the world is a topic worthy of extensive discussion given the impact of the dog on our daily lives in both positive and negative respects. In particular, the mechanism of attachment of people to their dogs and vice versa needs to be researched further if we are to gain a full

understanding of this phenomenon, especially in relation to the reliable and valid measurement of attachment in canines, the relationship between human attachment to their dogs and vice-versa, and the contrast of dog-human attachment behaviour with wolf-human attachment behaviour.

## CHAPTER 2: INTRODUCTION:
## ATTACHMENTS IN DOGS AND HUMANS

## 2.1. Introduction

The increased interest in human-companion animal relationships in recent years has led to the publication of numerous papers on the subject. The focus of these has largely been on human attachment to dogs, or pets in general (Collis & McNicholas, 1998; Scott, 1992; Voith, 1985), pet ownership in relation to health and well-being of owners (Hart, 1995; Wilson & Turner, 1998), and on the correlation between owner behaviour and behavioural problems in dogs (O' Farrell, 1995; Jagoe & Serpell, 1996). Few studies have explored the attachment of dogs to their owners (Prato-Previde *et al*., 2003; Topal, 1998).

Dogs have shared the lives of humans for longer than any other domestic species (Clutton-Brock, 1999), and they remain one of the most popular animals to keep as a pet (Hart, 1995). Dog breeds exhibit extraordinary morphological differences, but all are descended from grey wolves living more than 10,000 years ago (Clutton-Brock, 1977; Serpell, 1995). Artificial selection for appearance and behavioural traits may also have promoted the tendency to not only socialise with humans, but to readily form strong attachments to them (Kretchmer & Fox, 1975; Millot, 1994). This is discussed in more detail in chapter one.

It is easy to see the similarities that exist between the owner-dog relationship, and that of parent and child. Many people appear to treat their dog as if it were a human child, and dogs in turn are apt to exhibit behaviour patterns which elicit care (Askew, 1996). Askew (1996) has further argued that the behaviour of contemporary pet owners towards dogs does not only resemble human parenting, but actually is parental behaviour directed at another species which has evolved modified canine behaviours designed to stimulate maternal care. This chapter will review various attempts to measure attachment to animals, consider attachment behaviour in humans, and explore the use of Ainsworth's (1969) Strange Situation test with canines.

## 2.2. Measuring attachment to animals

### 2.2.1 Attitude scales

Attitude scales have been used extensively in companion animal studies due to the relative ease with which they can be administered, and the large amounts of data they can generate. This is particularly true, in more recent years, of scales which can be posted on the internet quickly and easily, allowing the researcher to collect huge amounts of data, often in just a matter of days (Gosling et al., 2004). The structured questionnaire is very useful for testing hypotheses concerning attitudes, which have already been studied at some length, given that the researcher will already know what is typically involved in the particular attitude under scrutiny (Kline, 1986).

Various attempts have been made to construct standardised measures for assessing pet attachment with adequate reliability and validity, to allow exploration of the human-companion animal relationship. Examples include the Companion Animal Bonding Scale (Poresky *et al*., 1987), the Pet Attitude Inventory **(**Wilson *et al*. 1987), the Pet Attitude Scale (Templer *et al*.,1981), the Pet Relationship Scale (Lago *et al*.,1988), a Pet Attachment Scale (Chumley *et al*., 1993), the Pet Attachment Survey (Holcomb *et al*.,1985), the Lexington Attachment to Pets Scale (Johnson *et al*.,1992), and the Comfort from Companion Animals Scale (Zasloff, 1996). Because many animals kept as pets are cats and dogs, attachment scales tend to reflect the specific types of interactions possible with these species such as grooming and playing, as well as emotional aspects such as love and trust which can be perceived as possible with any type of pet (Zasloff, 1996).

### 2.2.2. Development of attachment instruments

A review in 1984 of the literature concerned with pet ownership and well-being in humans concluded that a lack of scientific rigour was contributing to a poor understanding of the complex relationships between people and their animals (Marx, 1984). Much of the research in this area undertaken since Marx's review has shown a marked improvement in terms of quality and methodological rigour. One such piece of research led to the development of the Companion Animal Bonding Scale (Poresky *et al.*, 1987), which showed improvement in utility compared to previous efforts. Similarly, the Pet Attitude Inventory (Wilson *et al.*, 1987), the Pet Attitude Scale (Templar *et al.*, 1981), the Pet Attachment Survey (Holcomb *et al.*, 1985) and the Pet Relationship Scale (Lago *et al.*, 1988) all indicated adequate evaluations of reliability and validity, although most of the developmental work upon which these scales were based involved non-random opportunity samples.

Research following the creation of the above scales has drawn on the strengths of the existing attachment instruments, often combining items from two or more scales, and/or modifying the wording and focus of specific questions to allow the development of more reliable and valid measures. An example of this type of modification is the Pet Attachment Scale (Chumley *et al.*, 1993). This scale combined two pre-existing instruments to form a 21-item attachment measure consisting of two orthogonal factors interpreted as "pet companionship" and "pet affection." This scale has been successfully used to look at the relationship between perceived attachments to pets of the families of military personnel with whether or not the pets accompanied the families upon their transfer to different military bases.

A further study resulting in the Pet Attachment Survey (Holcomb *et al.*, 1985) utilised an opportunity sample of veterinary hospital clients who owned cats or dogs as pets. Analysis of the results indicates that this attachment instrument tended to be biased towards dog-owners in that some of the emerging dimensions of the scale were defined by activities which are only really associated with dogs, such as obedience training. As a result dog owners scored significantly higher on "relationship maintenance" than did cat owners, whereas there was no significant difference between cat and dog owners on the "intimacy" subscale as this was defined by attitudes and emotions such as feeling the pet was a family member and seeking comfort from the animal in question, and these attitudes/emotions did not preclude cat owners. This indicates the need to ensure that attachment scales are either species specific in their subscales, or species-non-specific including only universal pet-related feelings, activities and interactions. This realisation has led to the development of further attachment or comfort scales which either specify the species to which pet owners' attachment will be assessed, or are distinctly designed to determine levels of comfort and/or attachment to any kind of companion animal (Johnson *et al.*, 1992; Zasloff, 1996).

### 2.2.3 The Comfort from Companion Animals Scale (CCAS) (Zasloff, 1996)

This scale focuses on the emotional aspects of human-animal relationships and does not make reference to any specific behavioural traits of either dogs or cats. The thirteen items of the CCAS are derived partly from work by Beck and Katcher (1983) in their examination of the health benefits associated with keeping pets, partly from research by Lott (1988) on the apparently irresistible urge many people have to feed wild animals and the possible consequences of such behaviour, and finally, from discussions amongst researchers at the Centre for Animals in Society at the University of California, Davis, School of veterinary medicine. Pilot testing of the CCAS indicated that it is highly correlated with the Lexington Attachment to Pets Scale (LAPS) (Johnson *et al.*, 1992) with acceptable construct validity and a high level of reliability. Respondents to the CCAS are asked to indicate their level of agreement with statements such as: my pet provides me with companionship; my pet makes me feel needed; and, my pet makes me feel trusted (see Appendix A for the full CCAS).

CCAS data from almost 150 dog and cat owners was analysed by Zasloff (1996) indicating no significant differences in the perceived comfort gained from owning a pet cat or dog. In addition, the CCAS data was also analysed including two items pertaining to "feeling safe" and "getting exercise" and in this analysis it was clear that the perceived level of comfort of dog owners was significantly higher than for cat owners. It seems obvious from this that species-specific activities included as questionnaire items can seriously bias the data in favour of, in this case, dog-owners, but it has to be considered that dogs might actually be more of a comfort to their owners than cats are to cat owners given the tendency of dogs to exhibit affection and dependency more readily than cats (Johnson *et al.*, 1992; Stallones, Marx, Garrity & Johnson, 1988).

The CCAS then represents a powerful measure of perceived comfort gained from cat and dog ownership, and, given the literature on the comfort gained from ownership of other types of small pets such as various avian species, rabbits etc. (e.g., Loughlin & Dowrick 1993) and the facilitation of social interaction which is apparent in pet owning (e.g., Hunt, Hart & Gomulkiewicz, 1992; Mugford & M'Comisky, 1975) it seems highly likely that the CCAS could provide a reliable and valid measure of comfort from pets in general, and as such is a valuable instrument for examining the emotional aspects of the human-animal relationship.

### 2.2.4. The Lexington Attachment to Pets Scale (LAPS) (Johnson *et al.*, 1992)

The LAPS was developed for use with both cat and dog owners, and originally consisted of 42 questions scored using a Likert scale whereby a high score indicates a high level of attachment. A systematic sample of 412 respondents was interviewed by telephone resulting in a large data set ultimately revealing excellent psychometric properties. Items included in the scale were based upon a number of sources, namely the previous attachment scales developed by the authors research team (Johnson *et al.*, 1992), and from the work of other researchers, including the Companion Animal Bonding Scale (Poresky *et al.*, 1987), the Pet Attitude Inventory (Wilson *et al.*, 1987), and the Pet Attitude Scale (Templer *et al.*, 1981). The items were considered in terms of the respondent's emotional tie to their pet given that it is this aspect of social support which research into human health has indicated is the most important (House & Kahn, 1985), and which has been suggested by other researchers as a likely foundation for human-pet relationships (Garrity, Stallones, Marx & Johnson**,** 1989; Lago *et al.*, 1988; Ory & Goldberg, 1983). Respondents to the LAPS were asked to indicate their level of agreement with statements such as: I believe my pet is my best friend; I love my pet because it never judges me; owning a pet adds to my happiness (see appendix A for the full LAPS).

After the raw data were explored using traditional item analysis procedures (Kline, 1986) and item response theory models (Hambleton & Swaminathan, 1985), the questionnaire was reduced to 23 items, fourteen of which are indicators of above-average (i.e., strong) pet attachment. The remaining nine items measure less than average pet attachment but statistically speaking has a more restricted range. Johnson *et al.*, (1992), acknowledge that this strongly implies that the LAPS is more successful in measuring strong attachments than weak ones. In addition to the analyses indicated above, associations between the LAPS and various respondent characteristics were also examined. These revealed that those most highly attached to their pets were female, black and older respondents; also, less well educated and poorer individuals tended to score more than highly educated people of higher socio-economic status(Johnson *et al.*, 1992). The LAPS scores were also shown to be positively correlated with various personal social networks such as: household with no children, smaller households, divorced persons, those never married and co-habiting couples. Individuals who indicated that their favourite pet was a dog also had higher attachment scores than people indicating that their favourite pet was a cat (Johnson *et al.*, 1992).

The development of the LAPS described here has some limitations that need to be taken into

account. The problems inherent in telephone interviewing should not be underestimated (i.e., more time required of participants as the responses for this scale were transcribed during the call, etc.), but perhaps the biggest issue is that respondents were invited to answer questions regarding their "favourite" pet. This was to ensure that the attachment measured was to a single animal, and not pets in general (many of the respondents had more than one pet), but this may have led to a social desirability effect, influencing individuals to give more positive answers than they might otherwise have given. This problem is acknowledged by the researchers (Johnson *et al.*, 1992) and may indeed be part of the reason why the LAPS items did not really assess weaker attachments. Nonetheless, the LAPS represent a highly reliable and valid means by which to assess the attachment levels of cat and dog owners.

## 2.3. Attachment in humans

### 2.3.1. The construct of attachment

The affectional bond that develops between a human infant and its primary caregiver is well documented, and the construct of attachment was first used to explain this phenomenon (Bowlby, 1958). However, many social species demonstrate attachment behaviours and the study of these species has been approached in a number of ways. Attachment may be considered in terms of a behavioural system which causes one animal to seek and maintain proximity to another (Bowlby, 1972), or it can be seen as a hypothetical construct tying individuals together (Lorenz, 1966). Definitions of attachment are numerous, but most focus on the special nature of the affectional relationship, its specificity and its endurance over time, that is evident through behavioural preferences (Cohen, 1974; Wickler, 1976).

Three main theories of attachment exist; namely: 1. the psychoanalytic approach by theorists such as Freud (1946); 2. the various learning theories (e.g. Cairns, 1966; Gewirtz, 1972; Hoffman and Ratner, 1973;Solomon & Corbit, 1973); and 3., the ethological models of Ainsworth (1969, 1972) and Bowlby (1958, 1969). The ethological approach emphasises the evolutionary and developmental aspects of attachment behaviour, as well as genetic influences, and also assumes neurobiological devices that have been shaped by the environment (Bowlby, 1958; Kraemer, 1992). Research on humans and other primates has resulted in various operational criteria of attachment that can also be applied to other species. According to these, attachment requires: the ability to discriminate and respond differentially to the primary carer, a preference for the attachment figure,

and specific separation responses and reunion behaviours that are directed only at the attachment figure and are distinct from responses to others (Crnic, Reite & Shucard, 1982; Gubernick, 1981; Rajecki, Lamb & Obmascher, 1978).

### 2.3.2. The Strange Situation Test

Perhaps the most important methodological approach to assessing attachment is the well-known Strange Situation Test (SST), which was originally designed by Ainsworth (1969). In this test attachment behaviour is activated by separation from, and reunion with a primary caregiver in a laboratory procedure, which imposes increasing (though moderate) stress on a toddler aged between twelve and twenty months of age. From this relatively simple procedure, Ainsworth was able to devise instructions for classifying the infant's attachment relationship into one of three main groups, a "secure" group (B), and two "insecure" groups, "avoidant" (A), and "resistant" or "ambivalent" (C). This was based on close observation of just 23twenty-three mothers and infants from a middle-class population. According to Ainsworth, the three main groups may also be subdivided into eight further groups, but this requires much larger sample sizes and as such is rarely feasible. Classification is based largely on the infant's behaviour towards the caregiver during the reunion episodes with respect to four scales of infant-caregiver interactive behaviours (the other episodes of the procedure serve to provide a context for reunion and separation, and provide a contrast between interactive behaviour etc., and activation of the attachment system). These are proximity seeking, contact seeking, avoidance and resistance to contact and interaction. A fourth classification group has also been developed to account for those infants who are difficult to classify using the standard A-B-C criteria, and is termed "disorganised/disoriented" (D). Children in this group show a diverse set of behaviours that are characterised by a lack of observable goal or purpose in the immediate situation, i.e., the child lacks a coherent attachment strategy (Main & Solomon, 1986, 1990).

Given the importance of the SST as a classification tool, it is worth detailing the psychometric properties of the system. Researchers utilising the Ainsworth system have to be extensively trained, and in some cases certificated as proof that they can meet a minimum inter-coder reliability standard (Cassidy, 1999). This is because the classification process requires matching a particular case to a multidimensional, categorical template or prototype. Written descriptions of the templates cannot capture the nuances of behaviour and context that determine placement in a particular group; only experience of several cases of a particular group can allow development of the expertise needed to permit evaluation of new cases in terms of how well they fit into a particular attachment

category (Cassidy, 1999). Within-laboratory agreement for trained coders tends to be very high indeed, with 100% in the original study (Ainsworth & Bell, 1970)) and 85-95% for researchers trained by Ainsworth or her students (Main & Weston, 1981; Waters, Wippman & Sroufe, 1979).

Classification stability is, on the whole high, ranging from 50% to 96% when the assessments are two to six months apart or longer. Middle-class samples reveal the greatest stability with the lower-class mother-child samples being much less stable (Lyons-Ruth *et al*., 1991 [cited in Cassidy & Shaver, 1999]; Main & Weston 1981; Vondra *et al*., 1996 [cited in Cassidy & Shaver 1999]). However, much lower overall stability is recorded if the SST is repeated over the very short term (i.e., two to four weeks), but this is almost certainly due to infants desensitisation to the procedure and indicates the need to leave adequate spacing for studies in which a test-re-test procedure is required (Ainsworth *et al.,* 1978). Ainsworth was also able to demonstrate the stability of attachment category classification by visiting mothers and infants in their homes once a month for the first year of life and producing detailed narrative records of mother-child interaction. These showed that secure versus insecure laboratory attachment classifications were related to different patterns of behaviour in the home. In short, there can be little doubt that highly trained observers of the SST can, and do, assign attachment categories to infants which extensive research indicates are both valid and reliable, and stable over time (Ainsworth *et al.,* 1978).

However, it must be borne in mind that the original A-B-C classifications were based on observation of just 23 mothers and their infants, that variables such as mothers' work patterns, and the degree of fathers' involvement in the care of young children have changed considerably since the original study, and that modern research studies utilising larger and high-risk samples report much lower stability of classification (Belsky *et al*., 1996) than stated in earlier studies (e.g., Main & Weston 1981; Waters, 1979).

### 2.4. Application of the Strange Situation Test to canines

#### 2.4.1. Attachment behaviour in dogs (Topal, Miklosi, Csanyi & Doka, 1998)

Topal *et al.* (1998) were the first research team to provide empirical evidence of the nature of the dog's affectional tie with its owner. The aim of this original study was to describe the human-dog relationship by a well-known ethological method used for the evaluation of mother-child attachment, and to study the similarity of owner-dog relationships in the form of mother-child

interactions. An opportunity sample of 51 owner-dog pairs was studied; this was made up of both men and women with a wide age range, and male and female dogs of various breed types and ages. Topal *et al.* (1998) endeavoured to make the study as similar as possible to Ainsworth's original set up so that the resultant data could be treated similarly to hers. Behaviours such as exploration, play, passivity, physical contact, standing by the door and greeting behaviour were recorded and compared for owner and stranger. These behaviours were recorded continuously during observations and the relative percentage of the time spent performing each behaviour was calculated. Factor analysis was used to get theoretical dimensions thought to account for individual differences in the SST, and all the behavioural variables were assessed by cluster analysis to establish categories for the dog-human relationship. The effects of independent variables such as owner's gender, dog's gender, and dog's breed type were also explored in relation to the strange situation behaviour.

The results of these analyses indicate that the behaviour of the dogs differed significantly when owner and stranger interactions were compared. Three main factors were apparent in the behavioural data: namely the dogs' degree of anxiety, acceptance of the presence of the stranger, and dogs' level of attachment to owner (Topal *et al.,* 1998). The 51 dogs were divided into three main homogenous groups according to their behaviour patterns in the experiment: one group showed low levels of anxiety, medium-low level acceptance and medium-low level attachment: a second group showed high levels of anxiety, acceptance and attachment: and a third group showed medium levels of anxiety and acceptance and medium-low levels of attachment. Breed type had no significant effect on Strange Situation behaviour and only the number of family members correlated significantly with some of the variables, indicating that dogs living in large families tended to spend less time close to the door and showed greater passivity in the presence of the stranger (Topal *et al.,* 1998).

Thus, Topal *et al.*'s (1998) application of the SST to dogs and their owners proved an effective means by which to activate and describe dog attachment behaviour given that distinct clusters of behavioural types were clearly apparent in the data.

### 2.4.2. Is the dog-human relationship an attachment bond?

In a similar study, Prato-Previde *et al.* (2003) also used the SST to investigate the dog-human

relationship. This study likewise endeavoured to follow Ainsworth's procedure and behavioural analyses as closely as possible except that an extra separation period in which the dogs were left alone in the room with articles of clothing belonging to the owner and stranger was included in the eight experimental episodes. The dogs exhibited a secure base effect given that they were more willing to play with the stranger when their owner was present than when their owner was absent, and showed a range of attachment behaviours, such as search and proximity seeking behaviours when separated from their owner (e.g. scratching and jumping up at the door and barking). The dogs also spent more time next to their owner's clothing than to the stranger's clothing, and greeted their owners more energetically and for longer than they greeted the stranger.

However, Prato-Previde *et al.* (2003) do not consider that this provides convincing evidence that the dog-human bond constitutes an attachment. This viewpoint is based on a number of reasons, and it is worth considering them in some detail. Ainsworth (1989) identified three measures of the secure base effect as follows: 1. exploration and play behaviour is reduced in the presence of just the stranger, but are resumed when the mother returns; 2. infants return to their mother's side when the stranger enters; and 3. sometimes, infants will play with the stranger when their mother is present, but not when she is absent. In Prato-Previde *et al.*'s (2003) study it was felt that the lack of individual play in the dogs meant that this could not be used as a measure of secure base effect. Also, less than twenty percent of the dogs in the sample returned to their owner's side when the stranger entered, and most of the dogs did not seem at all wary of the stranger. Prato-Previde *et al.* (2003) interpreted this as a failure of the entering stranger to fully activate the attachment system.

The dogs' exploratory behaviours occurred mainly at the start of the experimental procedure. After this first episode Prato-Previde *et al.* (2003) observed a significant decline in this behaviour, and interpreted it as being probably due to an order effect of reduced curiosity over time rather than secure base behaviour. Similarly, the tendency of the dogs to engage in more social play with their owner than with the stranger was seen as the owner being the preferred playmate rather than as a secure base effect, given that the dogs did not, on the whole, engage in individual play more in the presence of their owner than in the presence of the stranger (a strong indicator of the secure base effect in human infants). On the whole, the behaviour of most of the dogs in the study seemed to indicate that being separated from their owner in an unfamiliar environment was distressing, but not as distressing as being left completely alone. When alone with the stranger, even distressed dogs reduced their vocalisations and increased physical contact with the stranger, and did not seem to

find her frightening at all. This strongly implies that most of the dogs were somewhat comforted by the stranger (Prato-Previde *et al.,* 2003).

However, a number of the dogs in this study did not seem to gain any comfort from the stranger and continued to demonstrate search and protest behaviours during their owner's absence, which only ceased when their owner returned (Prato-Previde *et al,.* 2003). This is consistent with activation of the attachment system described by Ainsworth and Bell (1970). In contrast, avoidance and/or withdrawal behaviour was very rarely observed in this sample, and nothing approximating resistance behaviours (in human infants this can be exhibited as trying to avoid physical or eye contact with carer) was seen; in human infants, this is a vital element of the attachment classification process (Ainsworth & Bell, 1970). However, it is not clear from this study exactly what resistance behaviours in canines might look like, or whether or not they can be interpreted in the same way as for humans.

The visual orientation of the dogs in this study was difficult to interpret in this context because, whilst it is possible to record reliably, it is difficult to establish what is implied by it. It is possible that gazing at the owner was related to comfort seeking, whereas, gazing at the stranger could be more to do with socialisation to humans in general and this may imply that making eye-contact serves a number of functions. A closer analysis of this behaviour in further research would allow it to become a more robust measure of a dog's attachment to its owner.

Despite the short-comings of the SST procedure, overall Prato-Previde *et al.* (2003) concluded that the SST is useful tool for exploring the bond between dogs and owners, particularly if modified versions aimed at reducing order effects are devised. In human studies it seems likely that the infant's level of fear in the Strange Situation is a function of the order in which the mother and the stranger are present (i.e., the child enters the room with the mother and is then introduced to the stranger whilst their mother is present and so on, thus potentially reducing the level of wariness towards the stranger from the start (Main & Weston, 1981) – the same may well be true of dogs; also, with a high proportion of dogs, there may simply be an effect of diminishing curiosity over time as investigation of novel objects and surroundings is completed (see Kaulfuss & Mills, 2007) resulting in increased familiarity with the 'strange' situation). Adult dogs' behaviour in their study was found to be strikingly similar to that of human infants and chimpanzees (Bard, 1983, 1991;

Miller *et al*., 1986) in the same situation. However, a number of behaviours vital to the allocation of human infants to attachment categories, were not apparent in the behaviours of dogs in this study, in particular the lack of secure base activity across the whole range of behaviours described by Ainsworth and Bell (1970). As a result, Prato-Previde *et al.* (2003) assert that the dog-human relationship as recorded by this procedure cannot be seen to conform fully to an actual attachment.

### 2.4.3. A counterbalanced version of Ainsworth's Strange Situation Procedure with dog-human pairs (Palmer and Custance, 2008).

In response to Prato-Previde *et al.*'s (2003) assertion that the order effects inherent in the SST (diminishing curiosity over time and/or diminishing wariness as the stranger becomes more familiar) make it impossible to establish whether or not owners function as a secure base for their companion dogs, Palmer and Custance (2008) ran a modified version of the Ainsworth procedure. In this version, thirty-eight adult dog-owner pairs were randomly placed in two conditions. Both conditions comprised six, three minute episodes. In condition A, dogs entered an unfamiliar room along with their owner; a stranger entered; the dog was left alone with the stranger; the dog was left entirely alone, the owner returned, and finally the dog was left alone with the stranger for a second time. In condition B, the dogs entered an unfamiliar room with the stranger; their owner entered; the dog was left alone with their owner; the dog was left entirely alone; the stranger returned; and finally the dog was left alone with their owner for the second time (Palmer & Custance, 2008).

This counterbalanced version of the strange situation revealed that the dogs did indeed use their owners as a secure base from which to interact, etc. This was evident in the dogs' readiness to explore the room, remain passive, play with the stranger, and engage in individual play more when their owner was present than when they were alone with the stranger, or when they were left completely alone, regardless of the order in which the experimental procedure was run (Palmer and Custance , 2008). This adds further evidence to the idea that the relationship between companion dogs and their owners does constitute an attachment which is remarkably similar to that observed in human infants and their mothers (Prato-Previde *et al.*, 2003; Topal *et al.*, 1998), and that the modified version of the original Ainsworth (1979) procedure is an effective measure of this relationship. This challenges the view that possible order effects in the procedure, as previously mentioned, seriously bias the data that can be gathered.

### 2.4.4. Physiology and observable behaviour of dogs in the Strange Situation (Palestrini, Prato-previde, Spiezio, & Verga, 2005)

Ainsworth's original procedure with human infants and their mothers was designed to inflict increasing, moderate stress on the infant in order to activate the attachment system to allow for attachment-type classification (Ainsworth, 1969). More recent studies, which have modified the original procedure for use with companion dogs, reveal that the procedure is an effective means by which to elicit similar attachment systems in canines (Prato-Previde *et al.*, 2003; Topal *et al.*, 1998). However, to clarify this further, Palestrini *et al.* (2005) have recorded both physiological and behavioural measures, to assess to what extent dogs' heart-rate could be treated as a correlate of behaviour, and whether or not the Strange Situation test for dogs is actually a procedure for producing increasing, moderate stress. Several studies indicate that heart rate may be used as a psychophysiological measure of dogs' affective and cognitive responses to different stimuli and environmental conditions (Beerda, *et al*., 1997; Fox, 1978; Murphee *et al*., 1967). In addition, heart rate is an easily accessible and quantifiable physiological measure that allows us to link physiology and observable behaviour (Beerda *et al*., 1998; Kostarczyk, 1992; Mason & Mendl, 1993).

Utilising the modified Ainsworth procedure from a previous study (Prato-Previde *et al.*, 2003), Palestrini *et al.*, (2005) strapped a lightweight heart monitor to the dogs' chests during the eight-episode procedure. The heart rate device was activated at the start of the first episode, and synchronised with video recording of behaviour to allow a comparison of physiological output and observed behaviour. In addition, the number of vocalisation bouts during the experiment was also recorded, given that vocal behaviour has been shown to be a strong indicator of stress and anxiety in dogs (Fox 1978; Overall *et al*., 1999).

The results show that in both behavioural and physiological terms, being separated from their owners, and remaining alone, or with a stranger, does cause a stress reaction in adult dogs. The behavioural responses are consistent with those observed in previous studies of this type (Prato-Previde *et al.*, 2003; Topal *et al.*, 1998). Heart rate varied significantly in relation to levels of physical activity, but also in relation to different episodes of the experiment. For example, during the two isolation episodes, dogs were significantly less active than during the baseline (which was set in the first episode) but despite this their heart rate remained high (Palestrini *et al.*, 2005). Research indicates that emotional states during stress can be accompanied by cardiovascular responses even during periods of low-level activity (Galosy & Gabelein, 1977).

However, changes in heart rate in this context are difficult to interpret given that dogs' excitement at greeting their owner, or meeting a new "friendly" person might both result in elevated heart rate. Conversely, it is possible that the presence of a stranger constitutes a stressor for some dogs, and likewise, causes an increase in cardiovascular activity. Nonetheless, this study makes a valuable contribution to our understanding of dogs' reactions to environmental changes, and in particular to our understanding of the effects of the strange situation test on dogs' behaviour and heart rate.

### 2.4.5. Attachment to humans: A comparative study on wolf and dog puppies (Topal et al., 2005).

The domestication of the dog, just as for many other species, is an example of artificial and accidental selection by humans. This has involved the adaptation of the dog, in a number of ways, to the human environment (Savolainen *et al*., 2002), and it is highly likely that this process has altered not only the morphology of the dog, but also its behaviour and behaviour control systems (Coppinger & Coppinger, 2002). Various studies show evidence for the relatively high levels of social competence of dogs when interacting with humans: these include communication (Agnetta *et al*., 2001; Miklosi *et al*., 2000; Miklosi *et al*., 1998; Soprani *et al*., 2001, 2002), cooperation (Naderi *et al*., 2001, 2002) and social learning (Kubinyi *et al*., 2003). Recent studies show that while dogs are keen to look at humans, and to use human directional gestures in problem-solving situations, wolves are not (Hare *et al*., 2002; Miklosi *et al*., 2003). This lends support to the hypothesis that genetic predispositions selected for in association with the process of domestication, have led to the emergence of social cognitive abilities in dogs, including the tendency to attach quickly to humans.

Topal *et al.* (2005) investigated the attachment behaviour of hand reared and extensively socialised wolf and dog puppies and pet dog puppies exposed to standard socialisation processes, by using the modified version of the Ainsworth Strange Situation test previously used (Topal *et al.*, 1998). They found that the attachment behaviours of sixteen-week-old dog puppies were essentially the same as for adult dogs, and that the puppies' socialisation history had only a minor effect on their attachment behaviours. In other words, the frequent exposure of hand-reared puppies to various humans, novel objects and situations did not reduce significantly the distress evoked in them by the strange situation procedure (Topal *et al.*, 2005).

However, the wolf puppies did not show similar patterns of attachment to those of the two dog groups in this study. Despite extensive socialisation, the wolf puppies were no more responsive to their familiar handler than to the unfamiliar stranger (Topal *et al.*, 2005). This strongly implies that it is not simply the process of socialisation that produces canine attachment to humans; rather it is the result of specific breeding processes (if we suppose that dogs are the descendants of a small number of grey wolves) such as selection for particular fur colour, and their less intentional side effects such as placidity and paedomorphosis, which have fragmented the well-organised behaviour repertoire of the wolf (Hemmer, 1990). The dog's capacity for attachment to humans may well be due to specific genetic changes caused by selective breeding for dependency and attachment

behaviours analogous to those of human infants (Cantazaro, 1984; cited in Serpell, 1995). Similarly, changes resulting from selective breeding, as noted above, are also strongly implicated in the emergence of communicative abilities in dogs (Miklosi *et al.*, 2003).

Topal et al.'s (2005) study is important in a number of ways. Firstly, it provides further evidence of the efficacy of the Ainsworth Strange Situation test for use with canines, given that extensive socialisation did little to reduce the stress of the strange situation test for the dogs (and so did not bias the results at all); secondly it provides experimental evidence of the likely genetic changes associated with the evolution of attachment behaviour in dogs; and thirdly, it clearly demonstrates the difference between "taming" an animal, and domesticating one. Even wolf pups raised by humans from a very young age retain their wolf attachment behaviour system, which does not allow anything like a comprehensive "adoption" of the wolf into a human social system, since this relies upon a level of dependency and responsiveness to humans which is simply not found in the wolf (Mech, 1988).

# Chapter 3: The development of the companion dogs attachment scale (CDA scale)

## 3.1. Introduction

In order to establish the perceived levels of attachment and comfort of dog-owners, measurement tools were required in the form of questionnaires to be completed by dog owners. A review of the literature in this area established that a number of such tools were available which would be partially suitable for the purposes of the proposed study. However, no single existing scale measured attachment, comfort and well-being gained from dog-owning and some of the negative aspects of dog-keeping in a single instrument. This chapter details the development of such a scale.

Much of the research conducted to date suggests that there is evidence to imply a positive correlation between companion animal ownership and human well–being. This relationship is frequently utilised in research in this area (see: Akiyama, Holtzman & Britz, 1986-7; Bolin, 1987; Culliton, 1987; Lago, Connell & Knight, 1983; Ory & Goldberg, 1983; Poresky, Hendrix, Mosier & Samuelson, 1987). The relationship is complex, given the enormous variation in human perception of pet-owning and the subjectivity of pet-owner self-reports on the effects of pet-ownership. It remains poorly understood in any great detail, particularly in terms of the measurement of the fundamental issues of attachment and perceived comfort. Various attempts have been made to construct attachment and comfort measures with adequate reliability and validity, which would allow us to assess, with scientific rigour, the human–companion animal relationship. Examples include the Companion Animal Bonding Scale (Poresky *et al.*, 1987), the Pet Attitude Inventory (Wilson, Netting & New, 1987), the Pet Attitude Scale (Holcomb, Williams & Richards, 1985), the Pet Relationship Scale (Lago, Kafer, Delaney & Connell, 1988), the Lexington Attachment to Pets Scale (Johnson, Garrity & Stallones, 1992), and the Comfort from Companion Animal Scale (Zasloff, 1996).

The Lexington Attachment to Pets Scale (LAPS) consists of 23 attachment items (statements) which were developed based upon a review of various other scales (see: the Companion Animal Bonding Scale, Poresky *et al.* ., 1987; the Pet Attitude Inventory, Wilson *et al.*, 1987; and the Pet Attitude Scale, Templer *et al.,* 1981), and upon research into the links between human emotional ties to animals and owners' health (see: Garrity *et al.,* 1989; Lago *et al.*, 1988; Ory & Goldberg 1983). Respondents to the original LAPS were required to state whether they strongly agreed, somewhat

agreed, somewhat disagreed, or strongly disagreed with each statement, via a telephone interview (for wording of the scale see 3.2.1 below).

A total of 412 interviews were completed in Johnson et al.'s (1992) original LAPS study and they analysed the data for internal consistency alpha (Cronbach, 1951) and using item response theory models (the two parameter binary Logistic IRT model). The analysis showed a high degree of internal consistency (alpha 0.937) between questionnaire items, and the IRT analysis (to determine the extent to which each question provided a reasonable 'fit' to the latent concept of 'attachment to pet') suggested an overall acceptable fit (G squared = 102.5, df= 93, $p$=0.235). The LAPS was thus considered a suitably valid measure of owner attachment to companion dogs, for use in the proposed study.

The Comfort from Companion Animals Scale (CCAS) consists of thirteen items designed to measure the perceived level of emotional comfort owners receive from pets. To this end the CCAS contains only items relating to emotional aspects of pet-owner relationships, such as love, trust and loyalty, and contains no reference to specific behavioural traits of pets associated with such things as exercise, training, grooming, etc. Nine of the items were derived from work by Katcher and Beck (1983) on how animals contribute to wellbeing. The other four items were taken from studies of human interactions with wildlife (Lott, 1988). Respondents to the original CCAS were required to state their level of agreement or disagreement with the statements in the same way as in the LAPS (for wording of the scale see 3.2.1 below).

A total of 145 pet owners completed the CCAS and the data were analysed for construct validity and internal consistency alpha (alpha 0.85, $p$<0.01). Accordingly, the CCAS was also considered a suitable measure for use in the proposed study given that it was used to measure 'comfort' in Zasloff's (1996) study, and therefore consists of items which are qualitatively different from those in the LAPS. Thus, it was felt that a combination of items from both the LAPS and the CCAS would yield a comprehensive tool for the assessment of attachment to companion dogs. The research presented here aims to give an analysis of some of the psychometric properties of the modified LAPS and CCAS, and to develop a new attachment instrument, the Companion Dogs Attachment (CDA) scale, and some of its psychometric properties.

## 3.2. Method

### 3.2.1.Modification of the scales

The LAPS and CCAS were piloted on a sample of twenty dog owners in order to do a preliminary re - check on the utility of the scales. A small sample of participants were used at this stage as both the LAPS and the CCAS had previously been administered to much larger numbers of respondents (412 and 177 respectively) and been shown to have adequate internal consistency. The participants were invited to comment on the scales in terms of how understandable, realistic, and useful as measures of comfort or attachment they seemed. Fifteen of the participants expressed a desire to indicate at least some negative statements about their relationship with their dog. Neither the LAPS nor the CCAS explicitly allow this, and so it was decided that the scales needed to be modified to allow for a more realistic measure of what it means to be attached to, or derive comfort from, dog owning.

Negative statements were formulated by asking the pilot participants to write down the kind of negative statement they would like to be able to make about their relationship with their dog in terms of the two separate scales. Some of the respondents were keen to point out specific problems associated with getting a puppy such as barking and howling at night in the first few days/weeks of ownership (separation anxiety), but more generic issues were selected which could apply to both puppies and older dogs as these tended to include specific puppy issues (e.g. barking at night could be considered more generally as an irritating habit).

For each scale there were a small number of negative issues which each of the fifteen participants referred to in relation to their companion dog. These were: time pressures, holiday difficulties, financial costs, unpleasant habits, irritating habits, embarrassing habits, impracticalities, emotional costs, lack of loyalty and excessive responsibility. Three of the negative issues described by respondents here were also reported by respondents to a much larger survey (Brown *et al*., 2007), so it would appear that restriction on freedom of movement, financial cost and time commitment are three commonly reported drawbacks of dog-owning. This resulted in seven negative items being added to the LAPS, and seven negative items being added to the CCAS (see Tables 3.2 and 3.4 for wording of the modified scales, and appendix A for a screenshot of the scales as they appeared on the web). The revised scales were then re-piloted on the same participants, No further shortcomings of the scales were expressed by the pilot sample of dog owners.

### 3.2.2. Data Collection

The revised LAPS and CCAS scales were posted on the internet. The survey software allowed respondents to indicate their level of agreement/disagreement with each statement online. At the end of each questionnaire respondents were invited to submit their answers by pressing a button, and given the opportunity to request feedback by automatically emailing the researcher. The data were anonymous and collected electronically as email replies.

A brief email message explaining the aims of the research, and inviting volunteers to take part was circulated to all members of the psychology department at the University of Exeter. This message was then forwarded by members of the psychology department, to various individuals and organisations around the world. Replies were received from America, Australia, Italy, Spain and the United Kingdom. In all, 548 respondents completed both the LAPS and the CCAS and the data was analysed to allow a reduction in the number of items and selection of the most pertinent items. Descriptive and inferential statistical analyses and explanations were sent electronically to all respondents who had requested feedback.

After analysing the responses to the LAPS and the CCAS (reducing the original 50 item total to thirteen) the resulting thirteen-item scale was compiled into a questionnaire which also included general questions on age, gender, dog-keeping history, etc. of the owner (as for the original LAPS and CCAS) and copies of this were left in the reception areas of two dog-training classes, a veterinary surgery, and a dog behaviour therapist's office. A sign invited owners of dogs with problems to fill them in anonymously (requesting feedback if required) or individuals who were living with a dog, but who did not consider themselves to be the primary carer/owner of the dog (requesting feedback if required). Several of the problem–dog owners took a questionnaire home with them for a family member to fill in who did not consider themselves the primary owner/carer of the animal. These sample-types were chosen as it was felt likely that they should get a lower score on the CDA scale, thus allowing us to ascertain its utility as a measure of high, medium and low scores on an attachment instrument. The completed questionnaires were retrieved daily until 100 of each sample type had been gathered as this was considered a large enough sample to allow meaningful inferential analysis (see Kline, 1984). Respondents who had requested feedback were duly contacted and a description/explanation of their score was sent by email to them.

### 3.2.3. Analysis Methods

The data was investigated using the Anderson-Darling test and found to be normally distributed thus allowing the use of parametric inferential statistics. The scales were analysed for alpha internal consistency coefficients (Cronbach, 1951), and a principal-components analysis (PCA) was conducted to examine the structure of both the LAPS and the CCAS (principal axis factoring [PAF], was also conducted which yielded a very similar structure to the PCA, but it was felt that the PCA gave a clearer solution). Using a varimax rotation procedure, a small number of orthogonal factors were identified for each scale, and these were also analysed in terms of their internal reliability using Cronbach's alpha. The criteria used in deciding which PCA factors to include in the analysis was to select only factors with initial eigenvalues greater than one, and then to look to the cumulative variance and introduce a cut-off point when the variance accounted for reached 50% or above within factors, and finally (to clarify the decision) via inspection of the scree plots, selecting a cut-off point where the "rubble" from the analysis levelled out.

In addition, the data were described in terms of frequencies and percentages, and from these, bar charts were constructed to allow participants requiring feedback to see a visual depiction of the overall responses. Written explanations of the bar charts were also included in the feedback. A new scale, the CDA scale, was constructed from the pertinent items from the two original scales, and this was then re-analysed, using the relevant combined web data gathered for the modified LAPS and CCAS, in terms of test-retest, alpha internal consistency, PCA and multiple regression one-way ANOVA to examine the relationships between the CDA scale and some respondent characteristics (demographics, social network ties and other characteristics important to owner-dog interaction) as existing research shows that variables within some categories of respondent characteristics are associated with attachment to companion animals (Serpell, 1981; Kidd and Kidd, 1989; Stallones et al. 1990).

Reliability and validity of the new scale was further examined using the data from two entirely new opportunity samples of dog-owners, 100 with dogs the owners described as having behavioural problem(s) and 100 from people who had dogs living with them but who did not describe themselves as the primary owner/carer of the animal. This was also done via test-retest, alpha-internal consistency, PCA and multiple regression one-way ANOVA to examine the relationships between the CDA scale and three categories of respondent characteristics (demographics, social network ties and other characteristics important to owner-dog interaction).

### 3.3. Results

The internal consistency of both the LAPS and the CCAS, and the factors resulting from the principal components analysis of them (henceforth known as the Companion Dogs Attachment scale (CDA scale)) were estimated as detailed above in 3.2.3.

#### 3.3.1. Comfort from Companion Animals Scale

Internal consistency of the twenty comfort statements was estimated using coefficient alpha. The coefficient for these items was 0.790. The principal components analysis identified a number of orthogonal factors, six of which had eigenvalues greater than one. Inspection of the scree plot and consideration of the cumulative percentage of the variance accounted for by these factors indicated that three factors were sufficient to represent the salient dimensions of the CCAS. Examination of the items loading most highly on each of the three factors suggested that the first represents a ’physical activities and feeling loved’ dimension. Items included in factor two indicate a ’giving and receiving of positive emotions’ dimension. The third factor contained items which are concerned with some of the more ’negative aspects’ of dog–keeping. Cronbach’s alpha coefficients for scales constructed from the items loading on these three factors were 0.842, 0.757 and 0.775 respectively. The scree plot is shown in Figure 3.1., the total variance is explained in Table 3.1., and the factor loadings and items are shown in Table 3.2.

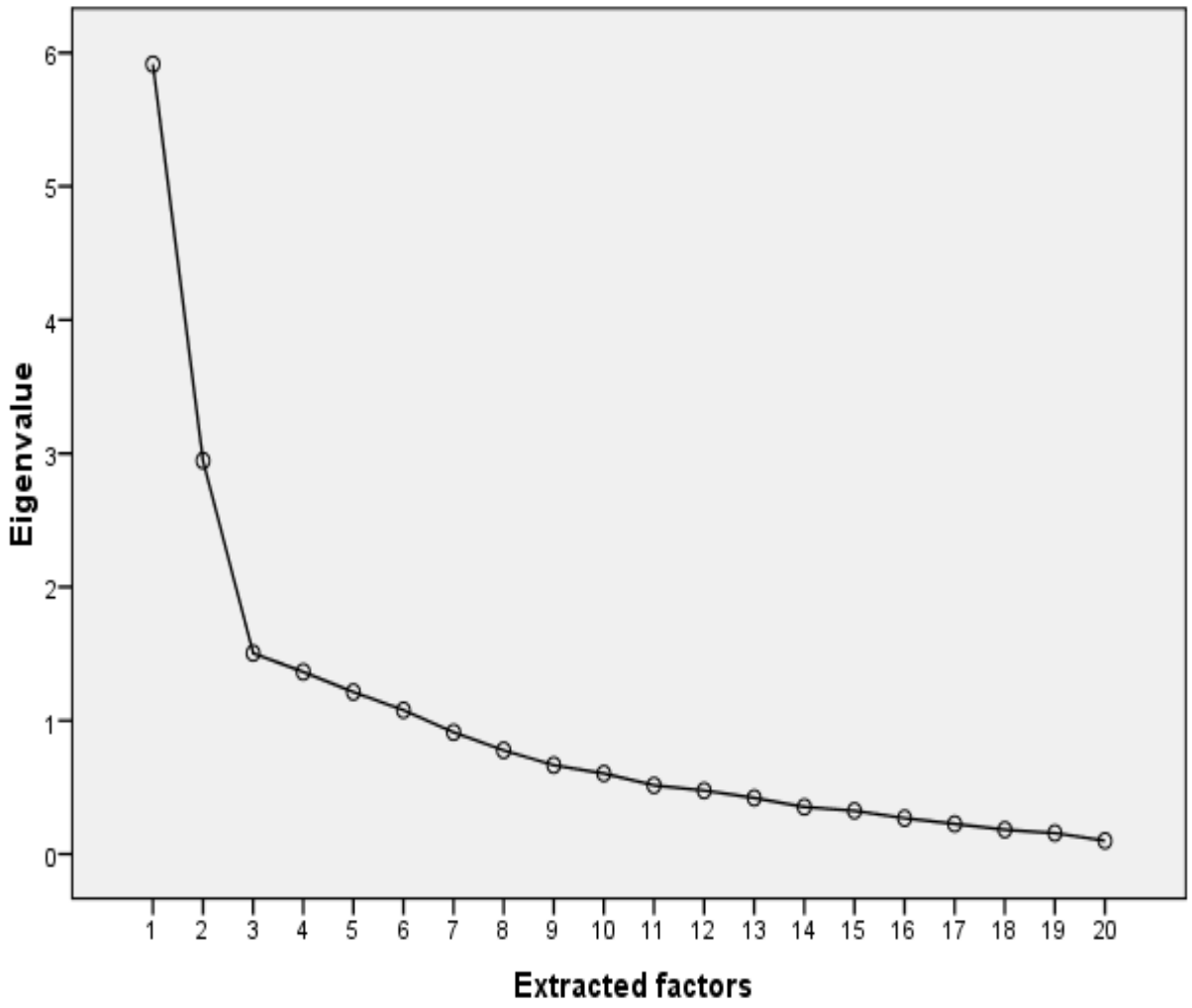



Figure 3.1. Scree plot generated by a principal components analysis of CCAS questionnaire items.

**Table 3.1. Total variance of CCAS PCA explained.**

| Questionnaire items | Initial eigenvalues | Extraction sums of squared loadings | | Rotation sums of squared loadings | | | Rotation sums of squared loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| 1 | 5.915 | 29.576 | 29.576 | 5.915 | 29.576 | 29.576 | 3.744 | 18.722 | 18.722 |
| 2 | 2.946 | 14.729 | 44.305 | 2.946 | 14.729 | 44.305 | 3.150 | 15.752 | 34.474 |
| 3 | 1.504 | 7.522 | 51.827 | 1.504 | 7.522 | 51.827 | 2.772 | 13.861 | 48.335 |
| 4 | 1.364 | 6.821 | 58.648 | 1.364 | 6.821 | 58.648 | 1.742 | 8.709 | 57.044 |
| 5 | 1.213 | 6.067 | 64.715 | 1.213 | 6.067 | 64.715 | 1.496 | 7.479 | 64.523 |
| 6 | 1.078 | 5.388 | 70.103 | 1.078 | 5.388 | 70.103 | 1.116 | 5.580 | 70.103 |
| 7 | .912 | 4.559 | 74.662 | | | | | | |
| 8 | .777 | 3.884 | 78.546 | | | | | | |
| 9 | .666 | 3.329 | 81.875 | | | | | | |
| 10 | .603 | 3.017 | 84.892 | | | | | | |
| 11 | .515 | 2.574 | 87.465 | | | | | | |
| 12 | .476 | 2.378 | 89.843 | | | | | | |
| 13 | .421 | 2.104 | 91.947 | | | | | | |
| 14 | .353 | 1.763 | 93.709 | | | | | | |
| 15 | .324 | 1.620 | 95.329 | | | | | | |
| 16 | .269 | 1.345 | 96.674 | | | | | | |
| 17 | .226 | 1.129 | 97.803 | | | | | | |
| 18 | .183 | .914 | 98.716 | | | | | | |
| 19 | .157 | .787 | 99.503 | | | | | | |
| 20 | .099 | .497 | 100.000 | | | | | | |

**Table 3.2. CCAS PCA factor loadings and items**

| Item | | Factor 1 | Factor 2 | Factor 3 |
|---|---|---|---|---|
| 17 | I get comfort from touching my dog | 0.895 | | |
| 18 | I enjoy watching my dog | 0.736 | | |
| 5 | My dog provides me with pleasurable activity | 0.688 | 0.306 | |
| 6 | My dog makes me feel loved | 0.578 | 0.472 | |
| 13 | My dog makes me play and laugh | 0.543 | 0.425 | |
| 16 | I get more exercise because of my dog | 0.409 | | |
| 1 | My dog provides me with companionship | 0.358 | | |
| 14 | Having a dog gives me something to love | 0.334 | 0.754 | |
| 20 | My dog makes me feel trusted | 0.302 | 0.686 | |
| 7 | My dog is a source of constancy in my life | 0.372 | 0.619 | |
| 9 | My dog makes me feel needed | | 0.599 | |
| 3 | Having a dog gives me something to care for | | 0.547 | |
| 11 | My dog makes me feel safe | | 0.478 | |
| 19 | My dog is not effective as a guard dog | | 0.393 | |
| 12 | My dog sometimes annoys me | | | 0.880 |
| 15 | My dog sometimes embarrasses me | | | 0.743 |
| 10 | My dog has some unpleasant habits | | | 0.730 |
| 4 | Having a dog sometimes stops me from going away | | | 0.460 |
| 2 | Having a dog is a tie | | | 0.369 |
| 8 | My dog costs me too much money | | | 0.364 |
| | | | | |
| Eigenvalue | | 5.915 | 2.946 | 1.504 |
| % of variance | | 29.576 | 14.729 | 7.522 |

### 3.3.2. Lexington Attachment to Pets Scale

The internal consistency of the 30 attachment statements was also estimated using coefficient alpha. The coefficient for these items was 0.906. The principal components analysis identified a number of

orthogonal factors, eight of which had eigenvalues greater than one. Inspection of the scree plot and consideration of the cumulative percentage of the variance accounted for by these factors indicated that three factors were sufficient to represent the salient dimensions of the LAPS. Examination of the items loading most highly on each of these factors suggested that the first represents a ’companionship and positive emotion’ dimension. Items included in factor 2 indicate a ’close relationship’ dimension. The third factor contained items, which are primarily concerned with ’good health.’ Cronbach’s alpha coefficients for these scales based on the items loading on three factors were 0.843, 0.877 and 0.783, respectively. The scree plot is shown in Figure 3.2., for explanation of the total variance see Table 3.3. The factor loadings and items are shown in table 3.4.

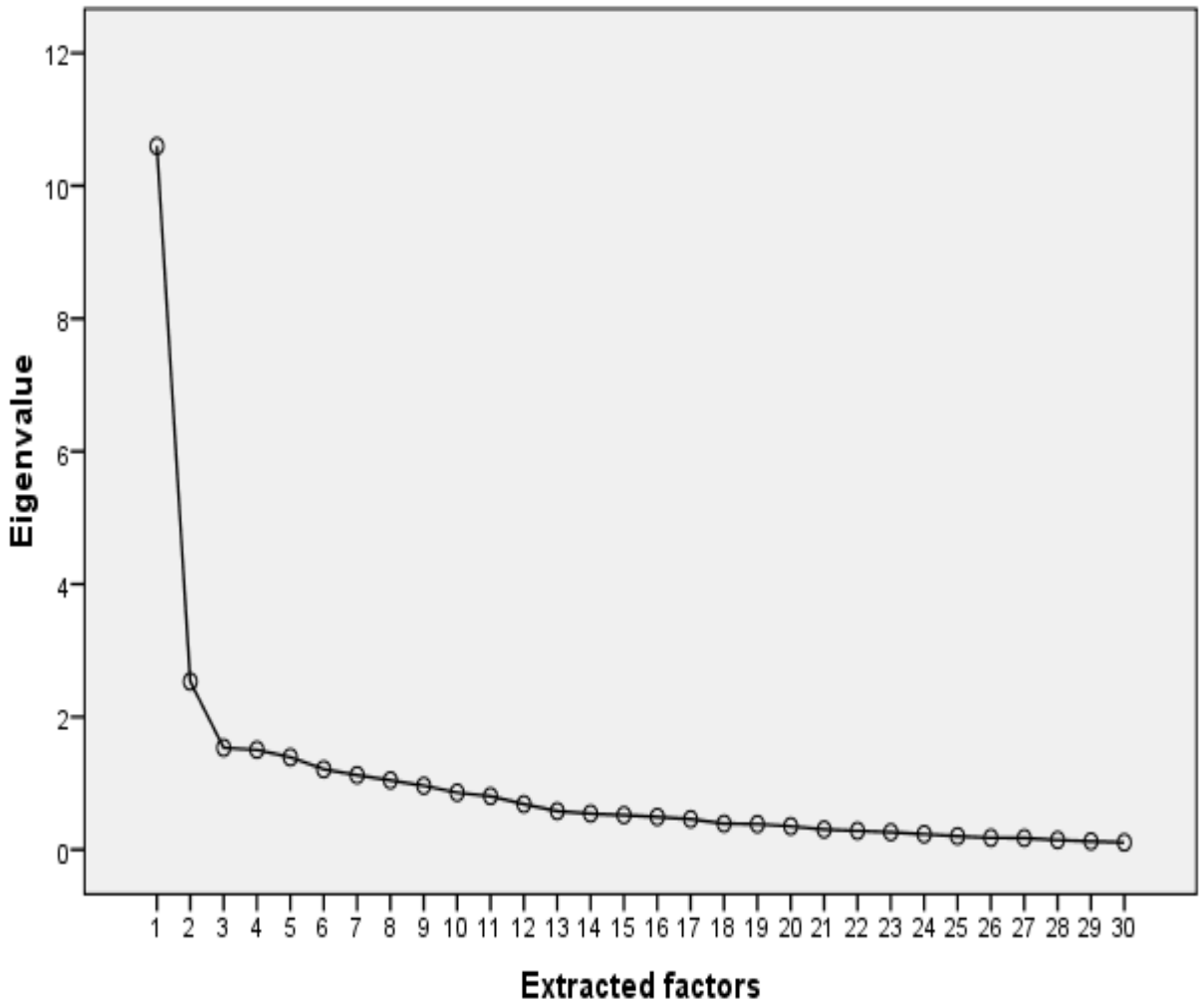



Figure 3.2. Scree plot generated by LAPS PCA.

**Table 3.3. Total variance of LAPS PCA explained**

| Factor | Initial Eigenvalues | | | Extraction sums of squared loadings | | | Rotation sums of squared loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| 1 | 10.598 | 35.326 | 35.326 | 10.598 | 35.326 | 35.326 | 4.921 | 16.404 | 16.404 |
| 2 | 2.533 | 8.443 | 43.770 | 2.533 | 8.443 | 43.770 | 3.020 | 10.068 | 26.472 |
| 3 | 1.535 | 5.118 | 48.887 | 1.535 | 5.118 | 48.887 | 2.914 | 9.713 | 36.185 |
| 4 | 1.503 | 5.011 | 53.899 | 1.503 | 5.011 | 53.899 | 2.233 | 7.442 | 43.626 |
| 5 | 1.392 | 4.641 | 58.540 | 1.392 | 4.641 | 58.540 | 2.225 | 7.416 | 52.042 |
| 6 | 1.211 | 4.038 | 62.578 | 1.211 | 4.038 | 62.578 | 2.096 | 6.988 | 58.030 |
| 7 | 1.123 | 3.743 | 66.321 | 1.123 | 3.743 | 66.321 | 1.844 | 6.147 | 64.177 |
| 8 | 1.046 | 3.487 | 69.807 | 1.046 | 3.487 | 69.807 | 1.689 | 5.630 | 69.807 |
| 9 | .964 | 3.212 | 73.019 | .964 | 3.212 | 73.019 | 1.143 | 3.810 | 38.608 |
| 10 | .858 | 3.859 | 75.878 | .858 | 2.859 | 75.878 | 1.136 | 3.788 | 42.396 |
| 11 | .807 | 2.689 | 78.567 | .807 | 2.689 | 78.567 | 1.128 | 3.760 | 46.156 |
| 12 | .687 | 2.290 | 80.857 | .687 | 2.290 | 80.857 | 1.111 | 3.705 | 49.860 |
| 13 | .580 | 1.935 | 82.792 | .580 | 1.935 | 82.792 | 1.077 | 3.591 | 53.452 |
| 14 | .543 | 1.811 | 84.603 | .543 | 1.811 | 84.603 | 1.072 | 3.573 | 57.024 |
| 15 | .520 | 1.735 | 86.337 | .520 | 1.735 | 86.337 | 1.058 | 3.528 | 60.552 |
| 16 | .494 | 1.646 | 87.983 | .494 | 1.646 | 87.983 | 1.052 | 3.508 | 64.060 |
| 17 | .460 | 1.533 | 89.516 | .460 | 1.533 | 89.516 | .980 | 3.265 | 67.326 |
| 18 | .392 | 1.306 | 90.822 | .392 | 1.306 | 90.822 | .979 | 3.264 | 70.589 |
| 19 | .384 | 1.280 | 92.103 | .384 | 1.280 | 92.103 | .916 | 3.053 | 73.642 |
| 20 | .352 | 1.173 | 93.276 | .352 | 1.173 | 93.276 | .905 | 3.018 | 76.660 |
| 21 | .303 | 1.010 | 94.286 | .303 | 1.010 | 94.286 | .895 | 2.985 | 79.644 |
| 22 | .284 | .945 | 95.231 | .284 | .945 | 95.231 | .885 | 2.950 | 82.595 |
| 23 | .262 | .874 | 96.106 | .262 | .874 | 96.106 | .883 | 2.944 | 85.538 |
| 24 | .233 | .778 | 96.884 | .233 | .778 | 96.884 | .802 | 2.673 | 88.211 |
| 25 | .202 | .675 | 97.559 | .202 | .675 | 97.559 | .788 | 2.628 | 90.839 |
| 26 | .178 | .592 | 98.151 | .178 | .592 | 98.151 | .759 | 2.531 | 93.370 |
| 27 | .175 | .585 | 98.736 | .175 | .585 | 98.736 | .685 | 2.284 | 95.654 |
| 28 | .145 | .484 | 99.219 | .145 | .484 | 99.219 | .514 | 1.713 | 97.367 |
| 29 | .126 | .420 | 99.640 | .126 | .420 | 99.640 | .475 | 1.584 | 98.951 |
| 30 | .108 | .360 | 100.000 | .108 | .360 | 100.000 | .315 | 1.049 | 100.000 |

**Table 3.4. LAPS PCA factor loadings and items.**

| Factor | | Factor 1 | Factor 2 | Factor 3 |
|---|---|---|---|---|
| 26 | My dog makes me feel happy | 0.764 | | |
| 27 | I feel my dog is part of my family | 0.721 | | 0.317 |
| 25 | I consider my dog to be a great companion | 0.698 | | |
| 23 | Owning a dog adds to my happiness | 0.673 | | |
| 30 | I consider my dog to be a friend | 0.634 | 0.436 | |
| 22 | I would do almost anything to take care of my dog | 0.583 | 0.386 | |
| 15 | I often talk to other people about my dog | 0.452 | 0.323 | 0.338 |
| 24 | I play with my dog quite often | 0.450 | | |
| 10 | I think my dog is just a pet | 0.382 | | |
| 8 | I enjoy showing other people pictures of my dog | 0.356 | 0.337 | |
| 28 | I am not very attached to my dog | 0.352 | | |
| 6 | The feelings I have for my dog are not as intense as the feelings I have for my family and friends | 0.340 | | 0.303 |
| 14 | | | | |
| 17 | | | | |
| 16 | My dog understands me | | 0.775 | |
| 13 | My dog knows when I am feeling bad | | 0.749 | |
| 4 | I believe my dog is my best friend | | 0.718 | 0.403 |
| 3 | I believe that dogs should have the same rights and privileges as family members | | 0.672 | 0.307 |
| 20 | My dog is oblivious to how I feel | | 0.627 | |
| 21 | My dog and I have a very close relationship | 0.449 | 0.540 | |
| 2 | Quite often I confide in my dog | | 0.505 | 0.406 |
| 18 | I believe that loving my dog helps me to stay healthy | 0.512 | | 0.640 |
| 29 | Having a dog does not benefit my health particularly | 0.441 | | 0.558 |
| 7 | I love my dog because he/she is more loyal to me than most of the people in my life | | 0.397 | 0.510 |
| 1 | My dog means more to me than any of my friends | | 0.474 | 0.501 |
| 19 | Dogs deserve as much respect as humans do | | 0.401 | 0.440 |
| 5 | Quite often my feelings towards people are affected by the way they react to my dog | | 0.395 | 0.421 |
| 11 | I love my dog because he/she never judges me | | 0.370 | 0.393 |
| 9 | My dog is not very loyal to me | | | 0.358 |
| 12 | | | | |
| Eigenvalue | | 10.474 | 2.432 | 1.519 |
| % of variance | | 34.914 | 8.106 | 5.065 |

A total of twenty-four items from the modified LAPS and CCAS load on single factors within the two PCA analyses (ten items from the LAPS and fourteen items from the CCAS), so these items were selected to analyse for use in the new scale. The remaining items from the modified LAPS and CCAS were deleted. This included seven of the negative statements which had been added to the

LAPS, as four of them appeared within the three rotated factors (and so loaded on already existing factors meaning that they did little to enhance or extend the new scale), and the remaining three negative statements did not appear in the three extracted factors at all (and so did not enhance any existing factors or constitute any new factors). This indicates that the addition of negative statements is not necessary to adequately represent the overall construct of the LAPS. Overall, this resulted in twenty-four items that were then re-analysed.

The internal consistency of the twenty-four attachment statements was estimated using coefficient alpha. The coefficient for these items was 0.781. The principal components analysis identified four orthogonal factors, but the solution offered by PAF was clearer and so is reported here. Examination of the items loading most highly on each of these factors suggested that the first represents a companionship and happiness dimension. Items included in factor two indicate a feeling needed and loved dimension. The third factor contained items that are primarily concerned with dogs as friends, and the fourth represents some negative aspects of dog keeping. Cronbach's alpha coefficients for these four factors were 0.779; 0.811; 0.686 and 0.669 respectively. The scree plot is shown in Figure 3.3., the total variance is explained in Table 3.5 and the factor loadings and items are shown in Table 3.6.

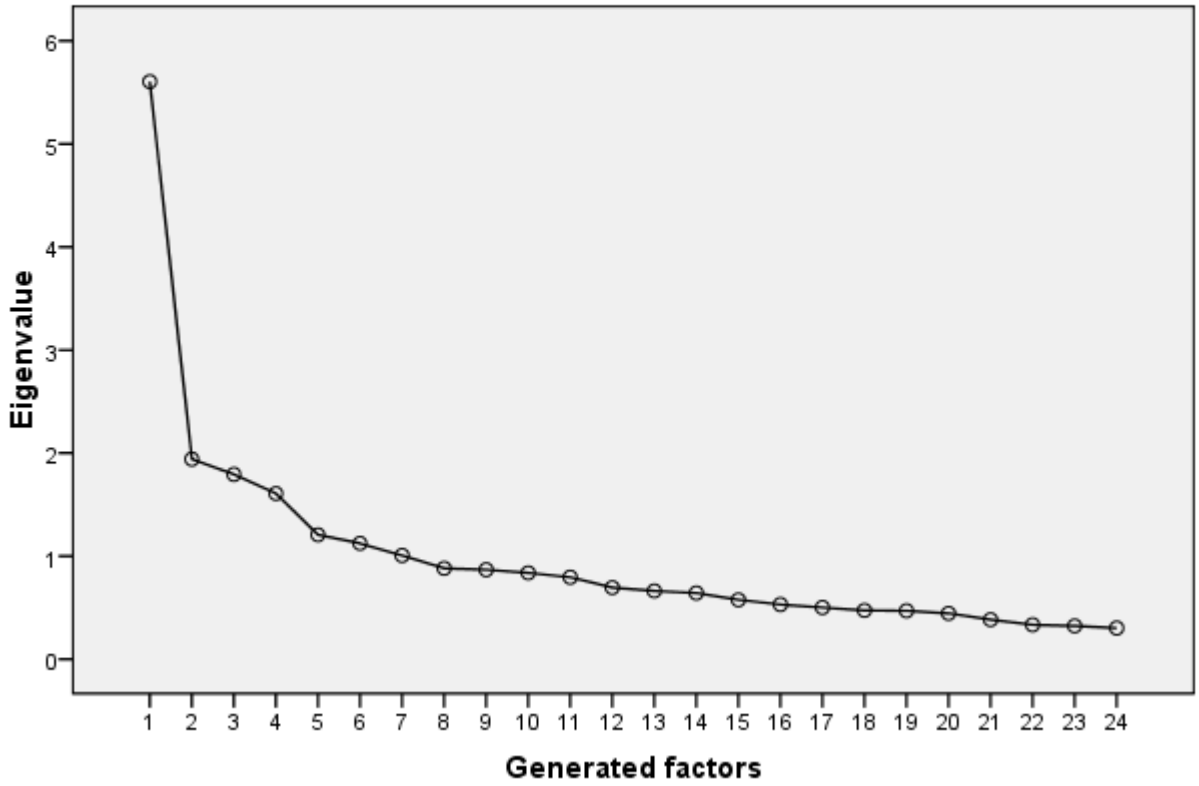



Figure 3.3. Scree Plot generated by preliminary CDA PCA

**Table 3.5. Total variance of preliminary CDA scale PAF explained.**

| Factor | Initial Eigenvalues | | | Extraction sums of squared loadings | | | Rotation sums of squared loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| 1 | 5.605 | 23.354 | 23.354 | 5.108 | 21.285 | 21.285 | 2.569 | 10.703 | 10.703 |
| 2 | 1.941 | 8.087 | 31.441 | 1.468 | 6.116 | 27.401 | 2.434 | 10.141 | 20.845 |
| 3 | 1.793 | 7.470 | 38.912 | 1.265 | 5.272 | 32.673 | 1.771 | 7.378 | 28.223 |
| 4 | 1.607 | 6.697 | 45.608 | 1.091 | 4.545 | 37.218 | 1.198 | 4.991 | 33.214 |
| 5 | 1.207 | 5.028 | 50.637 | .723 | 3.012 | 40.230 | 1.158 | 4.823 | 38.037 |
| 6 | 1.124 | 4.61 | 55.318 | .490 | 2.040 | 42.270 | .783 | 3.261 | 41.298 |
| 7 | 1.006 | 4.192 | 59.510 | .378 | 1.573 | 43.843 | .611 | 2.544 | 43.843 |
| 8 | .882 | 3.6738 | 63.183 | .882 | 3.673 | 63.183 | 1.017 | 4.238 | 34.285 |
| 9 | .868 | 3.617 | 66.800 | .868 | 3.617 | 66.800 | 1.017 | 4.238 | 38.523 |
| 10 | .838 | 3.492 | 70.292 | .838 | 3.492 | 70.292 | 1.016 | 4.234 | 42.757 |
| 11 | .795 | 3.311 | 73.603 | .795 | 3.311 | 73.603 | 1.008 | 4.200 | 46.958 |
| 12 | .694 | 2.893 | 76.497 | .694 | 2.893 | 76.497 | 1.007 | 4.196 | 51.154 |
| 13 | .662 | 2.758 | 79.254 | .662 | 2.758 | 79.254 | 1.007 | 4.195 | 55.349 |
| 14 | .642 | 2.675 | 81.930 | .642 | 2.675 | 81.930 | 1.003 | 4.181 | 59.529 |
| 15 | .576 | 2.399 | 84.329 | .576 | 2.399 | 84.329 | 1.003 | 4.180 | 63.709 |
| 16 | .530 | 2.210 | 86.539 | .530 | 2.210 | 86.539 | 1.002 | 4.174 | 67.883 |
| 17 | .501 | 2.087 | 88.626 | .501 | 2.087 | 88.626 | 1.000 | 4.165 | 72.048 |
| 18 | .474 | 1.973 | 90.599 | .474 | 1.973 | 90.599 | .996 | 4.151 | 76.199 |
| 19 | .470 | 1.958 | 92.557 | .470 | 1.958 | 92.557 | .984 | 4.102 | 80.301 |
| 20 | .445 | 1.853 | 94.410 | .445 | 1.853 | 94.410 | .972 | 4.049 | 84.350 |
| 21 | .383 | 1.596 | 96.006 | .383 | 1.596 | 96.006 | .966 | 4.024 | 88.375 |
| 22 | .334 | 1.390 | 97.396 | .334 | 1.390 | 97.396 | .953 | 3.972 | 92.347 |
| 23 | .323 | 1.344 | 98.740 | .323 | 1.344 | 98.740 | .926 | 3.860 | 96.207 |
| 24 | .302 | 1.260 | 100.000 | .302 | 1.260 | 100.000 | .910 | 3.793 | 100.000 |

**Table 3.6. Factor loadings and items for preliminary CDA scale.**

| Factor | | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|---|---|---|---|---|---|
| 9 | I consider my dog to be a great companion | 0.743 | | | |
| 6 | My dog makes me feel happy | 0.652 | | | |
| 11 | Owning a dog adds to my happiness | 0.643 | | | |
| 7 | I feel that my dog is part of my family | 0.618 | | | |
| 17 | My dog provides me with companionship | 0.489 | 0.360 | | |
| 18 | I play with my dog quite often | 0.376 | | | |
| 1 | My dog makes me feel loved | | 0.723 | | |
| 2 | My dog makes me feel trusted | | 0.705 | | |
| 13 | My dog makes me feel needed | | 0.667 | | |
| 3 | Having a dog gives me something to love | | 0.612 | | |
| 8 | I believe that my dog is my best friend | | | 0.734 | |
| 4 | My dog means more to me than any of my friends | | | 0.592 | |
| 20 | Quite often my feelings towards other people are affected by the way they react to my dog | | | 0.440 | |
| 22 | Dogs deserve as much respect as humans do | | | 0.413 | |
| 5 | I think my dog is just a pet | | | 0.380 | |
| 19 | My dog sometimes embarrasses me | | | | 0.755 |
| 16 | My dog has some unpleasant habits | | | | 0.662 |
| 10 | Having a dog does not particularly benefit my health | | | | |
| 21 | My dog sometimes annoys me | | | | 0.819 |
| 15 | Having a dog gives me something to care for | | | | |
| 14 | My dog is too much of a responsibility | | | | |
| 12 | I believe that dogs should have the same rights and privileges as family members | | | | |
| 23 | My dog demands too much of my time | | | | |
| 24 | I believe that loving my dog helps me to stay healthy | | | | |

**Table 3.7. Questionnaire items loading above 0.5 for each factor and subsequently included in the final CDA scale.**

| Item no | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|---|---|---|---|---|
| 9 | I consider my dog to be a great companion | | | |
| 6 | My dog makes me feel happy | | | |
| 11 | Owning a dog adds to my happiness | | | |
| 7 | I feel that my dog is part of my family | | | |
| 1 | | My dog makes me feel loved | | |
| 2 | | My dog makes me feel trusted | | |
| 13 | | My dog makes me feel needed | | |
| 3 | | Having a dog gives me something to love | | |
| 8 | | | I believe that my dog is my best friend | |
| 4 | | | My dog means more to me than any of my friends | |
| 19 | | | | My dog sometimes embarrasses me |
| 16 | | | | My dog has some unpleasant habits |
| 21 | | | | My dog sometimes annoys me |

Only eighteen of the selected twenty-four items were represented in the four extracted factors and only those loading at above 0.5 were chosen for the new scale. This resulted in thirteen remaining items to be known as the Companion Dog Attachment (CDA) scale.

### 3.3.3. The reliability and validity of the CDA scale.

Data from the 51 dog-owners from the Strange Situation for Dogs study (see chapter five this thesis) plus data from an opportunity sample of 100 owners of dogs with behavioural problems, and from 100 non-primary owners of dogs was analysed to provide an independent test of the reliability and to test for the validity of the new thirteen-item CDA scale.

Internal consistency of the thirteen statements for the three separate data samples was estimated using coefficient alpha, as well as for the overall merged sample. A principal components analysis identified the same four orthogonal factors in each case. Examination of the items loading most highly on each of these factors suggested that the first represents a companionship and happiness dimension. Items included in factor two indicate a feeling needed and loved dimension. The third factor contained items that are primarily concerned with dogs as friends, and the fourth represents some negative aspects of dog keeping (see Table 3.8).

**Table 3.8. Cronbach's alpha coefficients for the three CDA scale samples.**

| | Alpha coefficients per factor | | | | |
|---|---|---|---|---|---|
| Sample | Factor 1 Companionship and happiness | Factor 2 Feeling needed and loved | Factor 3 Dogs as friends | Factor 4 Some negative aspects of dog-keeping | Overall coefficient alpha per sample |
| 51 dog-owners taking part in the SST (see chapter 5 this thesis) | 0.954 | 0.994 | 0.955 | 0.899 | 0.962 |
| 100 owners of "problem" dogs | 0.946 | 0.954 | 0.952 | 0.872 | 0.732 |
| 100 non-primary dog-owners | 0.720 | 0.705 | 0.701 | 0.715 | 0.688 |
| Merged sample of 251 respondents | 0.967 | 0.954 | 0.952 | 0.872 | 0.836 |

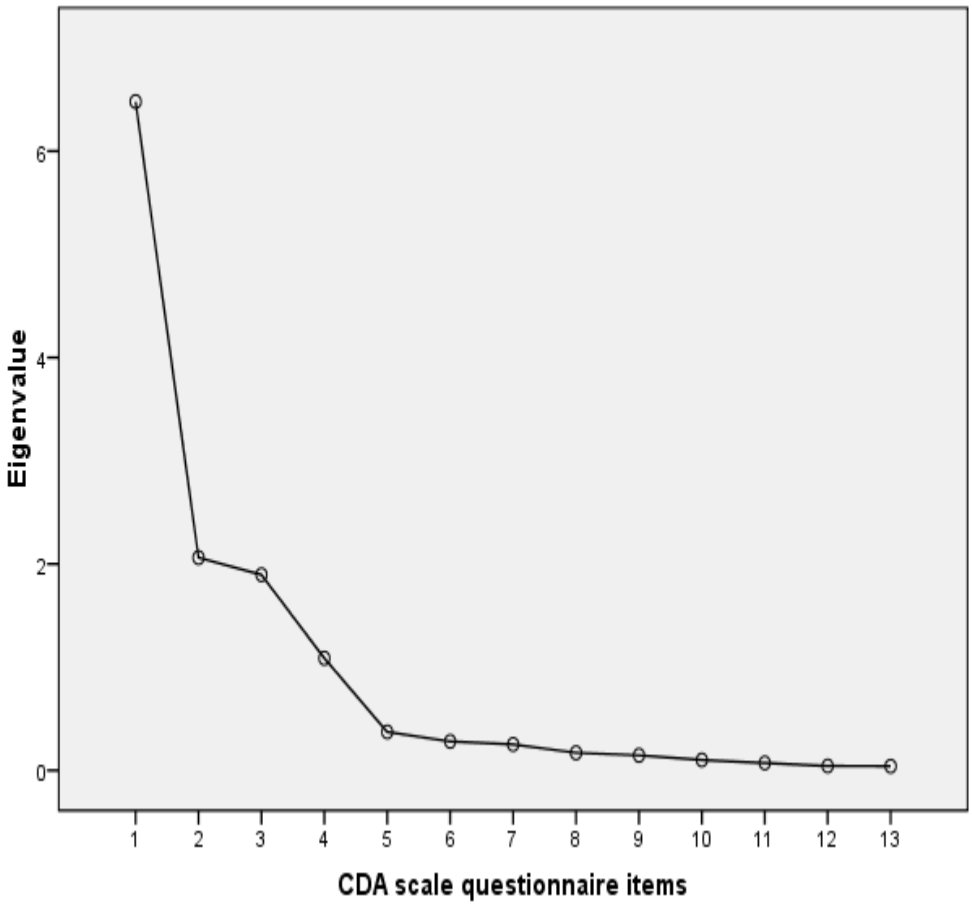



Figure 3.5. Scree Plot generated by CDA scale PCA for merged sample

**Table 3.9. Total variance of CDA scale PCA for merged sample explained.**

| Factor | Initial Eigenvalues | | | Extraction sums of squared loadings | | | Rotation sums of squared loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| 1 | 6.461 | 49.700 | 49.700 | 6.461 | 49.700 | 49.700 | 3.642 | 28.015 | 28.015 |
| 2 | 2.224 | 17.106 | 66.806 | 2.224 | 17.106 | 66.806 | 3.394 | 26.107 | 54.122 |
| 3 | 1.609 | 12.378 | 79.184 | 1.609 | 12.378 | 79.184 | 1.970 | 15.151 | 69.272 |
| 4 | 1.148 | 8.829 | 88.012 | 1.148 | 8.829 | 88.012 | 1.048 | 8.061 | 77.333 |
| 5 | .390 | 3.002 | 91.014 | .390 | 3.002 | 91.014 | .991 | 7.622 | 84.956 |
| 6 | .289 | 2.220 | 93.234 | .289 | 2.220 | 93.234 | .973 | 7.481 | 92.437 |
| 7 | .267 | 2.056 | 95.290 | .267 | 2.056 | 95.290 | .285 | 2.191 | 94.628 |
| 8 | .185 | 1.420 | 96.710 | .185 | 1.420 | 96.710 | .220 | 1.690 | 96.318 |
| 9 | .155 | 1.192 | 97.902 | .155 | 1.192 | 97.902 | .183 | 1.404 | 97.722 |
| 10 | .108 | .829 | 98.730 | .108 | .829 | 98.730 | .103 | .790 | 98.512 |
| 11 | .076 | .585 | 99.316 | .076 | .585 | 99.316 | .080 | .617 | 99.128 |
| 12 | .045 | .349 | 99.665 | .045 | .349 | 99.665 | .062 | .478 | 99.607 |
| 13 | .044 | .335 | 100.000 | .044 | .335 | 100.000 | .051 | .393 | 100.000 |

A one-way ANOVA was employed to examine the relationships between the CDA scale and three categories of respondent characteristics (demographics-gender and age; social network ties-household size, children in household, marital status; and pet-related variables-whether or not respondent grew up with pets, favourite type of pet, primary carer for dog) for the merged data sample in order to explore the construct validity of the new scale. This showed that there is a relationship between the scores on the CDA scale and the eight types of respondent characteristics included in the analysis. The results of the ANOVA are presented in Table 3.10.

Descriptive statistics reveal that 100% of women, and 100% of respondents over 40 years of age in the sample scored over 30 on the CDA scale. Scores of over 30 on the CDA scale were also

recorded for 97.5% of respondents whose households consisted of only one or two persons, for 99% of households without children, and for 95% of co-habiting, divorced and never married respondents. Finally CDA scores over 30 were also recorded for respondents expressing a preference for dogs as favourite pet species, for 95% of respondents who grew up with animals, and for households in which the companion dog is cared for by persons other than the respondent, or who share dog-care responsibilities. Scores of less than 30 on the CDA scale were thus recorded in general for men, for respondents in the 18-31 age-group, for married and separated persons, and for those stating their favourite pet species to be other than a dog or a cat.

**Table 3.10. One way analysis of variance for respondent characteristics by CDA scale scores.**

| Respondent characteristic | | Sum of squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Gender**<br>Male/Female | Between groups<br>Within groups<br>Total | 48.633<br>4.746<br>53.378 | 1<br>226<br>228 | 2.026<br>0.021 | 96.503 | 0.000 |
| **Age-group**<br>18-39, 40-59, 60+ | Between groups<br>Within groups<br>Total | 97.890<br>78.820<br>174.709 | 2<br>226<br>229 | 4.079<br>0.340 | 11.999 | 0.000 |
| **No of persons in household**<br>1, 2, 3-4, 5+ | Between groups<br>Within groups<br>Total | 93.145<br>112.074<br>205.219 | 3<br>226<br>230 | 3.881<br>0.496 | 7.826 | 0.000 |
| **Children in household**<br>Yes/No | Between groups<br>Within groups<br>Total | 48.633<br>4.746<br>53.378 | 1<br>226<br>250 | 2.026<br>0.021 | 96.503 | 0.000 |
| **Marital status**<br>Married, cohabiting, separated, divorced, widowed, never married | Between groups<br>Within groups<br>Total | 695.482<br>1621.690<br>2317.171 | 5<br>226<br>250 | 28.978<br>7.176 | 4.038 | 0.000 |
| **Grew up with pets**<br>Yes/No | Between groups<br>Within groups<br>Total | 24.823<br>35.337<br>60.159 | 1<br>226<br>250 | 1.034<br>0.156 | 6.615 | 0.000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Favourite type of pet**<br>Dog, cat , other | Between groups<br>Within groups<br>Total | 67.883<br>39.265<br>107.147 | 2<br>22<br>6<br>25<br>0 | 2.828<br>0.174 | 16.280 | 0.000 |
| **Primary carer of dog**<br>Respondent, others, shared | Between groups<br>Within groups<br>Total | 22.156<br>106.840<br>128.996 | 2<br>22<br>6<br>25<br>0 | 0.923<br>0.473 | 1.953 | 0.006 |

There is a significant effect of the above respondent variables on overall CDA scale scores.

**Table 3.10a. Regression analysis for respondent characteristics by overall CDA scale scores.** Adjusted R square = 0.58; $F_{4,245}$ = 85.905, p, 0.0005 (using the stepwise method). Significant variables are shown below.

| **Predictor variable** | **Beta** | ***p*** |
|---|---|---|
| Favourite pet:<br>dog or other | 0.398 | *p<0.0005* |
| Married | -0.270 | *p<0.0005* |
| Aged 18-39 | -0.210 | *p<0.0005* |
| Dog cared for by respondent | -0.143 | *p<0.001* |

The remaining independent variables were not a significant predictor in this model.

The model accounts for 58% of the variance in the overall CDA scores. The beta scores for these particular predictor variables are relatively low and so their impact on the overall CDA scores is not great.

**Table 3.10b.Regression analysis (stepwise method) for respondent characteristics by CDA scale sub-score for companionship/happiness.**

Adjusted R square = 0.44; $F_{3,246}$ = 65.615, p, 0.0005 (using the stepwise method). Significant variables are shown below.

| **Predictor variable** | **Beta** | ***p*** |
|---|---|---|
| Favourite pet: dog or other | 0.427 | *p<0.0005* |
| Aged 18-39 | -0.231 | *p<0.0005* |
| Married | -0.146 | *p<0.012* |

The remaining independent variables were not a significant predictor in this model.

The model accounts for 44% of the variance in the CDA scale sub-score for companionship/happiness. Again the beta scores for these predictor variables are relatively low and so their impact on the sub-scale of companionship/happiness scores is not great.

**Table 3.10c. Regression analysis (stepwise method) for respondent characteristics by CDA scale sub-score for feeling loved/needed.**

Adjusted R square = 0.49; $F_{3,246} = 68.456$, p, 0.0005 (using the stepwise method). Significant variables are shown below.

| **Predictor variable** | **Beta** | ***p*** |
|---|---|---|
| Favourite pet: dog or other | 0.355 | *p<0.0005* |
| Married | -0.246 | *p<0.0005* |
| Aged 18-39 | -0.227 | *p<0.0005* |

The remaining independent variables were not a significant predictor in this model.

The model accounts for 49% of the variance in the CDA scale sub-score for feeling loved/needed. Again the beta scores for these predictor variables are relatively low and so their impact on the sub-scale of feeling loved/needed scores is not great.

**Table 3.10d. Regression analysis (stepwise method) for respondent characteristics by CDA scale sub-score for dogs as friends.**

Adjusted R square = 0.30; $F_{3,246} = 36.560$, p, 0.0005 (using the stepwise method). Significant variables are shown below.

| **Predictor variable** | **Beta** | ***p*** |
|---|---|---|
| Married | -0.300 | *p<0.0005* |
| Dog cared for by respondent | -0.287 | *p<0.0005* |
| Aged 18-39 | -0.179 | *p<0.003* |

The remaining independent variables were not a significant predictor in this model.

The model accounts for 30% of the variance in the CDA scale sub-score for dogs as friends. Again the beta scores for these predictor variables are relatively low and so their impact on the sub-scale of dogs as friends scores is not great.

**Table 3.10e.Regression analysis (stepwise method) for respondent characteristics by CDA scale sub-score for negative aspects of dog-keeping.**

Adjusted R square = 0.25; $F_{2,247} = 43.364$, p, 0.0005 (using the stepwise method). Significant variables are shown below.

| **Predictor variable** | **Beta** | ***p*** |
|---|---|---|
| Children yes/no | -1.270 | *p<0.0005* |
| Favourite pet: dog or other | -0.425 | *p<0.034* |

The remaining independent variables were not a significant predictor in this model.

The model accounts for 25% of the variance in the CDA scale sub-score for negative aspects of dog-keeping but the beta scores for these predictor variables are relatively low and so their impact on the sub-scale of the negative aspects of dog-keeping scores is not great.

Frequency data for CDA scale scores and respondent demographics, social network ties and pet-related variables are given in appendix D.

Temporal reliability of the new CDA scale was established via test-re-test procedures and subsequent Wilcoxon matched pairs signed ranks tests, whereby an opportunity sample of twenty of the original 51 respondents to the CDA scale (see Chapter four this thesis) were re-tested eighteen months after their original responses (z = -1.414, N-ties =5, p= 0.312) and an opportunity sample of twenty each of the two samples of 100 participants with either "problem" dogs (z = -0.535, N-ties =12, p=0.795) , or who described themselves as not the primary owner of the dog in their household (z = -0.924, N-ties =12, p=0.484) were re-tested two months after their original responses. The Wilcoxon tests show that in each case the scores of the CDA scale did not differ significantly over time and so show the CDA scale to have temporal reliability.

### 3.4. Discussion

The purpose of the research presented in this chapter has been to modify existing scales of attachment and comfort from companion dogs, by the addition of negative statements which allow for respondents' full expression of what it means to be attached to, or gain comfort from, a companion dog, including the less than positive aspects. Behaviour problems with dogs, such as

aggression, disobedience, separation anxiety problems, and other more social factors such as embarrassment and/or annoyance problems can, in many cases, make the human–dog relationship an intolerable or uncomfortable one for the owner. In extreme cases the dogs may then be put up for re-homing in various dog shelters/charities (see Hart *et al.*, 1985: Mugford, 1981, 1985).

However, many dog owners are prepared to make compromises regarding things like travel, socialising with friends, and various other activities within their community. This can mean severing friendships with people who do not like dogs, or simply being unable to go away without the dog because of separation problems. Some owners have expressed the need to curtail their social activities in order to avoid embarrassing or otherwise difficult situations (see Cantazaro, 1984: Miller *et al.*, 1990). This kind of information indicates the possible need for the inclusion of negative statements in scales of attachment or comfort, given that few social relationships of any kind are wholly positive. The omission of negative statements in such instruments may have led to existing scales being rather better measures of very strong attachments and comfort than of moderate or weak ones.

Both of the modified scales show acceptable internal reliability, as measured by coefficient alpha, with the modified LAPS having a particularly high degree of internal consistency. In addition, the principal components analysis in each case indicated that there were three main factors for each of the original scales. Three factors were extracted and rotated in each case, partially because of the appearance of the scree plots, and partially due to the three factors capturing a reasonable amount of the cumulative variance of all the factors.

Closer examination of the initial eigenvalues indicates that for both the CCAS and the LAPS, factor one is a general factor, with factors two and three being more specific. All six factors showed an acceptable level of internal consistency in their own right. Factor three in the CCAS represents the negative aspects of dog keeping which confirms the desirability of additional negative statements in the ‘comfort from dog-keeping’ scale.

The combination of the most pertinent items from the combined modified LAPS and the CCAS, results in an instrument (the CDA Scale) with high overall alpha internal consistency, and four factors, each with good levels of alpha internal consistency in their own right. Again, closer

examination of the initial eigenvalues reveals that factor one of the CDA Scale is a general factor accounting for most of the variance, with factors two, three, and four being more specific. Construct validity of the CDA scale is also explored by analysis of some respondent characteristics; demographics, social network, and pet-related variables indicating that attachment scores are highest in women, those aged over 40, households with only one or two persons, households without children present, co-habiting, divorced and never married respondents, and respondents who express a preference for dogs over cats or other pets, who grew up with pets and who live in a household in which the companion dog is cared for by other people in the house or who share dog-care responsibilities. The new scale also shows temporal reliability as evidenced by test-retest procedures with the three samples of respondents to the CDA scale.

Regression analysis (stepwise method) indicates that few of the predictor variables (gender, marital status, children at home etc.) have a very large impact on either the overall CDA scale scores or on the four CDA sub-scales. However, if the CDA scale respondents favourite pet species is dogs, if the respondent is married, if the respondent is aged 18-39 and if the respondent is the primary dog-carer, these variables are consistent predictors of Companion Dog Attachment scale scores.

Some limitations of this research should be acknowledged. Firstly, the respondents were self-selected which means that in two of the samples they almost certainly felt at least moderately positive about dog-keeping which motivated them to fill in the questionnaires, and this may have biased the data. In addition, to date, the modified scales have only been used to collect online and self-administered responses. Although other research suggests that attitude measures are robust in the face of variations in data collection (van Tilburg *&* de Leeuw, 1991), face-to-face interviews have not been carried out and the data compared.

In conclusion, this study has produced a new scale for the assessment of attachment, the dimensions of which are a marriage of factors from the CCAS, which was originally designed to measure comfort gained from the keeping of pets in general, and factors from the LAPS, which was originally designed to measure expressed attachment to pets. Combining, adding and refining questionnaire items from the two sources has provided a novel scale which has shown reliability and validity, which is easy to administer and quantify, and which is meaningful in measurement of weaker attachments.

The CDA scale scores will play a vital part in the Strange Situation for Dogs study, which is detailed in the next chapter, thus allowing a greater comprehension of the association between expressed owner attachment and the observed attachment behaviour of their dogs.

# Chapter 4: The relationship between measured attachment in dogs and their owners

## 4.1. Introduction

The purposes of this study are to examine owners' perception of their bond with their dog as measured by the Companion Dog Attachment scale detailed in chapter three. The CDA scores will be examined in relation to the dogs' actual attachment data obtained in the Strange Situation observations. The data are further examined in terms of the association between attachment and problem behaviour in dogs, and also in terms of the effects of conspecific and heterospecific social group size on the levels of canine attachment in the SST. This chapter also examines the efficacy of the Strange Situation as a measurement of canine attachment, and makes additional behavioural categories that can be used to measure secure base behaviour as highlighted by more recent research in this area (Prato-Previde *et al.,* 2003) This methodology and treatment of the data could well provide a clearer indication of dogs' behaviour towards humans as elicited by the SST, how this relates to owners' perceived attachment to their dogs, and how different social group size may affect attachment behaviour in companion dogs.

The term attachment is usually used to refer to the bond that forms between a carer (very often the mother, or mother-figure) and infant (Bowlby, 1958). It is a particular type of affectional bond, but specifically, and typically, an attachment includes the security and comfort experienced as a result of the relationship and secure base behaviour, whereby the infant (or older person, or animal) has the confidence to engage with the world outside the bond, without the attachment figure, as a direct result of the relationship itself (Ainsworth, 1989). All affectional bonds also involve proximity and contact seeking, and distress on involuntary separation (Cassidy, 1999). Ainsworth's (1989) ethological model of attachment emphasises the evolutionary and developmental elements of attachment systems whereby attachment behaviours are the result of environmental pressures, and as such have survival worth as a defence against predation, or starvation etc.

Research on primates, including humans, has given us operational criteria for attachment, which can be applied to other species (Bard, 1991). An animal capable of forming an attachment must possess the necessary discriminative abilities, and show differential responses to the attachment figure. In addition, there must be a preference shown towards the attachment figure, and separation and reunion behaviours which are specific to the attachment figure and easily distinguished from

responses, in similar circumstances, to other individuals (Bard, 1991; Barker & Barker, 1988).

The human-canine relationship has been studied relatively intensively over the past twenty years or so, but usually from the point of view of the owners' perceived attachment to dogs (Jagoe & Serpell, 1986; Voith et al., 1985), of the proposed health benefits of dog owning (Katcher, 1985; McCullochy, 1983; Wilson & Turner, 1998), or of dog owners' behaviour in relation to specific problems in their dogs (Jagoe & Serpell, 1996; O'Farrell, 1992, 1995 cited in Serpell, 1995). Topal *et al.* (1998) used a modified version of Ainsworth's strange situation methodology with companion dogs and their owners, thus providing the first empirical study of canine affectional ties with people. Gacsi *et al.* (2001) went on to utilise the procedure in an examination of the forming of new bonds in dogs living at rescue centres, where the formation of attachments appears to be accelerated by the exceptional demand, in rescue dogs, for social contact with humans.

However, it is not simply the dogs' background and learning which are likely to affect patterns of attachment behaviour. Work by Marinelli *et al.* (2007) has emphasised pet owners' individual characteristics as fundamental to the nature of dog-owner bonds, whereby the owner's experience with pets, preference for dogs as a pet species, marital status, house-sharing, the number of emotional bonds held by the owner with other people, and the absence of children, all have a significant effect on the strength of the bond between owner and dog. Given this, it seems essential that behavioural studies of canine attachment should carefully consider the effects of a number of independent variables on the behaviour exhibited by the dogs being observed.

The lack of empirical studies on canine attachment behaviours is somewhat surprising given that it seems likely that the dog's evolutionary success as a sub-species of wolf, which is almost without parallel in the non-human world, is due, in large part, to dogs' uncanny ability to, as Budiansky (2001, p. 5) put it, "worm themselves into our homes, and into our relentlessly anthropomorphic psyches." Given this propensity for stimulating human affection, one might assume that the research on this type of affectional bond would be extensive.

The earliest certain find of a domesticated dog's remains are dated at 14,000 years ago, at Oberkassel in Germany (Nobis, 1979), but many of the convincing finds of *Canis lupus familiaris* are 2,000 years later at various sites in Western Asia (Davis & Valla, 1978). It has been suggested

that this era coincides with a dramatic change in hunting strategy, when the use of microliths (tiny stone blades/arrowheads) became widespread. The cooperation of dogs which could pursue wounded animals and bring them down would have been of enormous benefit to Natufian hunter-gatherers, and so the prevalence of domesticated dog remains from this period is in keeping with this possible practical use of dogs (Davis & Valla, 1978). However, this assumption may be erroneous, as some archaeological evidence suggests strongly that, even in their distant history, the majority of dogs were 'biological freeloaders.' Budiansky (1999) details the examples of modern day dogs that assist people by guiding the blind, herding animals, retrieving game, etc., as being relatively late developments in the history of domesticated canines. Only the tiniest fraction of dogs today actually earn their keep, as it were, by doing anything practical at all.

Humans have selected in dogs a number of distinctive behaviours and morphological characteristics, which have carried, in turn, a number of genetically-related traits that are not seen in adult wolves (Goodwin *et al.*, 1997). For example, most breeds of domestic dog demonstrate, to a greater or lesser extent, paedomorphosis (the prolongation of juvenile appearance and to some extent behaviour, or underdevelopment). Dogs pass through fewer growth stages than their lupine ancestors, and as a result, end up resembling juvenile modern wolves (Goodwin *et al.* 1997). This affects the signalling ability of adult dogs in general, and added to the selection of breed-specific morphology by dog-breeders this results in, for example, a Cavalier King Charles Spaniel only having the means to demonstrate and utilise two dominance and submission behaviour patterns, whereas a Siberian Husky retains fifteen such signals (Goodwin *et al.*, 1997). It is clear that this relates to the positive correlation that exists between a dog's physical similarity to a wolf, and wolf-like behaviour. Indeed, dog breeds with the smallest repertoire of signals draw their signals from those appearing before three weeks of age in the wolf, strongly suggesting that the retention of juvenile appearance has been accompanied by behavioural paedomorphism (Goodwin *et al.*, 1997).

Further to this, domestication has affected the ritualised aggression so apparent in wolf behaviour (Frank & Gialdini Frank, 1982). Neotenisation is at least partially responsible for the disintegration of this ritualised aggression in dogs, perhaps because humans now provide food for their dogs, and thus the potential life-threatening consequences of injuries sustained in fighting have been relaxed and dogs can 'afford' to risk injury (Frank & Gialdini Frank, 1982). Miklosi *et al.* (2003) have also demonstrated that a key difference between dog and wolf behaviour, is the dogs' ability to look at the human face and take instruction from gestures such as pointing a finger accompanied by facial

expressions indicating positive and negative emotional states on the part of the human. Complex forms of dog-human communication are the result of this evolutionary and ontogenetic process, and similar systems cannot be achieved in wolf-human interactions even after extended socialisation, so the evidence for selection, by humans, of these traits in dogs is strong (Miklosi *et al.*, 2003).

Moreover, research has indicated that specific dog behaviours vary according to the species with which the dog is interacting. For example, a dog playing with another dog does so differently compared to the play behaviour it exhibits with a human (Rooney, 2000). This may seem rather obvious in some ways, but it does reiterate the idea that dogs are able to organise their social groups to include other species despite the differences which exist between the species involved, and that there is no logical basis for interpreting dog behaviour with humans as if dogs themselves perceive humans as conspecifics (Semyonova, 2003).

One approach to investigating human-dog attachment is the controlled behavioural observation of specific interactive episodes similar to that which has been used with human infants. The Ainsworth strange situation test (SST, 1969) methodology allows the categorisation of human infants into three groupings: secure, the infant clearly misses the parent on separation, but quickly re-settles on their return; insecure-avoidant, the infant appears unconcerned at the disappearance of the care-giver, and actively ignores them upon reunion; and insecure-resistant, the infant is visibly very distressed on separation, and seeks comfort from the returning carer, but cannot be settled by them. More recently, a fourth category has been described by Main and Soloman (1990), in which the infant's reaction to separation from the carer appears relatively random and without goal; this pattern is known as disorganised attachment. In Topal *et al.*'s (1998) study, it was found that companion dogs could also be classified along the secure-insecure attachment dimension, where the attachment figure is their owner. The procedure is particularly suitable for application to dogs because it includes situations which most companion dogs will encounter in their everyday lives, such as temporary separation from their owner, exploration of a novel environment, and meeting a stranger. A similar result has been demonstrated in research with chimpanzees and humans (Miller *et al.*, 1990). Topal *et al.* (1998) concluded, from their study of dog behaviour in a form of the Strange Situation that dog-owner behaviour conforms to the operational definition of an attachment. Similarly, Prato-Previde *et al.* (2003) used Ainsworth's methodology to examine the dog-human relationship, but their focus was on behavioural categories indicating security, proximity, and comfort seeking, as these behaviours indicate the level of activation of the attachment behavioural

system. Analysis of these behaviours revealed a very similar pattern of behaviour to that reported in human infants, but Prato-Previde *et al.* (2003) felt that the habituating effect inherent in the strange situation procedure, whereby dogs and human infants simply get used to the room, stranger, etc., and react less to it, in general prevented this study from providing conclusive evidence that the dog-human bond constitutes an attachment.

Research such as this which asserts that domestication and selective breeding has influenced dogs' predisposition to form bonds with humans, also claims that the dog's social experience is of great importance (Gasci *et al.,* 2001, Topal *et al.*, 2005). This is important in terms of the use of the SST with dogs given that the test was originally developed for the infant-mother relationship in humans which is generally more uniform than the relationship between a dog and its owner (human participants in the original SST were genetic relations who had largely been together since the moment of the infant's birth). Dog-owner bonds are very diverse with some dogs being together with their owner since puppy-hood whilst others have joined their owners when fully adult after a string of different owners and domestic situations. If, as the research suggests, social experiences are very important in canine attachment to humans (Gasci *et al.,* 2001; Topal et al., 2005), the owner's previous experience with dogs, and the dogs' own social experiences and learning are likely to have an effect on the dogs' attachment behaviour patterns.

Research by Marinelli *et al.* (2007) shows that dog attachment is more affected by living context and owner management of the relationship, than by experiences during the dog's sensitive socialisation periods; a finding which concurs with research findings by Topal *et al.* (2005). Marinelli *et al.* (2007) also point out that the social context of the SST (the dog with the owner, stranger, or alone) is only one of the relevant variables that comes into play during the observed procedure. The dog's individual traits are also likely to be important in its own interpretation of the situation, and thus it's observable behaviour (Marinelli *et al.*, 2007). Most of the behaviour patterns elicited by the Strange Situation form part of the general dog ethogram, e.g. play, exploration, passivity, all of which may be more affected by factors unrelated to the relationship than by the procedure itself, and, according to Marinelli *et al.* (2007), it is only behaviours which have developed specifically with the owner and not the stranger in the SST, or indeed strangers in general, (e.g. greeting) which show a differentiation indicative of a qualitatively different type of bond between owner and stranger (Overall, 1997). It has to be said however, that Ainsworth herself (1969) pointed out that the defining behaviour patterns most strongly indicating different categories

of attachment type in human infants were those elicited when mother and infant were separated, and when they were re-united after the brief separations of the SST.

Further to this, Semyonova (2003) asserts that on meeting a stranger (human or canine) however fleetingly, a dog attempts to construct a stable binary social system via the emission of signals and consequent responses to those signals. According to Rugaas (1997) in usual circumstances most of these initial signals are of a non-threatening type and are designed to calm potentially threatening situations rather than to express any notion of "rank" or "dominance" to the stranger. This is potentially of great importance in the SST as the signals given, responded to/interpreted by the stranger-dog and owner-dog dyads will invariably affect the dogs' behaviour, and this in turn will affect stranger and owner behaviour towards the dog and so on. In short, the stranger and owner responses/signals to the dogs in the SST may well be crucial in terms of the dogs' interpretation of the situation and researchers' consequent measure of apparent attachment level and type in the dogs.

### 4.2. Method

#### 4.2.1. Participants

Fifty-one dog-owner pairs were recruited to take part in the study, from puppy-walking and dog-training classes (the sample size of 51 dog-owner pairs was considered a sufficient number of participants given Kline's (1986) assertion that for factor analysis to be meaningful there needs to be more participants than variables; there are eleven behavioural variables and 51 participants). The owners comprised 22 men, and 29 women with an age range of 20 – 60+. The group of dogs comprised 30 males, and 21 females with an age range of six months – twelve years. The dogs included nineteen cross-breeds, two Doberman Pinschers, two Rottweilers, seven Collies, four Golden Retrievers, two Lurchers, four Labradors, three Springer Spaniels, two Boxers, four Jack Russells and two Cairn Terriers.

#### 4.2.2. Procedure

The basic set up was similar to Ainsworth's original procedure but modified somewhat to accommodate the different needs of dogs (see description below). Prior to testing, the owners completed two questionnaires. One asked for personal details such as age, dog-keeping history, number of family members, other pets, dog's behavioural problems, etc., as well as a series of questions designed to ascertain the person's expressed attachment to their dog (see chapter three for

development of this scale), this is referred to as the Companion Dog Attachment (CDA) scale and gave an attachment score for each person based on their level of agreement or disagreement with each statement. (See Table 4.1 below for wording of the items).

**Table 4.1. Wording of the CDA scale.**

| No | Question | Strongly agree | Somewhat agree | Strongly disagree | Strongly disagree |
|---|---|---|---|---|---|
| 1 | I consider my dog to be a great companion | | | | |
| 2 | Owning a dog gives me something to love | | | | |
| 3 | Owning a dog adds to my happiness | | | | |
| 4 | I feel that my dog is part of my family | | | | |
| 5 | My dog sometimes annoys me | | | | |
| 6 | My dog makes me feel trusted | | | | |
| 7 | My dog sometimes embarrasses me | | | | |
| 8 | My dog makes me feel happy | | | | |
| 9 | I believe that my dog is my best friend | | | | |
| 10 | My dog means more to me than any of my friends | | | | |
| 11 | My dog makes me feel needed | | | | |
| 12 | My dog has some unpleasant habits | | | | |
| 13 | My dog makes me feel loved | | | | |

The second questionnaire was entitled, "What will your dog do in this situation?" The scenario of the experimental set up was described, and owners were asked to comment briefly on the behaviour they expected their dog to exhibit in this context (see Table 4.2).

**Table 4.2. Dog owner's predictions of their dog's behaviour in the SST**

**What will your dog do in this situation?**

Name: Dog's Name:

The "Strange Situation" is a procedure, which is usually used to work out what kind of bond children have with their carers. We have modified this procedure in order to measure the same thing with dogs and their owners. You and your dog will be videoed in a small room in a number of situations lasting no more than two minutes each. These include: you and your dog together, your dog when left alone in the room, your dog in the presence of a stranger, and so on.

Previous studies show that dogs can exhibit a number of behaviours in this situation, such as playing, being passive, seeking contact with people and staying close to them, standing by the door and scratching the door, gazing at people, and rushing to meet them when they come back into the room. You may feel that some or all of these behaviours would be typical of your dog.

Thank you very much for taking part in this study. If the results are published, you and your dog will remain anonymous. If you have any questions at all, please do not hesitate to ask me. You are not obliged to answer any of the questions if you do not want to, and you are free to leave at any time.

Please answer the following questions as honestly as possible with a detailed description of your dog's likely behaviour, and to the best of your ability. There are no right or wrong answers, and you and your dog are not being judged in any way.

1. When your dog is alone in the room how will he/she behave?
2. When the stranger enters the room and sits down to talk to you, how will your dog behave towards you, and the stranger?
3. When your dog is left alone in the room with the stranger, how will he or she behave towards you, and the stranger?
4. When you come back into the room and are reunited with your dog, how will he or she behave towards you, and the stranger?
5. When your dog is left alone with the stranger for the second time, how will he or she behave towards the stranger?
6. When you come back into the room and are reunited with your dog for the second time, how will he or she behave towards you, and the stranger?
7. This is the end of the questionnaire. Thank you very much for taking part.

The room used was a novel environment containing two chairs with a small number of dog toys on the floor. A clock with a second hand was clearly visible on the wall to allow for approximate timings within some of the episodes. The dimensions of the room were five metres by two and a half metres. The chairs and toys were positioned at the opposite end to the door to facilitate the best view from the video camera, which was located high up on a ledge near the ceiling. All behaviours exhibited in the fourteen and a half minute procedure were videotaped and later scored and analysed.

The experimental episodes of the Strange Situation Test for Dogs (SST) were as follows:

*Introductory Episode (30s)*

The observer introduces the owner and dog to the novel environment, explains what is required in the introductory and first episodes, and leaves. Subsequent episodes are explained to the owner by the stranger as part of the 'chatting' element of the various episodes. The dog's leash is removed and retained by the owner. The owner and dog familiarise themselves with the room for 30 seconds, then the owner proceeds to episode 1 of the situation.

*Episode 1 (2 min): Owner and dog.*
The owner does not interact with the dog, while the dog has the opportunity to explore. After one and a half minutes the owner stimulates play in the usual manner for their dog.

*Episode 2 (2min): Stranger owner and dog.*
At the two minute mark, the stranger enters (the same female stranger was used throughout) and sits down but says and does nothing for 30 seconds. After 30 seconds, she chats with the owner. At the two minute mark, the stranger stimulates play with the dog and the owner leaves quietly, leaving the dog's leash on the owner's chair.

*Episode 3 (2 min): Stranger and dog*
During the first minute the stranger attempts play with the dog. If the dog does not play, the stranger occupies him or her by petting. After two minutes the stranger stops playing but allows petting if it is initiated by the dog.

*Episode 4 (2 min): Owner and dog*
The owner calls the dog from behind the closed door. The owner then opens the door saying nothing, and allows their dog to respond. When the dog has responded the owner greets and comforts him or her if necessary whilst the stranger leaves. The owner then continues playing and or petting their dog. At the 2-minute mark the owner leaves after saying 'stay here' to the dog. The dog's leash remains on the owner's chair.

*Episode 5 (2 min): Dog alone*
The dog is left alone in the room for two minutes. Live pictures from within the room allowed constant observation of the dogs in case they became excessively distressed, in which case their owner could let them out and the procedure be discontinued. (This never occurred in this investigation)

*Episode 6 (2 min): Stranger and dog*
At the two minute mark the stranger enters and sits down. In the first minute the stranger attempts to play with the dog. If the dog will not play, the stranger occupies him or her by petting. At the 2 minute mark the stranger stops playing but allows petting if it is initiated by the dog.

*Episode 7 (2 min): Owner and dog*
The owner opens the door and says nothing but allows the dog to respond spontaneously. The owner then greets and comforts the dog if necessary whilst the stranger leaves. After two minutes has elapsed the door is opened to indicate the end of the procedure.

The stranger was the same woman in each case, the author of this thesis, who thus had a full understanding of the procedure of the strange situation for dogs in advance of the sessions. The owners were simply told that this part of the study concerned their dog's behaviour in a novel environment. Thus, they were unaware of the formal goals and hypotheses of the research.

### 4.2.3. Observations and Behavioural Categories

One trained observer analysed the videotaped sessions of the 51 dog-owner pairs. Each of the eleven behaviour categories was scored for both owner and stranger, resulting in a large data set. The recorded variables were as follows: 1. exploration in the presence of the owner/stranger; 2. playing in the presence of the owner/stranger; 3. passive behaviour in the presence of the owner/stranger; 4. physical contact with the owner/stranger; 5. standing by the door in the presence of the owner/stranger; 6. duration of gazing at owner/stranger; 7. tally of gazing at owner/stranger; 8. scratching the door in the absence of the owner/stranger; 9. proximity of contact seeking to owner/stranger; 10. duration of contact seeking owner/stranger; and 11. delay to greet entering owner/stranger.

The percentage of the time spent in these behaviours was established, and the relative duration of each variable was summed across relevant episodes, for the purposes of statistical analysis. In order to establish the reliability of the observer, a second observer sampled the behaviours (with both stranger and owner in each case). Inter-observer agreement was assessed by sampling the behaviour every ten seconds for ten of the SST sessions, and calculating the percentage agreement for the eleven behaviour categories. The reliability of timings was also established in a similar way by sampling five minute sections of the same ten SST sessions and calculating the percentage agreement in each case. These are given below in Table 4.3.

**Table 4.3. Inter-observer percentage agreement and a description of behaviours recorded in the SST.**

| Behaviour | Description | % agreement for behaviour type | % agreement for timings |
|---|---|---|---|
| 1. Exploration | Activity directed toward non-movable aspects of the environment, including sniffing, distal visual inspection, close visual inspection, or oral inspection. | 95 | 97 |
| 2. Playing | Any vigorous, toy or social partner related behaviour, including running, jumping or any physical contact with toys. | 98 | 96 |
| 3. Passive behaviour | Sitting, standing or lying down without any orientation towards the environment | 96 | 96 |
| 4. Physical contact | Duration of any physical contact with human. | 96 | 98 |
| 5. Standing by door | The time spent sitting or standing close to the door (<1m) | 98 | 98 |
| 6. Duration of gazing | Duration of gazing with eyes directed at human face. | 96 | 97 |
| 7. Tally of gazing | Total number of gazes directed at human face | 96 | n/a |
| 8. Duration of Contact Seeking | Duration of physical contact while greeting | 99 | 96 |
| 9. Proximity of contact seeking | The sum of the following scores: approach initiation (+1) full approach characterised by physical contact (+2), any sign of avoidance (-1) | 93 | 94 |
| 10. Delay to greet | The amount of time (secs) from the moment of the opening of the door, to the first sign of approach behaviour (if approach was not recorded, was considered to be the duration of the full episode, i.e.120s) | 95 | 95 |

### 4.3. Analysis of data

Behavioural data were recorded continuously during observations and the percentage of the time spent performing each behaviour was calculated. Behaviours shown in the presence of the owner versus the stranger were compared using two-tailed t-tests – see section 4.3.1 (corrected for multiple comparisons by Holm's sequential Bonferroni procedure (Holm, 1979). Factor analysis was carried out to establish variables thought to account for the individual differences in sets of behaviours observed in the SST (see section 4.3.2). All behavioural variables were then analysed by a cluster analysis to group the individual dogs according to the patterns of their behaviours in the SST (see section 4.3.3). Dogs' behavioural problems in relation to attachment, secure-base behaviours, etc. were investigated using ANOVA (see section 4.3.4).

Finally, the effects of independent variables (i.e., owner's age, sex, dog-keeping history, other dogs in the house, etc.) on all other variables were assessed in terms of their correlation coefficients, as were the secure base behaviours, owner's attachment scores from the CDA scale, 'what will…?' scores, the three factorial variables, and dogs' behavioural problems (see section 4.3.5). Correlation coefficients greater than 0.6 were considered regardless of sign in order to capture as many meaningful associations as possible.

### 4.3.1. Dogs' behaviour in the presence of the owner versus the stranger

The behaviour that the dogs exhibited in the presence of the owner and the stranger was compared using two-tailed Holm's sequential Bonferroni *t*-tests (Holm, 1979). The dogs tended to explore more, and make physical contact more in the presence of their owners *(*$t$ = 3.7, df = 50, $p$< 0.05: $t$ = -4.41, df = 50, $p$=<0.05). Dogs showed greater passivity in the presence of the stranger, and stood by the door for more of the time when they were with the stranger ($t$ = -5.25, df = 50, $p$< 0.05: $t$ = -5.90, df = 50, $p$< 0.05). Also, dogs scratched the door more when their owner was out of the room compared to when the stranger was out of the room ($t$= 7.76, df=50, $p$<0.05). Gazing behaviour was more prevalent in the presence of the owner both in duration and in number of gazes ($t$ = 4.16, df = 50, $p$<0.05: $t$ = 7.05, df = 50, $p$< 0.05). Also, dogs were quicker to greet their entering owners compared to the entering stranger ($t$ = 4.06, df = 50, $p$< 0.05). There were no significant differences in play behaviour in duration of contact or in contact seeking behaviour *(*$t$ = -1.53, df = 50, $p$ = 0.132: $t$ = .09, df = 50, $p$ = 0.928: $t$ = 0.53, df = 50, $p$ = 0.598). Appendix F shows the descriptive statistics for raw data of dogs' behaviour in the presence of the owner versus the stranger.

### 4.3.2. Factor Analysis

A principal components analysis with varimax rotation essentially reveals two rotated factors; with a lesser third factor (eigenvalue > 1.7). The scree plot is shown in figure 4.2, the total variance is explained in Table 4.4, and the rotated component matrix (factor loadings of behavioural variables) is shown below in Table 4.5., loadings >0.50 are shown in bold. The criteria used in deciding which PCA factors to include in the analysis was to select only factors with initial eigenvalues greater than one, and then to look to the cumulative variance and introduce a cut-off point when the variance accounted for reached 50% or above within factors, and finally (to clarify the decision) via inspection of the scree plots, selecting a cut-off point where the "rubble" from the analysis levelled out.

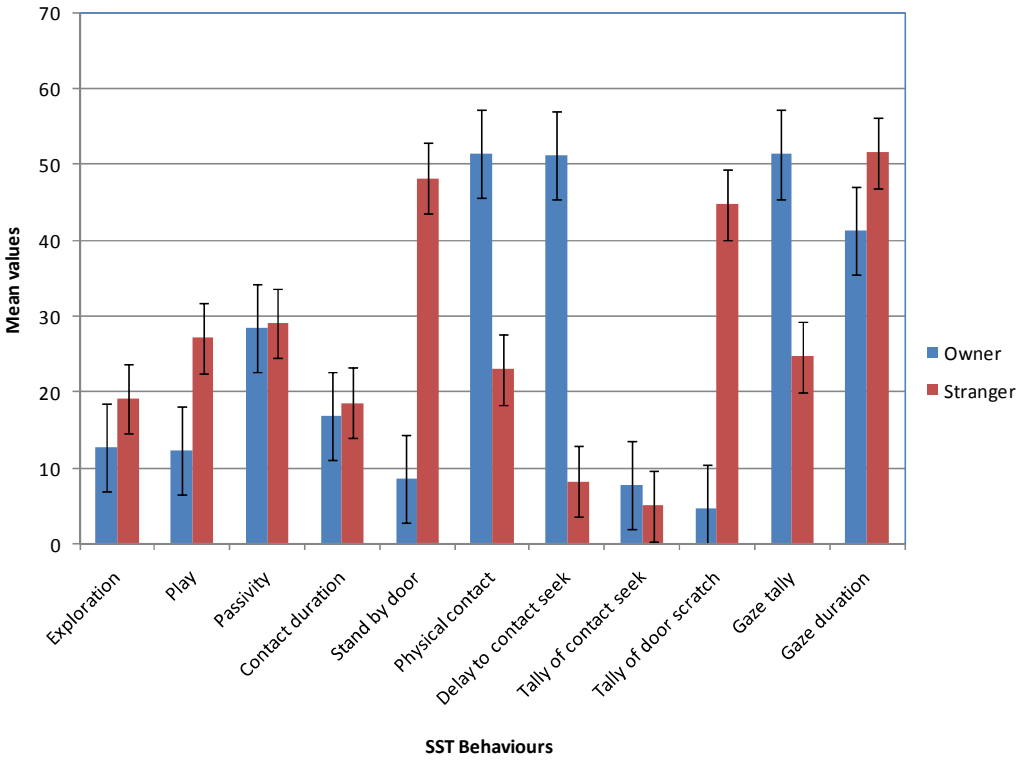



Figure 4.1. Comparison of mean values of SST behaviours in relation to the presence of owner and stranger (exploration - delay to contact seek are mean percentages of time spent, the following three behaviours are mean tallies, the final behaviour is mean duration). Standard error of mean is shown.

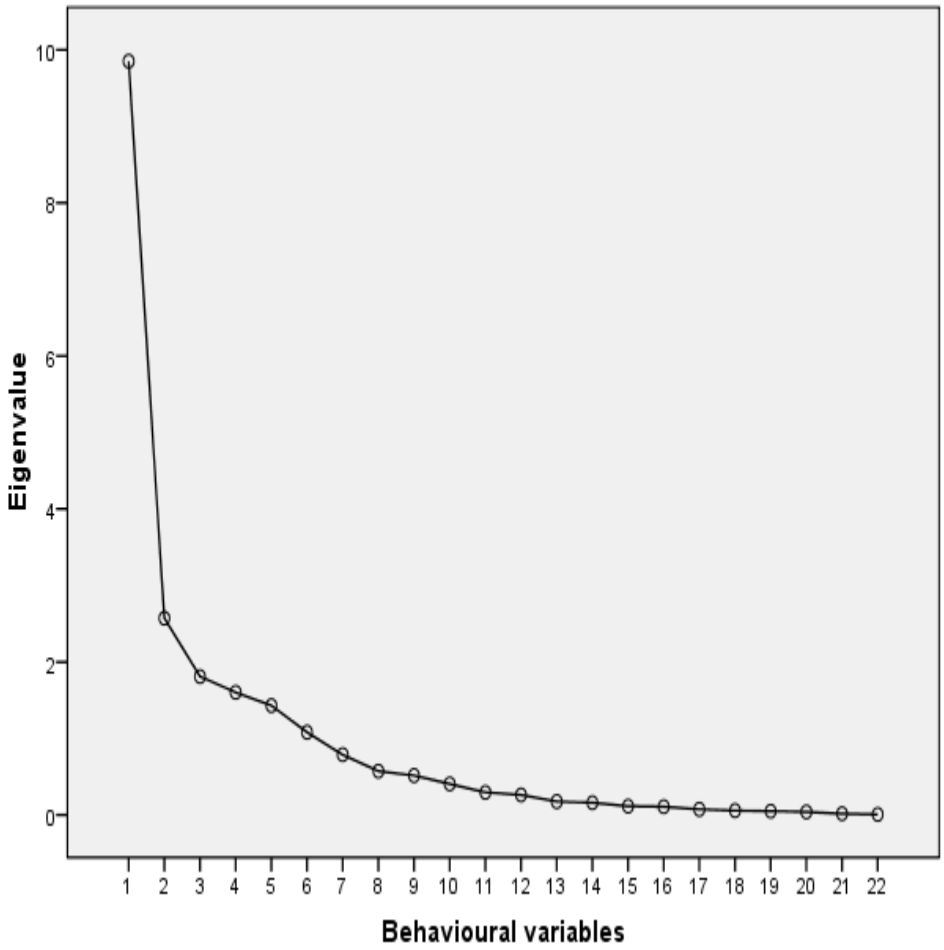



Figure 4.2. Scree plot generated by PCA of DDS behavioural variables

**Table 4.4. Total variance of SST behaviours PCA explained**

| | Initial Eigenvalues | | | Extraction sums of squared loadings | | | Rotation sums of squared loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| Factor | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| 1 | 9.851 | 44.777 | 44.777 | 9.851 | 44.777 | 44.777 | 3.869 | 17.584 | 17.584 |
| 2 | 2.572 | 11.693 | 56.469 | 2.572 | 11.693 | 56.469 | 2.942 | 13.373 | 30.957 |
| 3 | 1.810 | 8.228 | 64.698 | 1.810 | 8.228 | 64.698 | 2.379 | 10.814 | 41.771 |
| 4 | 1.602 | 7.284 | 71.982 | 1.602 | 7.284 | 71.982 | 1.767 | 8.033 | 49.804 |
| 5 | 1.431 | 6.502 | 78.484 | 1.431 | 6.502 | 78.484 | 1.643 | 7.468 | 57.272 |
| 6 | 1.082 | 4.918 | 83.402 | 1.082 | 4.918 | 83.402 | 1.224 | 5.564 | 62.836 |
| 7 | .788 | 3.581 | 86.983 | .788 | 3.581 | 86.983 | 1.204 | 5.473 | 68.310 |
| 8 | .573 | 2.606 | 89.590 | .573 | 2.606 | 89.590 | 1.164 | 5.291 | 73.600 |
| 9 | .516 | 2.345 | 91.934 | .516 | 2.345 | 91.934 | 1.104 | 5.020 | 78.620 |
| 10 | .406 | 1.847 | 93.782 | .406 | 1.847 | 93.782 | 1.005 | 4.568 | 83.188 |
| 11 | .296 | 1.346 | 95.128 | .296 | 1.346 | 95.128 | .970 | 4.408 | 87.596 |
| 12 | .262 | 1.193 | 96.321 | .262 | 1.193 | 96.321 | .848 | 3.855 | 91.451 |
| 13 | .176 | .799 | 97.120 | .176 | .799 | 97.120 | .776 | 3.529 | 94.981 |
| 14 | .161 | .732 | 97.851 | .161 | .732 | 97.851 | .347 | 1.578 | 96.559 |
| 15 | .115 | .522 | 98.374 | .115 | .522 | 98.374 | .184 | .835 | 97.393 |
| 16 | .109 | .494 | 98.868 | .109 | .494 | 98.868 | .153 | .697 | 98.090 |
| 17 | .074 | .338 | 99.206 | .074 | .338 | 99.206 | .122 | .553 | 98.643 |
| 18 | .058 | .263 | 99.469 | .058 | .263 | 99.469 | .114 | .520 | 99.163 |
| 19 | .051 | .230 | 99.699 | .051 | .230 | 99.699 | .092 | .419 | 99.582 |
| 20 | .041 | .185 | 99.883 | .041 | .185 | 99.883 | .044 | .199 | 99.782 |
| 21 | .017 | .079 | 99.962 | .017 | .079 | 99.962 | .039 | .177 | 99.958 |
| 22 | .008 | .038 | 100.000 | .008 | .038 | 100.000 | .009 | .042 | 100.000 |

**Table 4.5. Rotated component matrix (factor loadings) of behavioural variables (loadings above 0.5 are emboldened).**

| Behaviour | Factor 1 'Attachment' | Factor 2 'Acceptance' | Factor 3 'Eye-contact' |
|---|---|---|---|
| Playing - With owner | **-0.749** | -0.196 | -0.368 |
| - With stranger | **-0.782** | -0.407 | -0.218 |
| Passivity - With stranger | **0.809** | -0.013 | 0.226 |
| Contact duration - With owner | **0.831** | 0.267 | -0.141 |
| - With stranger | **0.579** | 0.152 | -0.164 |
| Physical contact - With owner | **0.864** | -0.046 | 0.326 |
| - With stranger | **0.621** | 0.468 | 0.219 |
| Delay of contact seek -With owner | **-0.530** | -0.459 | -0.222 |
| -With stranger | -0.110 | **-0.752** | -0.054 |
| Duration of gazing - With owner | **0.505** | **0.823** | -0.068 |
| - With stranger | **0.536** | **0.792** | -0.029 |
| Tally of contact seeking - Owner | 0.244 | **0.567** | 0.124 |
| - Stranger | -0.055 | **0.891** | -0.056 |
| Gazing tally - With owner | 0.243 | 0.121 | **0.889** |
| - With stranger | 0.218 | -0.086 | **0.929** |
| Tally of door scratch - With owner | **0.523** | **0.632** | |
| - With stranger | **0.587** | **0.537** | |

Three factors were considered, partly due to the appearance of the scree plot, but also due to the fact that the cumulative percentage of the variance is over 64% with the first three factors extracted. The first factor clearly relates to attachment behaviour in the dogs and can thus be referred to as 'attachment.' Dogs that scored high on this factor did not play at all and often behaved passively towards the stranger although they did seek some physical contact with both humans. Also, these dogs showed little or no delay in greeting their entering owner, and scratched at the door when their owner was absent. 'Attachment' contains nine behavioural variables with high loadings. The second factor clearly relates to the dogs' acceptance of the stranger and the situation, and can be referred to as 'acceptance.' High scores on this factor were characterised by dogs who spent long periods of time gazing at both their owner and the stranger, sought contact with the stranger in general and showed no delay in greeting the entering stranger, and scratched at the door when the stranger was absent. 'Acceptance' contains six behavioural variables with high loadings. High scores on this third factor represents dogs that looked at their owner and the stranger many times, and thus can be referred to as 'eye-contact.' Eye-contact' contains two behavioural variables with high loadings.

### 4.3.3. Cluster Analysis

Using the same variables as the factor analysis, a hierarchical cluster analysis was calculated. Visual examination of the resulting dendrogram revealed that the dogs could be divided into four major groups. Group one contains fifteen dogs, group two contains seven dogs, group three contains seven dogs, and group four contains 22 dogs (see See figure 4.3). When deciding which groupings to include, the most feasibly compact and distinct clusters were chosen. The ***weight*** of each cluster is represented by the number of individual dogs that each branch of the dendrogram leads to, thus the weight of a cluster is its percentage of the total height of the dendrogram. The ***compactness*** of a cluster represents the minimum distance at which the cluster comes into existence and the ***distinctness*** of a cluster can be seen on the dendrogram as the length of a branch along the horizontal axis (Kaufman & Rousseeuw, 1990). The categorisation of dogs into these groups was further supported by the results of post hoc ANOVA tests on the behavioural variables using the groups as independent variables (factors). Significant differences were found between the groups in all of the behavioural categories, and the post hoc Duncan multiple-range test showed significant ranges for each behaviour whereby the level of any behaviour variable could be classified as low, medium or high (L, M, H) in a given group (see Table 4.5. below).

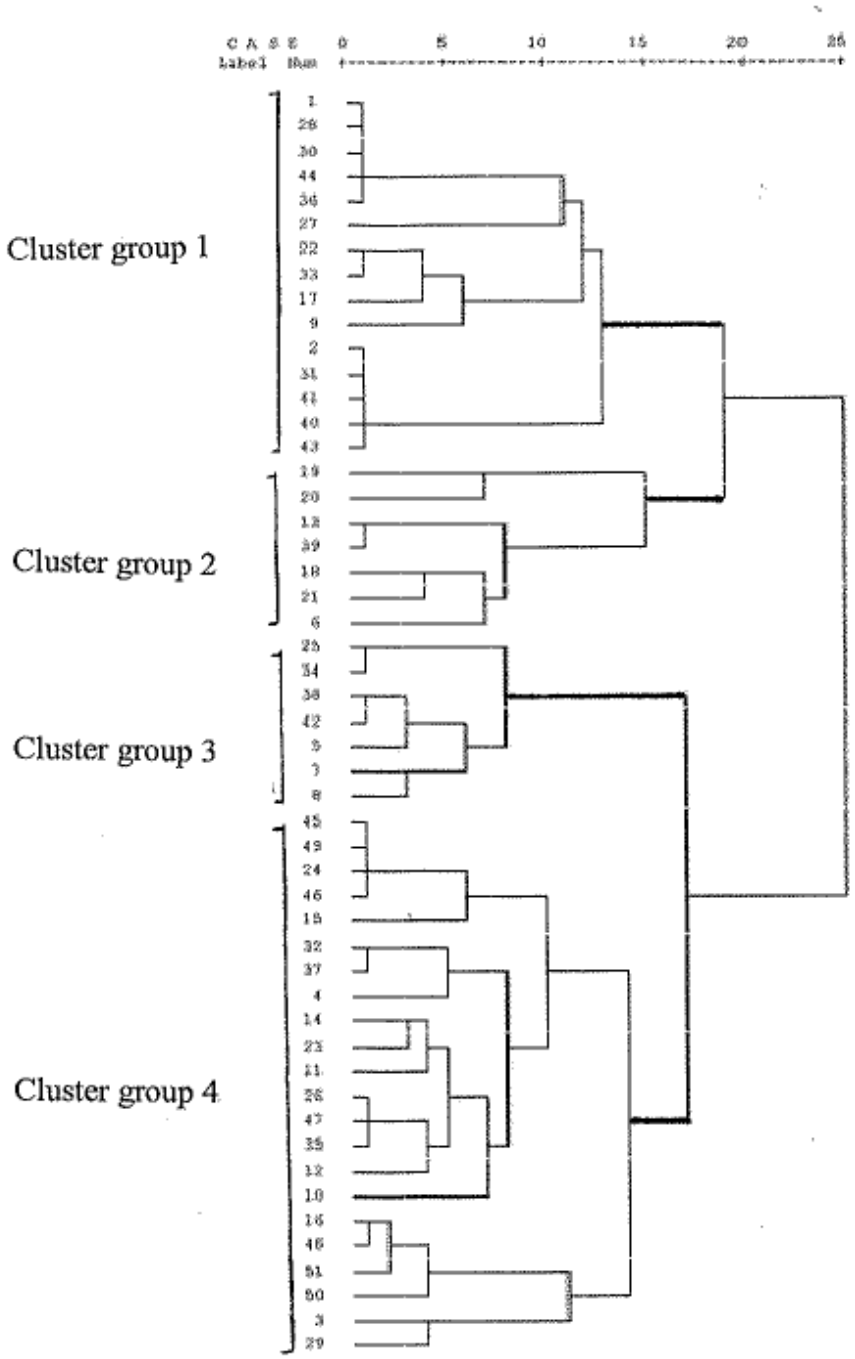



Figure 4.3. Hierarchical cluster analysis showing major groupings of dogs in the SST (numbers below the dendrogram indicate individual dogs. Average linkage between groups is shown).

**Table 4.6. Low, medium and high ranges for each behavioural variable in relation to cluster groupings of dogs in the SST.**

| | Cluster groups | | | | | ANOVA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | High range | | | | | Medium range | | | | | Low range | | | | | |
| Variable | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 | *F(7,50)* | *p* |
| Exploration with owner | | H | | | | M | | | | | | | L | L | 2.83 | 0.016 |
| Exploration with stranger | | | | | | | | | | | L | L | L | L | 10.46 | 0.0005 |
| Play with owner | | | | | | | | M | M | | L | L | | | 23.66 | 0.0005 |
| Play with stranger | | | | | | M | | M | M | | | L | | | 29.42 | 0.0005 |
| Passivity with owner | | H | | | | | | M | M | | L | | | | 5.510 | 0.0005 |
| Passivity with stranger | | H | | | | | | M | M | | L | | | | 19.38 | 0.0005 |
| Duration of contact with owner | | | | | | | | M | M | | L | L | | | 23.93 | 0.0005 |
| Duration of contact with stranger | | | | | | M | | | M | | | L | L | | 10.38 | 0.0005 |
| Stands by door when with owner | | | | | | | | | | | L | L | L | L | 26.35 | 0.0005 |
| Stands by door when with stranger | | H | H | | | | | | M | | L | | | | 25.45 | 0.0005 |
| Tally of gazes with owner | | | | | | | | | M | | L | L | L | | 23.57 | 0.0005 |
| Tally of gazes with stranger | | | | | | | | M | M | | L | L | | | 18.88 | 0.0005 |
| Duration of gazes with owner | | H | | | | | | | M | | L | | L | | 13.22 | 0.0005 |
| Duration of gazes with stranger | | H | | | | | | M | M | | L | | | | 12.85 | 0.0005 |
| Physical contact with owner | | H | | | | | | | M | | L | | L | | 19.89 | 0.0005 |
| Physical contact with stranger | | | | | | | | M | | | L | L | | L | 6.50 | 0.0005 |
| Tally of contact seeking entering owner | | H | | | | | | | M | | L | | L | | 4.31 | 0.001 |
| Tally of contact seeking entering stranger | | H | H | | | M | | | M | | | | | | 7.55 | 0.0005 |
| Delay of contact seeking entering owner | | | | H | | M | | M | | | | L | | | 19.64 | 0.0005 |
| Delay of contact seeking entering stranger | | | | H | | M | | | | | | L | L | | 14.33 | 0.0005 |
| Tally of door scratching in absence of owner | | | | | | | | | | | L | L | L | L | 24.20 | 0.0005 |
| Tally of door scratching in absence of stranger | | | H | | | | | | | | L | L | | L | 24.20 | 0.0005 |
| Totals | 0 | 9 | 3 | 2 | | 6 | 0 | 9 | 14 | | 16 | 13 | 10 | 6 | | |

More than half of the behaviours when categorised according to the post-hoc Duncan multiple range test, were exhibited at a low level by the four clusters of dogs, almost a third of the behaviours were exhibited at a medium level and fourteen of the behaviours were exhibited at a high level in this sample of dogs. Cluster group one exhibited most behaviours at a low level with six at a medium

level, group two exhibited nine at a high level with most at a low level, group three exhibited three behaviours at a high level and similar numbers of behaviours at a medium and low level, and finally, cluster group four exhibited two behaviours at a high level, fourteen at a medium level and six at a low level.

Cluster analysis groups were also compared in terms of the factorial variables using the post-hoc Duncan multiple-range test (see Table 4.7).

**Table 4.7. Factorial Patterns of the four Cluster Groups**

| | Cluster group | | | | Anova | |
|---|---|---|---|---|---|---|
| Factor | 1 | 2 | 3 | 4 | *F(7,50)* | *p* |
| Attachment | M | M | H | H | 2.790 | 0.0005 |
| Acceptance | M | L | L | M | 4.021 | 0.0005 |
| Eye- contact | M | M | H | M | 3.783 | 0.0005 |

Cluster group one showed medium levels of the three factors, group two showed medium levels of attachment and eye-contact with low level of acceptance, group three showed high levels of attachment and eye-contact with a low level of acceptance, and group four showed a high level of attachment with medium levels of acceptance and eye-contact.

### 4.3.4. Secure Base Effect

According to Ainsworth (1989) the secure base effect is the primary factor that distinguishes an attachment from other types of affectional bonds. A child exhibiting the secure base effect uses their mother as a secure base from which to explore the environment and interact with others, returning to the 'safety' of their mother's arms when any situation perceived as potentially threatening by the child occurs. In Topal *et al.*'s (1998) analysis there is a lack of evidence relating to canine behaviours akin to the secure base effect as some relevant behavioural categories were not included in Topal *et al.'s* study. This omission in the Topal *et al*. (1998) study was also noted by Prato-Previde *et al.* (2003) in their observational study of dogs' secure-base behaviour in the Strange Situation in which they assert that the order effects inherent in the SST make it impossible to observe reliable secure-base behaviours.

Palmer and Custance addressed this in their 2008 study which counter-balanced the various episodes of the SST. The secure-base behaviours included in the present study give the potential for

exploration of their importance in the human canine bond as measured by the SST without counter-balancing the episodes. The three factorial variables already identified by factor analysis, namely attachment, acceptance and eye-contact, overlap with the analysis of secure base behaviours, but the analysis is included here as it highlights what Ainsworth (1989) considered a defining factor in the measurement of attachment in human infants, and compares it to that of domestic canines.

The current study includes behavioural variables relevant to the secure-base effect; both gazing and door scratching behaviour assess preference, proximity seeking and searching behaviour. The current study also performs a specific analysis of the secure base effect as set down in the Prato-Previde *et al.* (2003) study. The SST procedure provides the means by which one can identify a secure base effect. Play and exploration behaviour in the presence of the owner compared to the stranger can be noted, as well as behaviours indicating anxiety in the presence of the stranger.

In the present study, eight of the behaviours recorded represent Ainsworth's four secure base behaviour categories as follows:

- Safe base effect - passive behaviour and play behaviour
- Proximity seeking - physical contact and gazing behaviour
- Search behaviours: standing by door and scratching door
- Comfort seeking - duration of contact and delay to greet

The behaviour that the dogs exhibited in the presence of the owner and the stranger in terms of these four secure base behaviour categories was compared using two-tailed Holm's sequential Bonferroni procedure (Holm, 1979). The dogs exhibited more safe base behaviour in the presence of their owner than the stranger, $t = 4.37$, df = 50, $p < 0.05$, and sought the proximity of their owners more than they did the stranger, $t = 4.84$, df = 50, $p<0.05$. The dogs also showed more searching behaviour when their owner was absent from the room than they did when the stranger was absent from the room, $t = 7.34$, df = 50, $p < 0.05$ and they sought comfort from their owner more than they did from the stranger, $t = 0.88$, df = 50, $p<0.05$.

The categorisation of dogs into the same four cluster groups was further supported by the results of post hoc ANOVA tests on secure base behaviours using the four groups as independent variables (factors). Another post hoc Duncan multiple-range test showed significant ranges for each behaviour whereby the level of any behaviour variable could be classified as low, medium or high (L, M, H) in a given group (see Table 4.8).

**Table 4.8. Low, medium and high ranges for secure base behaviours in relation to cluster groupings of dogs in the SST**

| | Cluster groups | | | | | | | | | | | | Anova | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | High range | | | | Medium range | | | | Low range | | | | | |
| Behaviour Type | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | *F(7,50)* | *p* |
| Safe base effect with owner | | H | | | M | | M | M | | | | | 1.008 | 0.001 |
| Safe base effect with stranger | | | | | M | | M | M | | *L* | | | 6.001 | 0.0005 |
| Proximity seeking with owner | | H | | | | | | M | L | | L | | 2.420 | 0.0005 |
| Proximity seeking with stranger | | H | | | M | | M | M | | | | | 3.165 | 0.0005 |
| Search behaviours with owner | | | | | | | | | L | L | L | L | 2.636 | 0.0005 |
| Search behaviours with stranger | | H | H | | | | | | L | | | L | 1.779 | 0.0005 |
| Comfort seeking with owner | | H | | H | | | M | | L | | | | 1.042 | 0.0005 |
| Comfort seeking with stranger | | H | | H | M | | | | | | L | | 7.907 | 0.0005 |
| Totals | 0 | 6 | 1 | 2 | 4 | 0 | 4 | 4 | 4 | 2 | 3 | 2 | | |

Secure base behaviours were spread relatively evenly across the ranges with nine behaviours exhibited in the high range and eleven in each of the medium and low ranges. Dogs in cluster group one showed equal numbers of behaviours in the medium and low ranges, group two exhibited most of the secure-base behaviours in the high range with two in the low range, group three exhibited most behaviours in the medium and low ranges with one in the high range, and cluster group four showed half the secure-base behaviours in the medium range with two in each of the high and low ranges. Thus the four groupings of dogs derived from the hierarchical cluster analysis remain relatively robust when analysed in terms of both the (eleven) behavioural categories, the three variables derived from factor analysis and in relation to secure base behaviours.

**Summary of cluster analysis**

Cluster group one, comprising fifteen dogs, was characterised by medium levels of attachment, acceptance and eye-contact, and low to medium levels of the secure base behaviours, and were the least reactive of the groups of dogs. Perhaps the most striking feature was their very low level of search behaviours. They did not appear to distinguish between owner and stranger, and responded to the situation in a consistently low to medium level manner.

Cluster group two, which comprised seven dogs, were characterised by medium level attachment, low-level acceptance, and medium level eye-contact, but had the highest levels of secure base behaviours within the groups of dogs, and can thus be seen as the most reactive of the three groups, although there was some differentiation between owner and stranger in the secure base and search behaviours whereby there was little secure base effect observed in relation to the stranger and very little search behaviour seen in relation to the owner. Nonetheless, these dogs responded at a high level to the SST in general.

Cluster group three, comprising seven dogs, showed high level attachment, low-level acceptance, and high levels of eye-contact, and contained a mixed set of animals with medium and low levels of most of the secure base behaviours, but high levels of search behaviour with the stranger. These dogs were fairly consistent in their responses to the SST but demonstrated a somewhat mixed reaction to the experimental situation in general.

Cluster group four, comprising 22 dogs showed high levels of attachment and medium levels of acceptance and eye-contact, but with a diverse set of responses in terms of the secure-base behaviours. These dogs were the least consistent of the four groups in their behavioural patterns.

**Owners prediction of their dogs' behaviour in the SST**

Responses to the questionnaires on the owners' prediction of their dog's behaviour in the SST were rated in terms of whether or not safe base, proximity/comfort seeking and search behaviours (for owner and stranger) were described in responses to each question. A score of one was given for any description of the eight secure base behaviours regardless of how many times a description of the same behaviour might be given per answer. As there are eight possible secure base behaviours for five of the six questions, and four possible secure base behaviours for the first question, the

maximum score on 'What will your dog do in this situation?' is therefore 44. Thus the higher the score the more secure base behaviour was predicted by their owner (maximum score, 44).

The relationship between the CDA scale scores and the owner's predictions of their dog's behaviour in the SST were investigated using Pearson's product moment correlation coefficient ($r$ = 0.803, $p$<0.001). Thus, a high CDA score is positively correlated with owners' prediction of their dogs' secure-base behaviour in the SST procedure indicating that if owners feel highly attached to their dogs, they strongly believe that their dogs will exhibit behaviours indicating a high level of attachment to them in the SST.

The relationship between the overall CDA scale scores, and the four CDA subscale scores (companionship, feeling loved, dogs as friends, negative aspects) and the dogs' behaviours in the SST were also investigated using Pearson's product moment correlation coefficient. The factorial behaviours of attachment, acceptance and eye-contact were not found to be significantly correlated to either the overall CDA scores or the CDA sub-scores. This indicates that the owners' expressed attachment to their dogs is not linked to their dogs' actual behaviour in the SST. (See appendix B for correlation coefficients and significance levels)

### 4.3.5. Correlational analyses

The correlation between three key factors; attachment, acceptance and gazing, and several behaviours exhibited in the SST were examined (Pearson product moment test; Table 4.9).

**Table 4.9. Correlations (Pearson product moment, n=51) between factors in Strange Situation behaviour. Coefficients and p values are given for correlation coefficients greater than 0.6 regardless of sign (see text on p.86 for explanation of this criterion). Other correlations are indicated by ns.**

| | attachment | acceptance | gazing |
|---|---|---|---|
| attachment | - | *ns* | *ns* |
| acceptance | ns | - | *ns* |
| eye-contact | ns | *r=0.60*<br>*p =0.0005* | - |
| safe base owner | *r=0.60*<br>*p<0.0005* | r=*-0.61*<br>*p<0.0005* | *ns* |
| safe base stranger | ns | *ns* | *ns* |

| | | | |
|---|---|---|---|
| proximity seek owner | *r=0.65 p<0.0005* | *r=0.73 p<0.0005* | *r=0.62 p<0.0005* |
| proximity seek stranger | *r*=-0.37 *p*<0.007 | *r=-0.94 p<0.0005* | *r=-0.67 p<0.0005* |
| search for owner | *r=-0.60 p<0.0005* | *r=-0.29 p<0.037* | *r=-0.48 p<0.0005* |
| search for stranger | *r=-0.72 p<0.0005* | *r=-0.58 p<0.0005* | *ns* |
| comfort seek owner | *r*=-0.91 *p*<0.0005 | *r=-0.65 p<0.0005* | *ns* |
| comfort seek stranger | *r*=-0.70 *p*<0.0005 | *r=-0.52 p<0.0005* | *ns* |
| duration of contact with owner | *r*=-0.80 *p*<0.0005 | *ns* | *ns* |
| duration of contact with stranger | ns | *r=-0.49 p<0.0005* | *ns* |
| play with owner | *r*=--0.40 *p*<0.003 | *r=-0.61 p<0.0005* | *r=--0.45 p<0.001* |
| play with stranger | *r*=--0.61 *p*<0.0005 | *r=--0.80 p<0.0005* | *r=--0.2 p<0.002* |
| passivity with owner | *r*=-0.69 *p*<0.0005 | *ns* | *r=-0.37 p<0.007* |
| passivity with stranger | *r*=-0.28 *p*<0.048 | *ns* | *ns* |

The factors are significantly correlated with several of the behaviours exhibited in the SST, and are intuitive in terms of what one might expect. *Attachment* behaviour is significantly positively correlated with *safe base behaviour with owner, proximity seeking owner, searching for owner, comfort-seeking owner and duration of contact with owner*. *Attachment* is significantly negatively correlated with *play with stranger*. *Acceptance (of stranger)* behaviour is significantly positively correlated with *proximity-seeking strange*. *Acceptance* is significantly negatively correlated with *safe-base behaviour with owner*.

However, some of the significant correlations are less clear in that they are perhaps counter-intuitive, so that *attachment* (as defined by behaviours clustered in the factor analysis) is significantly positively correlated with *search for stranger, comfort-seek stranger* and *passivity with owner. Acceptance* (of stranger) by dogs is significantly positively correlated with *proximity-seeking owner, comfort-seeking owner* and *play with owner*. *Acceptance* is significantly negatively correlated with *play with stranger*. These counter-intuitive correlations will be discussed in section 5.4.6.

Finally, *eye-contact* is significantly positively correlated with *acceptance of stranger, proximity-seeking owner* and *proximity-seeking stranger*. It is clear from this finding that gazing behaviour in this sample of domestic dogs is an important element of initiating contact/proximity–seeking humans. This will be discussed further in section 5.4.6.

**Table 4.10. Significant effects (with correlation coefficients of +/- 0.6 or above emboldened) of secure base behaviours on strange situation behaviours. r-values are given above with p-values below.**

| | **safe base owner** | **secure base stranger** | **proximity seek owner** | **proximity Seek stranger** | **search for owner** | **search For stranger** | **comfort Seek owner** | **comfort Seek stranger** | **"what will…? Scores"** |
|---|---|---|---|---|---|---|---|---|---|
| safe base owner | - | ns | ns | ns | 0.33<br>0.017 | ns | ns | ns | ns |
| safe base stranger | ns | - | -0.47<br>0.0005 | -0.58<br>0.0005 | 0.44<br>0.001 | -0.28<br>0.050 | -0.28<br>0.044 | -0.48<br>0.0005 | ns |
| proximity seek owner | ns | -0.47<br>0.0005 | - | **0.88**<br>0.0005 | 0.48<br>0.0005 | 0.35<br>0.012 | **0.78**<br>0.0005 | 0.51<br>0.0005 | ns |
| proximity seek stranger | ns | ns | **0.88**<br>0.0005 | - | 0.32<br>0.024 | ns | ns | ns | -0.28<br>0.0005 |
| search for owner | ns | ns | 0.48<br>0.0005 | ns | - | ns | ns | ns | ns |
| search for stranger | ns | -0.28<br>-0.050 | 0.35<br>0.012 | 0.41<br>0.003 | 0.38<br>0.006 | - | **0.71**<br>0.0005 | ns | ns |
| comfort seek owner | 0.35<br>0.013 | ns | **0.78**<br>0.0005 | **0.70**<br>0.0005 | ns | ns | - | ns | ns |
| comfort seek stranger | 0.52<br>0.0005 | ns | 0.51<br>0.0005 | 0.48<br>0.0005 | ns | **0.64**<br>0.0005 | **0.61**<br>0.0005 | - | ns |
| duration of contact with owner | 0.32<br>0.021 | -0.29<br>0.040 | **0.74**<br>0.0005 | **0.68**<br>0.0005 | 0.48<br>0.0005 | **0.63**<br>0.0005 | **0.89**<br>0.0005 | 0.57<br>0.0005 | ns |
| duration of contact with stranger | 0.43<br>0.002 | -0.40<br>0.004 | 0.43<br>0.002 | 0.44<br>0.001 | ns | 0.53<br>0.0005 | 0.49<br>0.0005 | **0.78**<br>0.0005 | ns |
| passivity with owner | ns | ns | **0.82**<br>0.0005 | ns | 0.48<br>0.0005 | 0.36<br>0.010 | **0.75**<br>0.0005 | 0.54<br>0.0005 | ns |
| passivity with stranger | ns | ns | ns | ns | 0.34<br>0.014 | 0.40<br>0.003 | 0.28<br>0.044 | 0.36<br>0.009 | ns |
| play with owner | ns | ns | ns | **-0.73**<br>0.0005 | 0.48<br>0.0005 | -0.30<br>0.036 | **-0.62**<br>0.0005 | -0.40<br>0.004 | ns |
| play with stranger | ns | ns | ns | **-0.85**<br>0.0005 | -0.30<br>0.034 | -0.49<br>0.0005 | **-0.73**<br>0.0005 | **-0.60**<br>0.0005 | ns |
| "what will…?" scores | ns | ns | ns | -0.28<br>0.0005 | ns | ns | ns | ns | - |

Similarly, several of the secure-base behaviours are significantly correlated with individual behaviours exhibited in the SST, and are intuitive in terms of what one might expect. So that dogs *comfort-seeking* their owner is significantly positively correlated with *proximity-seeking owner* and *duration of contact with owner*.

*Comfort-seeking owner* is significantly negatively correlated with *play with owner* (if the dog exhibited comfort-seeking behaviour towards his or her owner it did not tend to exhibit play as well) and *play with stranger.* Dogs' *search behaviours* when the stranger was out of the room is significantly positively correlated with *comfort-seeking stranger*. *Proximity-seeking owner* is significantly positively correlated with *duration of contact with owner*. *Comfort-seeking the stranger* is significantly positively correlated *with duration of contact with stranger*.

Again however, some of the significant correlations are less clear in that they are perhaps counter-intuitive, so that *proximity-seeking the stranger* is significantly positively correlated with *proximity-seek owner, comfort-seek owner* and *duration of contact with owner*. *Search for stranger* is significantly positively correlated with *duration of contact with owner*. *Comfort-seek owner* is significantly positively correlated with *search for stranger, comfort-seek stranger* and *passivity with owner*. These counter-intuitive correlations are discussed in section 5.4.6.

### 4.3.6. Effects of independent variables on SST behaviours, and the association between canine attachment, problem behaviour, conspecific social group size, and heterospecific social group size.

Multiple regression analysis on the 51 dog-owner pairs in the SST indicates a number of significant effects of independent variables on SST behaviours (see Table 4.11a-c) whereby household size, the presence of children, whether or not the owner grew up with pets, the owners favoured pet species, primary dog-carer and whether or not the dog lives with other pets has an effect on all or some of the SST factors (attachment, acceptance, and eye-contact).

**Table 4.11a. Multiple regression showing significant effects of independent variables on dogs' attachment behaviour.**

Adjusted R square = 0.53; $F_{3,46} = 19.327$, p, 0.0005 (using the stepwise method). Significant variables are shown below.

| **Predictor variable** | **Beta** | ***p*** |
|---|---|---|
| 1-person household | 0.646 | *P<0.0005* |
| 2-person household | 0.566 | *P<0.0005* |
| Respondent grew up with pets yes/no | -0.310 | *P<0.004* |

The remaining independent variables were not a significant predictor in this model.

The model accounts for 53% of the variance in dogs' attachment behaviour. The beta scores for these predictor variables indicate the level of their impact on dog attachment behaviours.

**Table 4.11b. Multiple regression showing significant effects of independent variables on dogs' acceptance behaviour.**

Adjusted R square = 0.06; $F_{1,48} = 4.245$, p, 0.045 (using the stepwise method). Significant variables are shown below.

| Predictor variable | Beta | *p* |
|---|---|---|
| Dog not cared for by respondent | 0.285 | *P<0.045* |

The remaining independent variables were not a significant predictor in this model.

The model accounts for only 6% of the variance in dogs' acceptance behaviour. The beta score for this predictor variable indicates the low level of its impact on dogs' acceptance behaviour.

**Table 4.11c. Multiple regression showing significant effects of independent variables on dogs' eye-contact behaviour.**

Adjusted R square = 0.32; $F_{3,46} = 8.770$, p, 0.0005 (using the stepwise method). Significant variables are shown below

| Predictor variable | Beta | *p* |
|---|---|---|
| Dog lives with children yes/no | 0.391 | *P<0.002* |
| Dog lives with another pet species | 0.309 | *P<0.013* |
| Dog care is shared by family members | -0.266 | *P<0.029* |

The remaining independent variables were not a significant predictor in this model.

The model accounts for 32% of the variance in dogs' eye-contact behaviour. The beta scores for these predictor variables indicate the relatively low-level of their impact on eye-contact behaviour.

The original SST sample of 51 participants contained 36 dogs whose owners had submitted data (via a checklist of problem behaviours derived from Mugford, 1992) on their dog's perceived behavioural problems at the beginning of the study. Behavioural problems included in this subset were: 'too noisy', 'too excitable', 'destructive chewing' and 'over-attached'. Analysis of variance with this subset indicates eight significant effects of dogs' behavioural problems on SST behaviours whereby the dogs having behavioural problems had a significant effect on levels of attachment, eye-contact, safe-base behaviour with owner, proximity-seeking owner and stranger, searching for

owner and stranger, and comfort-seeking behaviour with the stranger.

**Table 4.12. Significant effects of dogs behavioural problems, on SST behaviours.**

| SST behaviour | Dogs with behavioural problems ANOVA F(8,35) |
|---|---|
| Attachment | *F 2.795*<br>*P 0.014* |
| Eye-contact | *F 8.740*<br>*P 0.0005* |
| Safe-base behaviour with owner | *F 3.402*<br>*P 0.004* |
| Proximity-seeking behaviour with owner | *F 2.757*<br>*P 0.015* |
| Proximity-seeking behaviour with stranger | *F 6.010*<br>*P 0.0005* |
| Search behaviour with owner | *F 2.858*<br>*P 0.012* |
| Search behaviour with stranger | *F 2.062*<br>*P 0.062* |
| Comfort-seeking behaviour with stranger | *F 4.400*<br>*P 0.001* |

Employing the Bonferroni post- hoc test, no significant differences were found *within* any of the four specific behavioural problems in the sample and SST behaviours.

**Effects of the presence of children, other dogs and other pets**

The effects of the presence of children, other pets and other dogs in the house on dogs' behavioural problems were not analysed using inferential statistics due to small numbers. Descriptive statistics are displayed in figure 4.5.

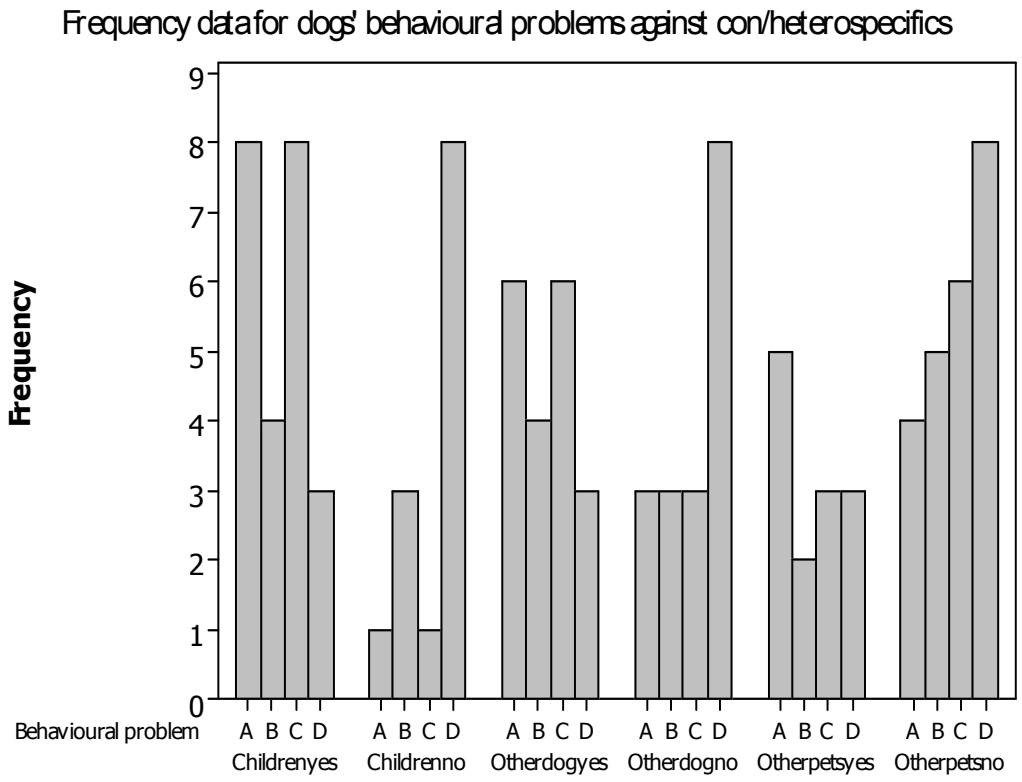



Figure 4.5. Frequency of dogs' behavioural problems (A-too noisy, B-too excitable, C-destructive chewing, D- over-attached) in relation to the presence of children, presence of another dog, and other pets in the household.

In this sub-sample more dogs living with children, other dogs and other pets were described by their owners as being too noisy, with the greatest difference being between households with and without children. Dogs living with children and other dogs were more frequently described as too excitable by their owners when compared to dogs living without children and dogs, but the difference is small, and dogs living with other pets were less often described as too excitable when compared to those not co-habiting with other pet species. More dogs were described as destructive chewers when they lived with children and other dogs, but less often if they lived with other pets. Finally dogs were more often described by their owners as over attached when they lived without children, dogs and other pets.

### 4.4. Discussion

The aim of this study was to apply the Ainsworth (1969) strange situation test (SST) to companion dogs and their owners, and to include behavioural categories conducive to the measurement of secure base behaviour. In addition, owners' perception of their bond with their dog was examined in relation to the actual attachment data obtained in the observations. The data was examined in terms of the association between attachment and problem behaviour in dogs and the effects of conspecific and heterospecific social group size on the levels of canine attachment in the SST. The results show that the modified version of the SST was effective in eliciting certain behaviour patterns in companion dogs, and that these patterns are affected by some independent variables such as the number of persons in a household and whether or not there are other pets in the home.

The procedure works as a measure of attachment type and strength in human infants because attachment is usually regarded as a feature of childhood (Gasci *et al.,* 2001). The dogs in the present study were aged between six months and twelve years of age, and most of them were adults rather than infants, however, this does not pose a problem in the use of the method and can be explained if we consider the process of dog domestication. This has resulted in a dependent animal, which may have, as previously mentioned, evolved behaviours conducive to accelerated attachment to humans (Gasci *et al.,* 2001). Such behaviours may well have evolved in conjunction with human selection for paedomorphic canines with a tendency to behave in a similar fashion to human infants in social situations (Soproni *et al*., 2001).

For example, in studies where information on the location of hidden food is conveyed to dogs by means of human communicative gestures such as head nodding and pointing, dogs perform much better than do chimpanzees, and indeed very similarly to human children, suggesting that dogs, like children, interpreted the test situation as a form of communication (Soproni et al.,2001). This constitutes strong evidence for the likely efficacy of the SST as an assessment tool for attachment behaviours in adult companion dogs, given their lifelong puppy-like behaviour and willingness to treat humans communicatively, and as conspecifics. The dogs in the study clearly demonstrated secure base behaviours given that they showed a strong preference for their owner in terms of proximity and comfort, and exhibited more searching behaviours when their owner was out of the room than when the stranger was. These findings are analogous to those of similar studies involving children (Ainsworth, 1969), monkeys (Kaufman & Rosenblum, 1969), chimpanzees, (Bard, 1991), and dogs, (Topal *et al.*, 1998; Prato-Previde *et al.*, 2003).

However, it is necessary to bear in mind the likely effects of the dogs' individual differences in terms of their living context and learned behaviours as clarified by Gasci *et al.* (2001), and Topal *et al.* (2005), who stressed the importance of these social and individual influences operating alongside the social contexts of the SST. These authors also pointed out that most of the behaviours elicited by the SST vary only by degree in relation to the dogs' owners and the stranger and that only greeting behaviour is developed specifically with the owner and not the stranger.

This is not to say that the behaviours observed in the SST which constitute the general dog ethogram are of no interest or relevance to attachment behaviour, given that data from the present study and previous research (Topal et al., 1998.; Prato-Previde, 2003) clearly record a difference in the degree to which a dog exhibits the behaviours in the presence of the owner as compared to the stranger; rather the difference in the dogs' greeting behaviour upon being re-united with their owners versus being reunited with the stranger should perhaps be taken as a very specific interaction for the assessment of the level of dog to owner attachment. It is also worth noting, as Heath (1995) states: ".....a statistically significant difference is not necessarily biologically significant." Any two samples of animal data are highly unlikely to be identical and thus the null hypothesis can be rejected in virtually every case, but this doesn't mean that the difference holds biological or practical interest. Thus, one's interpretation of data and its output from analysis needs to be valid in real terms.

Further to this it is important to consider dog and human behaviour in the SST in terms of both the dogs' and owner/stranger's interpretation of the situation and the behaviours therein. This was elucidated by Rugaas (1997) in her work on the "calming signals" she observed in studies of dog-dog and dog-human social interactions. For example, if a dog in the SST emits a non-threatening signal to the stranger such as not making physical contact and/or averting their gaze, and the stranger responds by making direct eye-contact and/or enforced physical contact it is quite possible that certain dogs could interpret this as a threatening situation. Such dogs will respond to the apparent threat according to the general "rules," as Rugaas (1997) puts it, of canine-human social interaction, and, very importantly, according to their own individual patterns of behaviour (based on experience, learning, and individual tendency; Gasci *et al.,* 2001). How individual dogs may interpret the SST is difficult to measure, but more crucially, the realisation that different individuals may have unique perceptions of the SST due to uncontrolled factors such as past experience, individual tendency, the exact behaviour (signals given and received/interpreted) exhibited by the

stranger and owner in the SST, forces us to question the validity of the modified (for dogs) Ainsworth procedure as it has been used to date, as a measure of attachment in canines.

However, the idiosyncracies noted may not be sufficient to outweigh general trends as the modified SST clearly does measure statistically significant differences in dog-owner vs. dog-stranger behaviour shown in the present study, and in previous studies which have utilised the modified procedure (Topal et al., 1998.; Prato-Previde, 2003). Future research should perhaps focus in much more detail on the dogs' background, experiences, age and domestic context and it should also seek to control the exact behaviours and responses exhibited by at least the stranger, and preferably to some extent by the dog-owners, in the modified Ainsworth procedure, so that a more reliable measure of the dogs' responses to the various episodes of the SST can be recorded and analysed in relation to each individual dog's details. This way the further modified version of Ainsworth's (1969) test could potentially provide a detailed, reliable and valid measure of the complex social and attachment behaviours of dogs towards their owners, elicited by just a few relatively quick and simple experimental episodes based on brief separation and reunion.

In the present study the dogs' SST behaviours were affected by household size, the presence of children, whether or not the owner grew up with pets, the owner's favoured pet species, and whether or not the dog lives with another dog. Attachments to owners were generally stronger when there were fewer persons in the household, when the owner's preferred pet species is dogs, when the dog is the sole canine, and when the dog is the sole pet. According to Marinelli *et al.* (2007), this may simply be because when a dog lives alone with one person and no other pets, the owner just has more free time to attend to their dog, and there is less dispersion of attention than when the household increases in terms of the number of persons and/or pets it contains. Marinelli et al.'s findings (2007) emphasise the possible effects of exclusivity on dog-owner bonds and they even go so far as to say that when there is more than one person living in a household dogs are generally less attached to their owners and more insecure. In the present study dogs living without children, dogs and other pets were more commonly described by their owners as being over attached than dogs living in households with these cohabitees, although in this case the sample size was small. However, it is possible therefore that a link does exist between dispersion of attention and dog attachment levels, and possibly other dog behavioural problems. These then may be other important factors in future research into dog behavioural problems in relation to owner factors, and in future research in the use of the SST with canines.

The cluster analysis revealed that the dogs could be sub-divided into 4 main groups each showing a distinct behavioural pattern of the factorial variables (attachment, acceptance, and eye-contact), and a distinct behavioural pattern of the secure-base behaviours (secure-base effect, proximity seeking, search behaviours, and comfort-seeking behaviours).

The correlational analyses indicate a number of positive and negative relationships that are intuitive, such as attachment behaviour scores for the dogs being positively correlated with secure base behaviour towards the owner. However, there are significant correlations which are less intuitive, such as play behaviour in the dogs being negatively correlated with their attachment behaviour in general, and comfort-seeking with the owner being positively correlated with acceptance of the stranger. This hints at the complexity of the attachment system in dogs, which, although measurable to some extent, given its elicitation by the experimental procedure used here, is by no means fully understood. The dogs' interpretation of the SST in terms of what Rugaas (1997) called "calming signals" and the stranger's response to them, and Semyonova's (2003) assertion that even in brief encounters with strangers, dogs generally attempt to set up a stable binary social system based on signal exchange, strongly suggest that further in-depth analysis of the interplay between dog and stranger in this experimental set-up is required in future research.

Regression analysis (stepwise method) indicates that a small number of the predictor variables (size of household, whether or not the respondent grew up with pets, if the dog is cared for by the respondent or other family members, if there are children in the house and if there is another pet species present) have an impact on dogs' attachment, acceptance and eye-contact behaviours. The strongest predictor variables are one or two person households in relation to dogs' attachment behaviours indicating that as household size increases dogs attachment behaviour to one person decreases and is perhaps spread more diffusely amongst family members. It is worth noting that this may link to the tendency of wolves attachment behaviours to be directed towards the pack and not to individuals (Mech, 1999), thus it is not surprising that dogs in multi-owner households may to some extent exhibit the same tendency.

The owners and dogs observed in the modified SST were attending dog-training classes. The extent to which the results can be generalised to the wider population will depend upon the factors that led the owners to attend the classes. For example, attendance could be indicative of the owner's level of

interest and commitment to their dog, or it could indicate that the owners were aware of some developing or existing behavioural problems with their dog. Future use of the procedure in this type of setting needs to include items on the questionnaire pertaining to the owner's reasons for attendance at training classes.

# Chapter 5: Application of the strange situation to highly socialised, group-living captive wolves; clarification that it doesn't elicit the attachment response in *Canis lupus*.

## 5.1. Introduction

This chapter considers the differences between wolves and their domesticated relatives companion dogs, in terms of their attachment behaviours towards humans given that existing research suggests a distinct difference in the behaviour elicited by the SST for dogs and wolves (Topal et al.,2005). The study detailed in chapter four of this thesis clarifies further the suite of behaviours elicited by dogs subjected to the SST as well as considering dog-owners' perceptions of their attachment to canines. Thus it follows that a further study which utilises the SST procedure with socialised wolves be carried out in order to further understand the mechanisms involved in wolf-human attachment behaviour as compared to dogs, and to consider the perceptions and predictive abilities of the wolves' familiar handler as compared to dog owners.

It is possible to develop what might be termed 'domestic' traits in foxes in as little as twenty generations if one selects foxes exhibiting social behaviour towards humans (Belyaev, 1979). Despite this demonstration, the transition from wolf to prototypic wolf-dog, and finally to dog is often assumed to have been a long process dependent on selective pressures and other related factors (Nowak, cited in Mech & Boitani, 2003). It seems likely that the early wolf-dogs were not selectively bred for any specific trait at all, but bred freely and only associated with humans because of the ready supply of food they offered the opportunist canid (Olsen, 1985). Those animals which became habituated to humans from an early age would have facilitated the domestication process simply by their proximity to humans (Mech, 1970; Scott & Fuller, 1965; Scott, 1967).

The domestication of any species involves the creation of new conditions of selection, and this may well lead to the modification of a wide range of genetic traits. In the domestic dog this has meant adaptation to the human environment in a number of ways. Morphologically speaking, one of the first noticeable changes is in skull size and shape, with a general reduction in size, a shortening of the muzzle and, thus, a broader palate, a steeper forehead, and more crowded teeth (Morey, 1994b; Olsen, 1985). An almost universal character of domestic dogs of all sizes and types is a broad and heavy frontal shield at the top of the skull a feature not found in the modern wolf (Nowak, 1979).

The grey wolf as it exists today is as much the result of evolutionary pressures as is the companion dog, although some major pressures on the dog will have been produced by the process of domestication and would not therefore have been acting upon the wolf, thus it goes without saying that whilst there are great similarities between *Canis lupus familiaris* and *Canis lupus* today given their common ancestry, there are also great differences (Mech, 1970).

The physical characteristics noted above give domestic dogs the appearance of juvenile wolves (paedomorphosis), and are associated with characteristically puppy-like behaviours such as a greater tendency to playfulness than is seen in adult wolves. Evolutionary processes independent of human control such as alterations in development rate and timing (heterochrony), and changes in genetic regulation, may be the driving force of domestic reorganisation, resulting in an adjustment in the behaviour control systems linked to specific behaviours (Belyaev, 1979; Coppinger & Coppinger, 2002).

Adult dogs show a specific pattern of attachment behaviour towards their owner in the SST (Prato-Previde *et al.*, 2003; Topal et al., 1998) even when the dogs being tested have previously been deprived of human contact and have only recently been adopted into a human domestic setting. Wolves observed in the same experimental set-up apparently do not show this specific pattern regardless of their socialisation history with humans (Topal et al., 2005). In the Topal et al. (2005) study, the wolves under study lived with their human carers as companion animals in their domestic homes.

However, Mech (1970) suggests that both dog and wolf puppies do show similar development at least in some ways from birth to maturity. Development can be divided into periods: 1. the neonatal period from birth to eye opening (12-14 days); 2. the transition period, from eye opening to 20 days; 3. the period of socialisation from 20-77 days; and 4. the juvenile period from 12 weeks to maturity (Mech, 1970; Scott & Fuller, 1965: see appendix D for detail of the development of wolves and dogs from birth to the period of socialisation; after Mech *et al.,* 1966).

By the mid juvenile period the mothers of both wolf and dog puppies play only a minor role in reducing separation stress and so this phase of development is where dogs and wolves separate in terms of their non-maternal attachments (Elliot & Scott, 1961). Mech's description of general

canine puppy development clearly indicates how similar wolf and dog pups may be in some respects, especially in their early development, but the similarity in attachments, at least as far as people are concerned, appears to stop there (in the mid-juvenile phase). This is shown by the failure of the SST to activate the suite of attachment behaviours in highly socialised captive wolves living with humans that we see in the domestic dog in this set-up (Topal *et al.* 2005).

This may well be due to the genetic differences that exist between dogs and wolves especially in relation to human selection, in dogs, for dependency, attachment to humans, and neotenous morphological features which may have set in motion the evolution of other associated and unintended behavioural traits. It is of course quite possible that a canine's socialisation history and its genetic inheritance (or predisposition to develop certain behaviours) interact in producing an animal which attaches readily and quickly to humans, but a detailed qualitative and quantitative study of extensively socialised, group-living wolves under experimental conditions in the SST is required to clarify the captive wolf-human attachment system as it is observed in the modified Ainsworth (1969) test.

Studies of the behaviours of captive wolves, applied as a template for the social organisation of free-ranging wolves in the wild, have been heavily criticised because of the enormous differences in pack membership (and thus behaviour) of captive versus wild wolf groups (Mech, 2002). However, this has also led some to conclude that the atypical membership of assemblages of captive wolves (e.g. unrelated, unacquainted, adult, juvenile, male, female, as opposed to the more typical family group seen in the wild), makes their behaviour much more like that of domestic dogs in similar contexts than of free-ranging wild wolves (Mech, 1999; 2002). Consequently, observing the behaviour of highly socialised, group-living captive wolves may allow an insight into the underlying attachment system of other captive, socialised canines with respect to their human handlers, free of the many complexities of the domestic life in which the companion dog lives. The current study attempts to provide clarification of the captive wolf-human attachment system and considers the reasons behind the accuracy of the wolf handler's predictions about the wolves' behaviour in the SST.

## 5.2. Method

### 5.2.1. Research animals

A case series of five wolves (four females and one male) selected by opportunity sample were observed in a modified version of the Ainsworth (1969) SST at the Wolf Conservation Trust facility in Reading England. All the wolves were fit and well at the time of the study, four of them were North American in origin, whereas the male was a cross between a North American and a European wolf. The wolves' ages ranged from eight months to eight years at the time of the study.

The wolves' living area was a very spacious, purpose built enclosure allowing full expression of the wolf's behavioural repertoire including den building, interacting with other wolves, and even hunting of small prey items such as mice, pheasants, partridges and pigeons which strayed into the enclosure. Their diet also consisted of road-kill deer, wild rabbit (containing no lead shot), chicken, beef, oily fish and fruit such as blackberries which the animals foraged themselves from the bramble patches within their enclosures. All the animals in the study had been identi-chipped, received veterinary check-ups regularly, and received medical care as necessary. Any necessary medication and/or treatment at the UK Wolf Conservation Trust (UKWCT), Reading, England, is carried out with the wolf fully conscious as a matter of course unless this is not possible (e.g., for surgery, etc.). All the wolves studied were described as being 'well behaved' for the veterinarian by their familiar handler.

For five days a week at least one person is always on site with the wolves, who are let outside at 6.30am and shut in most nights at 9.30pm, although on occasion they are allowed to remain outside at night. The animals studied often come into contact with domestic dogs (on the other side of the wire of their enclosures) and generally behave in a playful manner towards them. The wolves regularly encounter different members of the UKWCT staff and volunteers, as well as members of the public who come to 'walk' the wolves on chain leads accompanied by two members of UKWCT staff.

### 5.2.2. Case descriptions

**Dakota**

Dakota is a female North American wolf born in 1988 at Woburn Safari Park. She lives with her sister and littermate Duma and twelve year old brother Kodiak. She is one of the UKWCTs main ambassador wolves, often being taken on visits to schools and agricultural shows around the country.

**Duma**

Duma is also a female North American wolf born in 1988 at Woburn safari Park. She lives with her sister and littermate Dakota and twelve year old brother Kodiak. She is the boldest female in her small pack and is slightly shorter and slighter than her sister. She is described by her keepers as very sociable with humans, and often accompanies her sister on visits to schools and agricultural shows around the country as a wolf ambassador.

**Torak**

Torak is a male wolf born at the Anglian Wolf Society in April 2006. He was hand raised and now lives with two sisters, Mai and Mosi, who are unrelated to him. His mother was a North American wolf, his father a European wolf. He was described by his keepers as gentle if somewhat aloof, and exhibited the boldest behaviour of the wolves in his pack in the sense that he was less cautious than his pack-mates when encountering a novel stimulus or situation, and was thus first to investigate such things.

**Mosi**

Mosi is a North American wolf born in April 2006 at Dartmoor Wildlife Park. She lives with her littermate Mai and an unrelated male, Torak, of the same age. Mosi and her sister Mai were rescued from their flooded den at only two days old, after this they were hand-raised by keepers and volunteers at the UKWCT. Mosi is described by her keepers as submissive when very young, but now shows bolder behaviour than her sister in new situations.

**Mai**

Mai is a female North American wolf born in April 2006 at Dartmoor Wildlife Park. She lives with her littermate Mosi and an unrelated male wolf, Torak, of the same age. She is described by her keepers as less bold and inquisitive than her sister.

### 5.2.3. Procedure

The basic set up was similar to the previous study in this thesis with dogs (chapter 4), where a version of Ainsworth's ( 1969) SST was utilised with additional behavioural categories included in the Strange Situation for Dogs (duration and tally of gazing behaviour and tally of door scratching). The main difference between the Strange Situation for Wolves and the SST was the enclosure used, and the animals' exposure to people and other wolves during the procedure. We were not able to use a fully enclosed room with the wolves, as we had for the dogs, as no suitable room was available at the UKWCT, and this would also have raised health and safety issues for the people involved, and potential welfare problems for the wolves. As a consequence, a partially occluded (by opaque sheet plastic) mesh enclosure allowed the wolves and people to see, to a small extent other wolves and people outside the experimental enclosure in the distance. Prior to testing, the wolves' familiar handler (the same man in each case who was in charge of handling the wolves every day) completed a questionnaire entitled, "What will each wolf do in this situation?" whereby the scenario of the experimental set up was described, and the regular handler asked to comment briefly on the behaviour he expected each wolf to exhibit in this context. This was the same as the questionnaire used with dog-owners in the study detailed in Chapter four. (see Table 5.1).

**Table 5.1 Questionnaire to assess handler's prediction of each wolf's behaviour in the SSW.**

**What will each wolf do in this situation?**

Name: Wolf's name:

The "Strange Situation" is a procedure, which is usually used to work out what kind of bond children have with their carers. We have modified this procedure in order to measure the same thing with wolves and their regular handler. You and each individual wolf will be videoed in a small enclosure in a number of situations lasting no more than two minutes each. These include: you and each wolf together, each wolf when left alone in the small enclosure, each wolf in the presence of a stranger, and so on.

Previous studies show that canines can exhibit a number of behaviours in this situation, such as playing, being passive, seeking contact with people and staying close to them, standing by the door and scratching the door, gazing at people, and rushing to meet them when they come back into the room. You may feel that some or all of these behaviours would be typical of each animal, please indicate which behaviours you feel are likely.

Thank you very much for taking part in this study. If the results are published you will remain anonymous. If you have any questions at all, please do not hesitate to ask me. You are not obliged to answer any of the questions if you do not want to, and you are free to leave at any time.

Please answer the following questions as honestly as possible with a detailed description of each wolf's likely behaviour, and to the best of your ability. There are no right or wrong answers.

1. When each wolf is alone in the small enclosure how will he/she behave?

2. When the stranger enters the room and talks to you, how will each wolf behave towards you and the stranger/

3. When each wolf is left alone in the room with the stranger, how will he or she behave towards you and the stranger?

4. When you come back into the room and are reunited with each wolf, how will he or she behave towards you, and the stranger?

5. When each wolf is left alone with the stranger for the second time, how will he or she behave towards the stranger?

6. When you come back into the room and are reunited with each wolf for the second time, how will he or she behave towards you, and the stranger?

The small enclosure used was a four x four metre square concrete yard surrounded by thick metal

mesh which was occluded by opaque sheet plastic, and with two bolt-able gates, one leading into the wolves' regular large enclosure, and one leading out of the experimental space into a further concrete yard surrounded by thick metal mesh, and on out of the complex. All behaviours exhibited in the fourteen and a half -minute procedure were videotaped by a hand-held recorder operated by an experienced volunteer. The behaviours were later analysed. The person filming the episodes did so at a distance of several feet (inside the secondary concreted enclosure leading out of the complex) using a long lens to capture the detail of each episode without disturbing the wolves, remaining silent but partially visible to the wolves.

**5.2.4. The experimental episodes of the Strange Situation for Wolves (SSW):**

The experimental episodes of the Strange Situation for Wolves were the same as for the dogs (detailed in chapter four). The role of stranger was played by the author of this thesis. A risk assessment had also been carried out and the possible dangers of being in a small space with the wolves carefully considered and planned for in the case of injury or other emergency. The handler was simply told that this part of the study concerned each wolf's behaviour in a novel context. Thus, he was unaware of the formal goals and hypotheses of the research.

**5.2.5. Observations and Behavioural Categories**

One trained observer analysed the videotaped sessions of the five wolf-handler pairs. Each of the eleven behaviour categories was scored for both handler and stranger in the same way as for the dog study detailed in chapter four. The recorded variables were as follows:

1. Exploration in the presence of the handler/stranger
2. Playing in the presence of the handler/strange
3. Passive behaviour in the presence of the handler/stranger
4. Duration of physical contact with the handler/stranger
5. Standing by the gate in the presence of the handler/stranger
6. Duration of gazing at handler/stranger

7. Tally of gazing at handler/stranger

8. Duration of physical contact while greeting

9. Tally of scratching the gate or fence in the absence of the handler/stranger

10. Score for proximity of contact-seeking handler/stranger

11. Score for delay to greet entering handler/stranger.

The percentage of the time spent in these behaviours was established, and the relative duration of each variable was summed across relevant episodes, for the purposes of analysis. This was done in exactly the same way as for the previous SST study with dogs in this thesis. In order to establish the reliability of the observer, a second observer sampled the behaviours. Inter-observer agreement was assessed by sampling the behaviour every ten seconds for two of the SSW sessions, and calculating the percentage agreement. These are given below in Table 5.2.

**Table 5.2 Percentage agreement between the stranger and an independent observer instructed in the behavioural categories of the SSW.**

| Behaviour | Description | % agreement on behaviour type | % agreement on timings |
|---|---|---|---|
| 1. Exploration | Activity directed toward non-movable aspects of the environment, including sniffing, distal visual inspection, close visual inspection, or oral inspection | 95 | 92 |
| 2. Playing | Any vigorous social partner related behaviour, including running, jumping or any playful physical contact. | 99 | 94 |
| 3. Passive Behaviour | Sitting, standing or lying down without any orientation towards the environment. | 96 | 96 |
| 4. Physical Contact | Duration of physical contact with human | 96 | 92 |
| 5. Standing by Gate | Time spent close to the gate (<1m) | 99 | 97 |
| 6. Duration of Gazing | Duration of gazing directed at human face | 95 | 93 |
| 7. Tally of Gazes | Total number of gazes directed at human face | 98 | n/a |
| 8. Duration of Contact-Seeking | Duration of contact-seeking | 93 | 93 |
| 9. Tally of door scratching | Total number of times a food was used to contact the gate in a scratching motion in the absence of the handler/stranger | 100 | n/a |
| 10. Proximity of contact-seeking | The sum of the following scores: approach initiation (+1), full approach characterised by physical contact (+2), any sign of avoidance (-1) | 96 | n/a |
| 11. Delay to greet | The amount of time (secs) from the moment of the opening of the gate, to the first sign of approach behaviour (if approach was not recorded, was considered to be the duration of the full episode (120s) | 95 | 95 |

### 5.2.5. Analysis of data

Behavioural data were recorded continuously during observations and the percentage of the time spent performing each behaviour was calculated for both the handler and stranger episodes. A description of each of the behaviours is given above in Table 5.2.

## 5.3. Results

### Secure Base Behaviour

The SSW procedure provides the means by which one can identify secure base behaviours. Play and exploration behaviour in the presence of the handler compared to the stranger can be noted, as well as behaviours indicating anxiety in the presence of the stranger.

In the present study, as for the dog study detailed in chapter four, eight of the behaviours recorded represent secure base behaviour as follows: (See Table 5.2 for descriptions of behaviours)

- Safe base effect – 1.passive behaviour and 2.play behaviour

- Proximity/comfort seeking – 3.physical contact, 4.gazing behaviour, 5.following behaviour and 6.greeting behaviour

- Search behaviours – 7.standing by door and 8.scratching door

Responses to the questionnaires on the handler's prediction of each wolf's behaviour in the SSW (see Table 5.2) were rated in terms of whether or not secure base, proximity/comfort seeking and search, behaviours (for handler and stranger) were described in responses to each question. A score of one was given for any description of the above eight secure base behaviours regardless of how many times a description of that behaviour was given within an answer.

As there are eight possible secure base behaviours for five of the six questions (i.e., all the secure base behaviours listed above are possible in the situations described in the first five questions), and

four possible secure base behaviours for the first question (i.e., question one relates to when the wolf is alone so behaviours directed towards people are not possible in this scenario), the maximum score on "What will each wolf do in this situation?" is 44.

The "what will…" scores for each wolf are shown below in Table 5.3, whereby the higher the score the more secure base behaviour is predicted by their handler (maximum score, 44)

**Table 5.3. Handler's prediction of wolves' behaviour in the SSW**

| **Wolf** | **Handler's prediction (scores) of behaviours indicating secure base effect.** | **Handler's prediction (scores) for behaviours indicating proximity/Comfort – seeking.** | **Handler's prediction (scores) for behaviour indicating searching.** | **Handler's prediction (scores) of wolf's overall behaviour in the Strange Situation (max score 44)** |
|---|---|---|---|---|
| **Duma** | passivity-2<br>play-none<br>Total=2 | physical contact-2, following-2, greeting-1, gazing–1<br>Total =6 | standing by gate–2<br>scratch gate-none<br>Total = 2 | 10 |
| **Dakota** | passivity–2<br>play-none<br>Total=2 | physical contact-1, following-1, greeting-2, gazing–1<br>Total = 5 | standing by gate–2<br>scratch gate-none<br>Total = 2 | 9 |
| **Torak** | passivity–none<br>Play-none<br>Total=0 | physical contact-3, following-1, greeting-2, gazing-3<br>Total = 9 | standing by door-2<br>scratch door-none<br>Total = 2 | 11 |
| **Mosi** | passivity–none<br>play-5<br>Total=5 | physical contact-4, following-2, greeting-2, gazing–1<br>Total = 9 | standing by door–1<br>scratch door – none<br>Total = 1 | 15 |
| **Mai** | passivity–none<br>play-2<br>Total=2 | physical contact-3, following-1, greeting-1, gazing-2<br>Total =7 | standing bygate–2<br>scratch gate-none<br>Total = 2 | 11 |

**Bar charts comparing data for each wolf with handler and stranger are shown in figures 5.1a below**

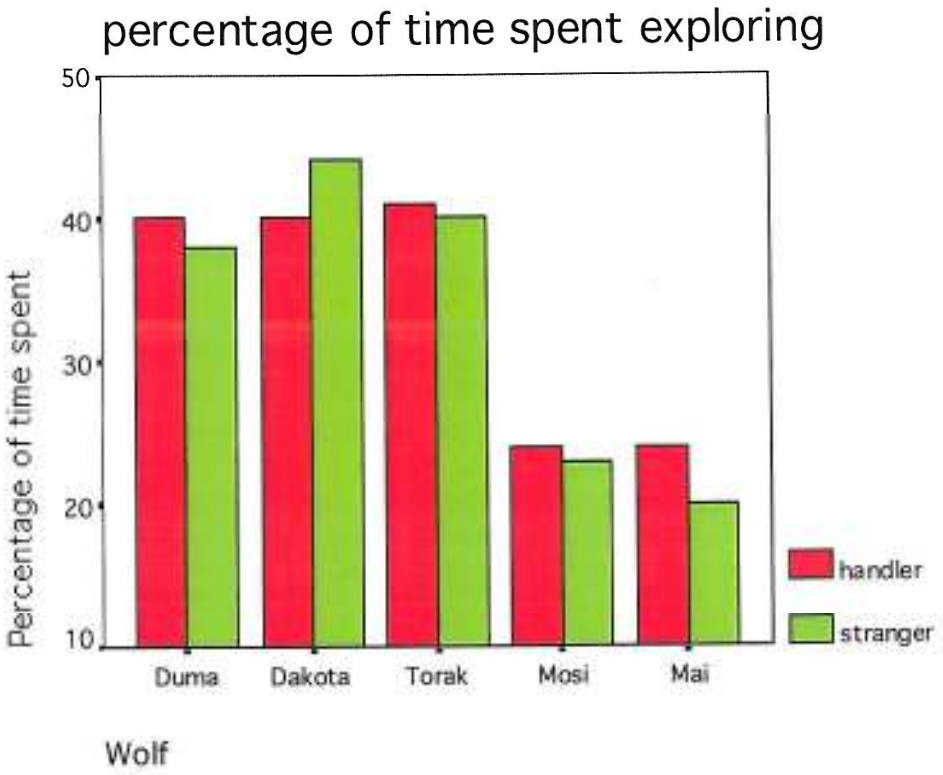



Figure 5.1a Percentage of time spent exploring in the presence of the handler versus the stranger.

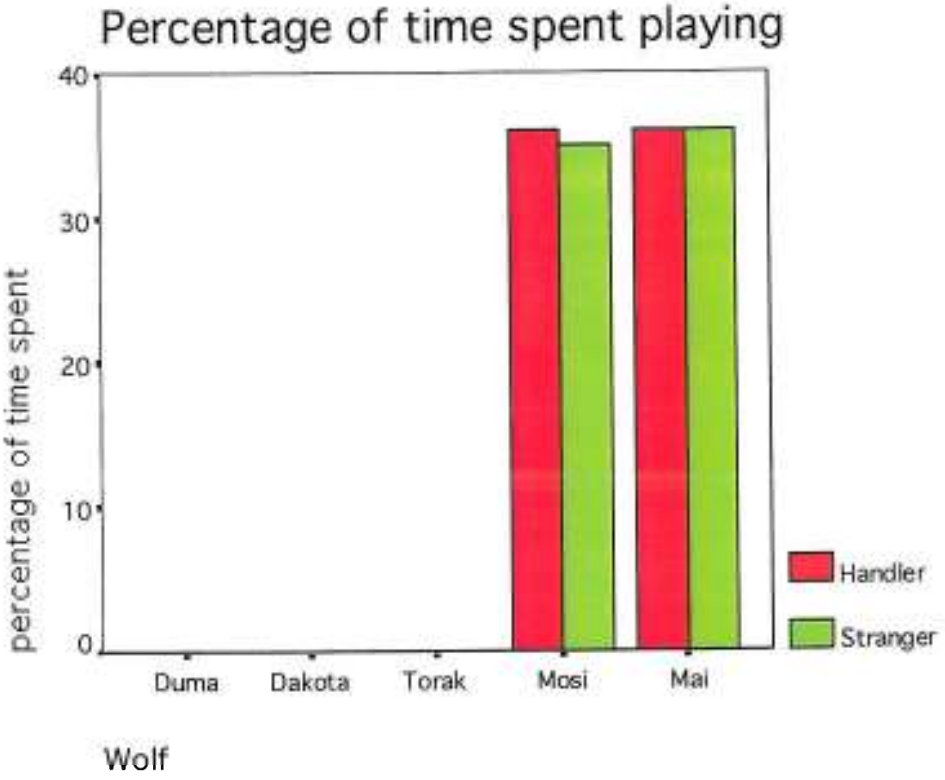
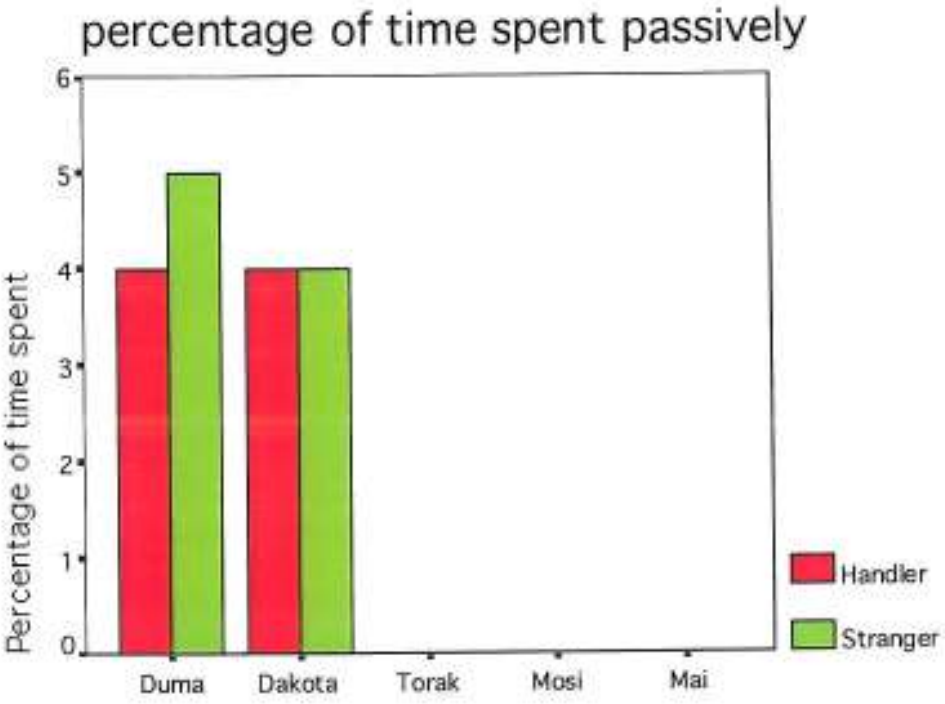



Figure 5.1b Percentage of time spent playing in the presence of the handler versus the stranger.




Wolf

Figure 5.1c
Percentage of time spent behaving passively in the presence of the handler versus the stranger.

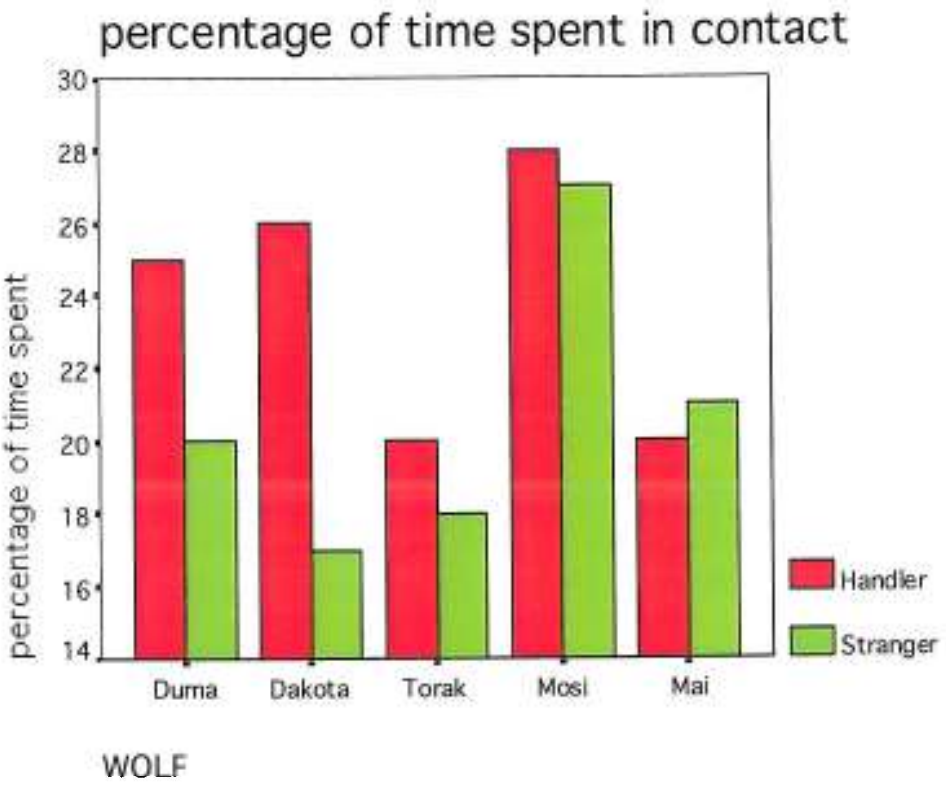



Figure 5.1d Percentage of time spent in contact with the handler versus the stranger.

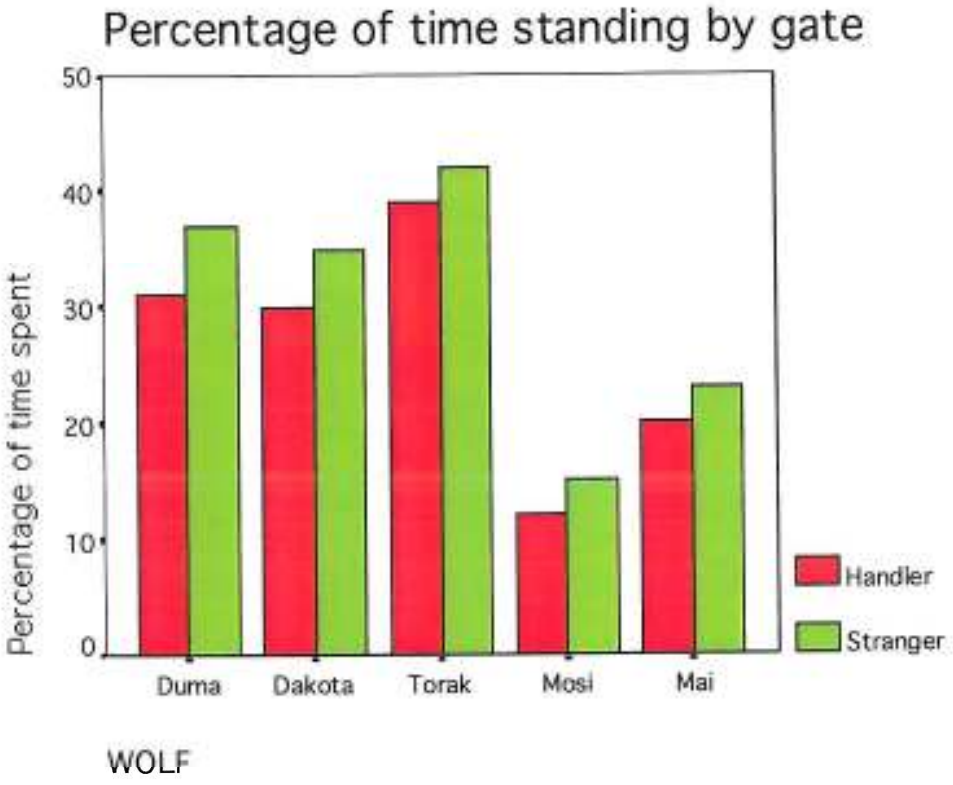



Figure 5.1e Percentage of time spent standing by the gate when in the presence of the handler versus the stranger.

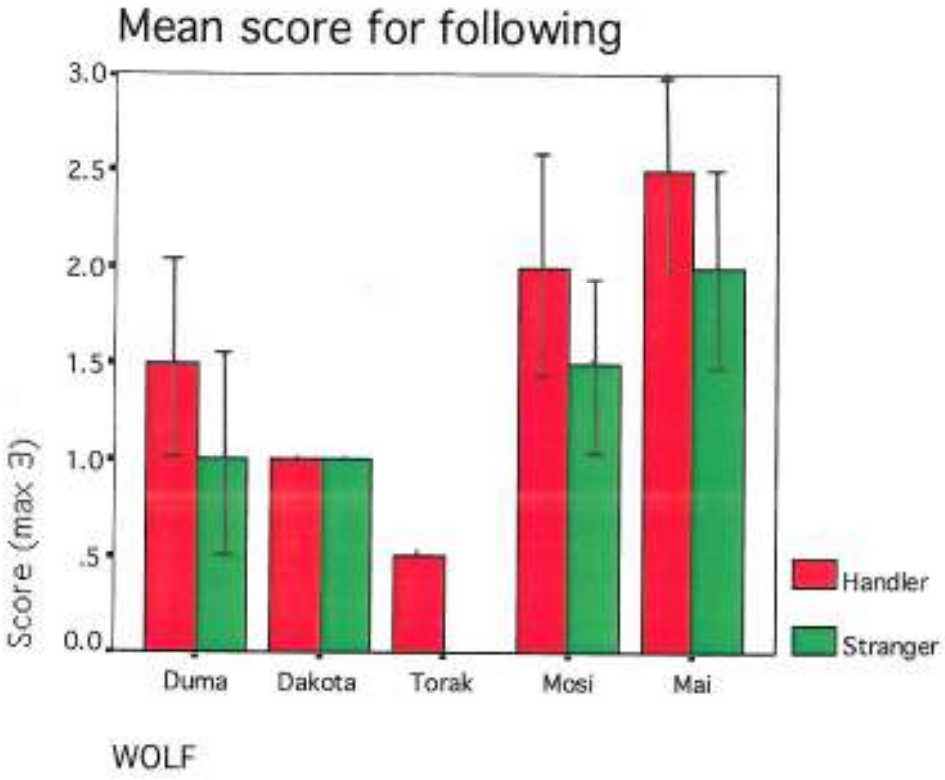



Figure 5.1f Mean score for following the handler versus the stranger. Standard error of mean is shown.

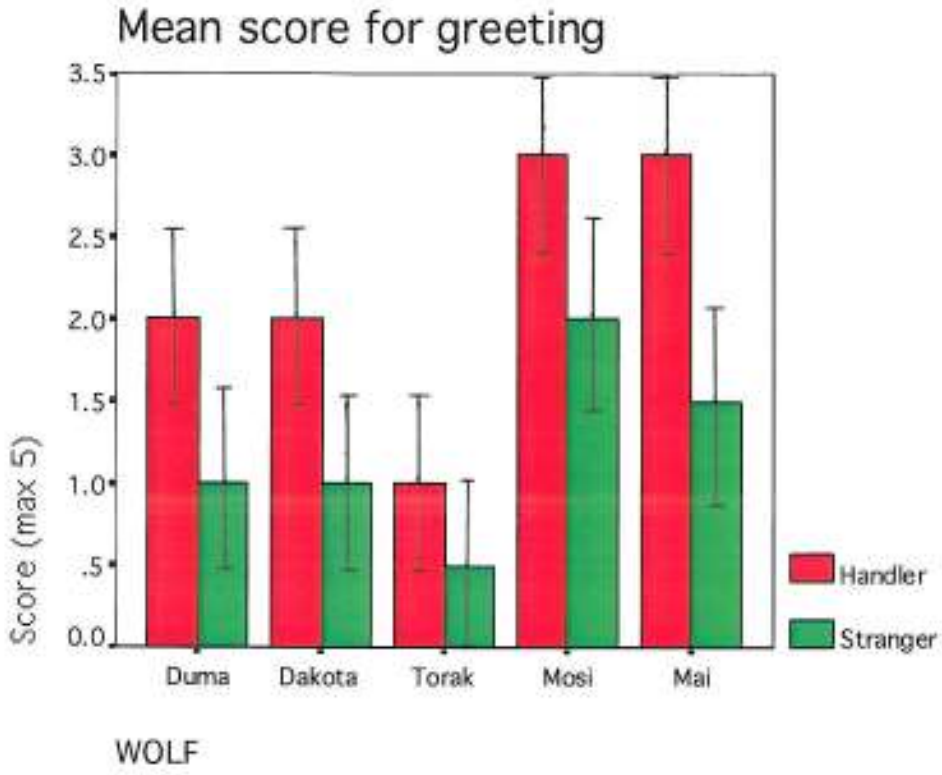



Figure 5.1g Mean score for greeting the handler versus the stranger. Standard error of mean is shown.

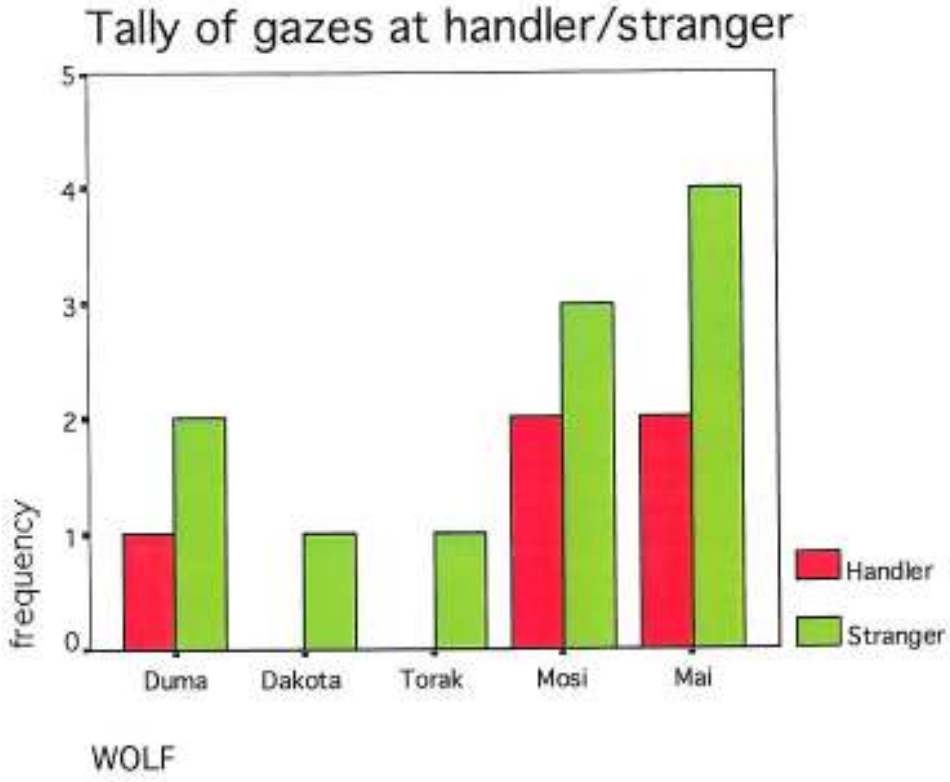



Figure 5.1h Tally of gazes when with the handler versus when with the stranger.

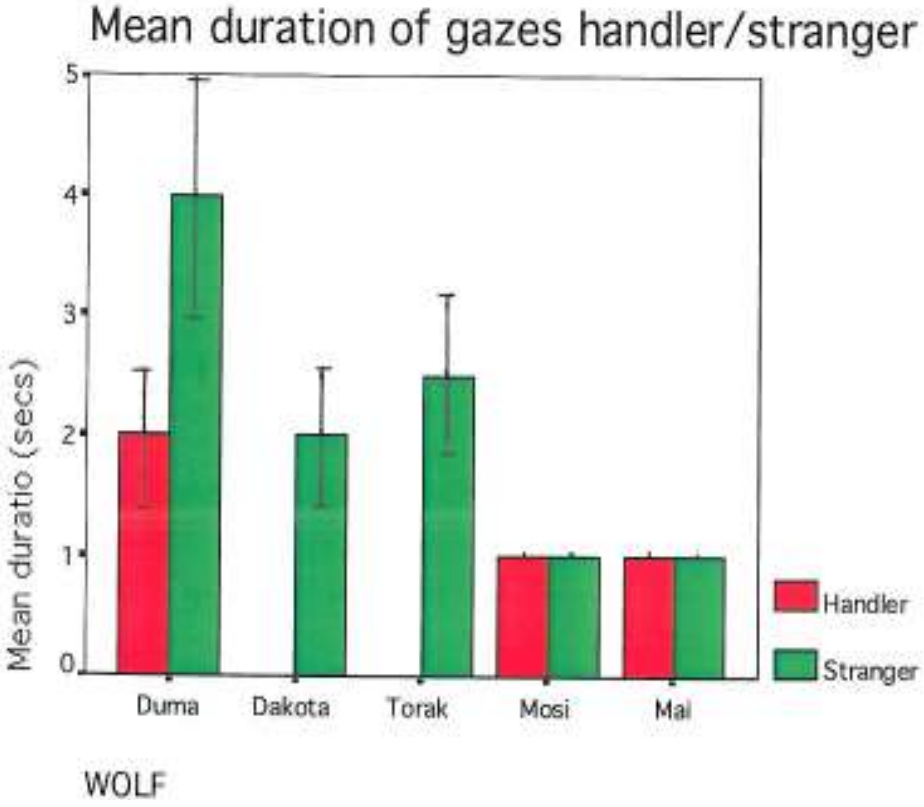



Figure 5.1i Mean duration of time spent gazing at handler versus gazing at the stranger. Standard error of mean is shown.

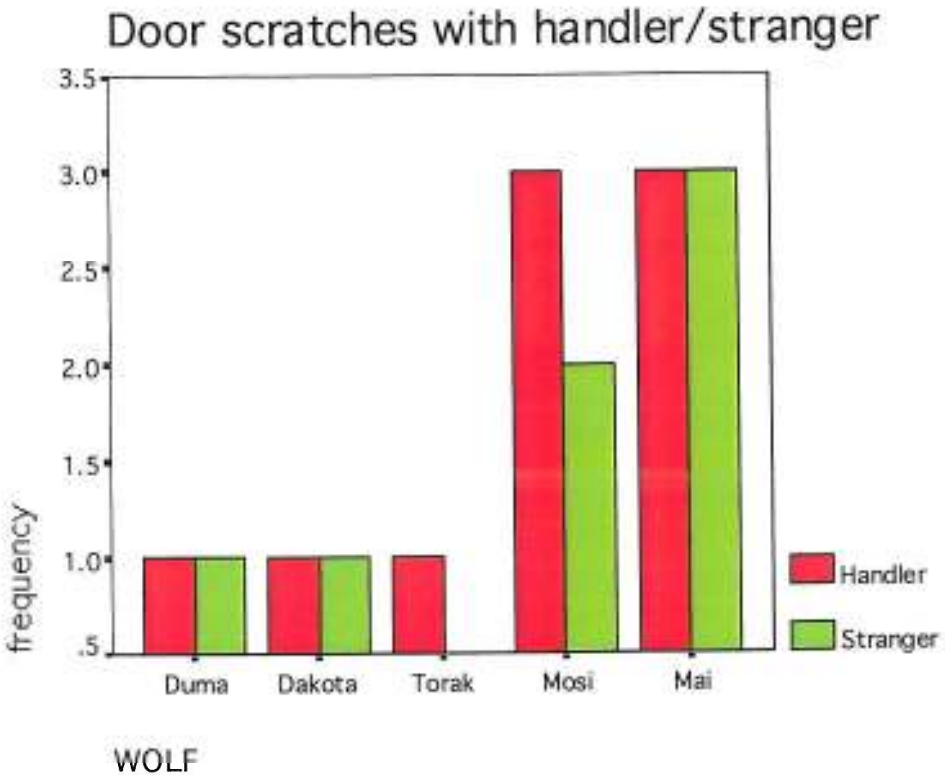



Figure 5.1j
Number of door scratches in the absence of the handler versus in the absence of the stranger.

### 5.3.1. Qualitative data

**Duma**

Her carers describe Duma as the boldest female in her small pack. When she entered the enclosure with her handler she explored the boundaries of the pen by sniffing and occasionally scratching the floor. When the stranger entered, she approached briefly, made eye-contact with the handler once for two seconds, and with the stranger twice for two seconds each gaze. Overall, she explored the enclosure for 40% of her time with the handler and 38% of her time with the stranger. She did not initiate contact with the stranger except to sniff closely, after circling twice, resulting in her opening her mouth slightly. She did allow the stranger to stroke her stomach, eventually splaying her back

legs a little to allow stroking of a specific point. She spent a total of 25% of her time with the stranger in physical contact (largely initiated by the stranger), and 20% of her time with the handler in physical contact.

As soon as her initial assessment of the situation was complete, she oriented her body in the direction of her sister Dakota (she had been led away on a lead by other handlers) and began to howl intermittently in 3-second bouts. She exhibited no play behaviour whatsoever and achieved low mean scores for both following and greeting behaviour (following stranger 1; following handler 1.5; greeting stranger 1; greeting handler 2). When Duma's sister Dakota howled in the distance, Duma became visibly less active and then exhibited passive behaviour for 4% of her time with the handler and 5% of her time with the stranger. She scratched the gate once only in the presence of the handler, and once only in the presence of the stranger. When she was not exploring she was generally oriented in the direction of her sister's intermittent howls or standing by the gate (standing by gate in absence of handler, 31% of time; standing by gate in absence of stranger, 37% of time).

Her regular handler's prediction of her behaviour in this situation was remarkably accurate on the whole. He predicted overall that her secure-base, proximity/comfort-seeking, and search behaviours would be low (a total score of 10 out of a possible 44). He felt that she would show very little passive behaviour (a total score of 2) and would only stand by the gate briefly throughout the procedure (a total score of 2). She did in fact spend almost a third of her time without the handler standing by the gate, and just over a third of her time standing by the gate when the stranger was not present, so her search behaviour was rather more prevalent than the handler had expected. In terms of physical contact, following and greeting, he correctly predicted that she would accept some physical contact rather than initiating very much herself, and would only follow and greet the handler and the stranger very briefly (a total score of 4).

**Dakota**

Her carers describe Dakota as the less bold female in her small pack. On entering the enclosure she explored it in the same way as her sister had, namely by sniffing the boundary and occasionally scratching the floor. When the stranger entered Dakota made physical contact in the form of thorough sniffing whilst circling many times. She allowed the stranger and handler to scratch her

stomach, again, behaving in a similar fashion to her sister, in that she splayed her back legs a little to allow scratching of a specific area of her body (physical contact with handler 26% of time; physical contact with stranger 17% of time). She looked into the eyes of the stranger only once, but for a full 2 seconds, and did not look into the eyes of the handler at all. She explored the enclosure for a total of 44% of her time with the stranger, and 40% of her time with the handler.

Like Duma, she oriented herself for much of the time in the direction her sister had gone, and achieved low mean scores for following and greeting behaviour (following handler 1; following stranger 1; greeting handler 2; greeting stranger 1). She only exhibited passive behaviour in the later stages of the procedure, and only then for 4% of her time with each person. She exhibited no play behaviour whatsoever, and only scratched the door once in the presence of her handler, and once in the presence of the stranger.

Her regular handler's prediction of her behaviour in this situation was remarkably accurate on the whole, and strikingly similar to his predictions for Duma. He predicted overall that her secure-base, proximity/comfort-seeking, and search behaviours would be low (a total score of 7, out of a possible 44). He felt that she would show very little passive behaviour (a total score of 2) and would only stand by the door briefly throughout the procedure (a total score of 2). Like her sister, she did in fact spend almost a third of her time without the handler standing by the gate, and just over a third of her time standing by the gate when the stranger was not present, so again, her search behaviour was rather more prevalent than the handler had expected. In terms of physical contact, following and greeting, he correctly predicted that she would accept some physical contact (but less than Duma) rather than initiating very much herself, and would only follow and greet the handler and the stranger very briefly (a total score of 3).

**Torak**

On entering the experimental space, Torak immediately began exploring by sniffing the boundary, scratching the floor occasionally, and looking up and down (presumably) at the dimensions of the space. In total he spent 41% of his time with the handler, and 40% of his time with the stranger, in exploratory behaviour. When the stranger entered he looked into her eyes once, and did not avert his gaze for 2.5 seconds (the stranger looked away before he did). Immediately after this one gaze, he initiated physical contact with the stranger by jumping up at her, resting his paws on her shoulders, and sniffing her face and ears very thoroughly. After that he did remain close to both the handler

and stranger by standing adjacent to them whilst maintaining contact by leaning (he did jump up at his handler briefly and nip his beard with his teeth) for 20% of his time with his handler, and 18% of his time with the stranger.

His greeting and following behaviour was minimal, scoring just 1 out of 5 for greeting his handler, and 0.5 out of 5 for greeting the stranger, and scoring 0.5 out of 3 for following the handler (mean scores). He exhibited no following behaviour towards the stranger at all, and no passive or play behaviour whatsoever throughout the entire procedure. Torak spent 39% of his time with his handler standing by the gate, scratching it just once, and 42% of his time with the stranger standing by the gate.

Torak's regular handler correctly predicted that he would exhibit no play or passive behaviour during the procedure at all. He did feel that his contact, following and greeting behaviour would be low, but not quite as low as for Duma and Dakota, and this accurately reflected this wolf's behaviour. His prediction for gazing behaviour was that Torak would look into the eyes of the stranger more often than he actually did, but the handler did draw attention to Torak's tendency to 'out-gaze' humans, which was apparent in the length of gaze shown by him in this procedure (total score predicted for Torak on proximity/comfort-seeking, 9). Torak spent 39% of his time with the handler standing by the gate, and 42% of his time with the stranger standing by the gate and this was rather more than had been predicted by his handler (prediction for standing by gate score, 2), who explained his predictions by describing Torak as "self-contained" and "unfathomable."

**Mosi**

Mosi is described by her keepers as the bolder of the two females in her small pack. On entering the enclosure she proceeded to explore briefly, sniffing here and there but without pacing the boundary of the pen (exploration in presence of handler, 24% of time; exploring in presence of stranger, 23% of time). She immediately greeted the handler enthusiastically, and then the stranger slightly less enthusiastically (mean score for greeting handler, 3 out of a possible 5: mean score for greeting stranger, 2 out of a possible 5). She initiated physical contact with the stranger by jumping up on her and sniffing her body very thoroughly. She licked the stranger's and owner's faces and nipped the stranger's ear with her teeth (physical contact with handler, 28% of time; physical contact with stranger, 27% of time). She was keen to interact, especially in the first episodes of the procedure, but after that spent much of her time oriented in the direction of her pack-mates who were not

visible to her, but whom she could presumably smell.

She exhibited no passive behaviour whatsoever, and played for 36% of her time with the handler, and 35% of her time with the stranger. She looked into the eyes of the handler twice and into the eyes of the stranger three times. Unlike the gazes of Duma, Dakota and Torak, these were quick glances lasting no more, on average, than 1 second. Mosi's mean score for following her handler was 2 out of a possible 3, and her mean score for following the stranger was 1.5 out of a possible 3. Her overall behaviour was much more juvenile in comparison to Duma, Dakota and Torak, despite the fact that she and Torak are the same age. Her standing by the gate behaviour, and occasional scratching of it appeared to be directed at her pack-mates rather than her human carer, given that she scratched the gate and stood beside it when the handler and/or stranger were present, as well as when they were absent (standing by the gate in the absence of the handler, 12%; standing by the gate in the absence of the stranger, 15%; tally of door scratches with handler, 3; tally of door scratches with stranger, 2).

Mosi's regular handler was correct in predicting that she would exhibit no passive behaviour, but would be somewhat playful (predicted score for play, 3), although she was a little more playful than he had expected. Similarly he stated that she would show all the proximity/comfort-seeking behaviours (total predicted scores for physical contact, following, greeting, and gazing, 9) In fact, she spent more time in physical contact with the handler and stranger than any of the other wolves (percentage of time spent in contact with handler – 28%, percentage of time spent in contact with stranger – 27%). Her handler's predicted score for Mosi's standing by the gate behaviour was just 1, but she still spent 12% of her time away from the handler standing by the gate, and 15% of her time away from the stranger standing by the gate so some of her standing by the gate behaviour was directed at her pack-mates rather than at her handler or at the stranger, nonetheless, this is considerably less time than was spent by Duma, Dakota and Torak in the same behaviour.

**Mai**

Mai's handlers see Mai as the least confident wolf in her small pack, although it was stated by them that there is little overall difference between her and her sister in terms of behaviour at this point in their lives. The SSW did reveal remarkably similar behaviour in these young siblings.

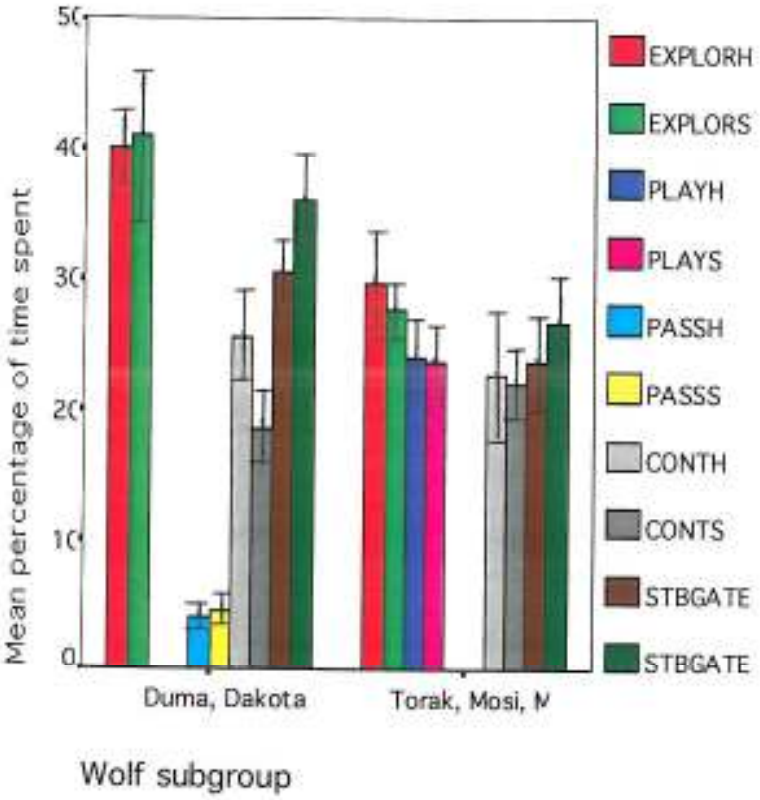
Like her sister, she exhibited no passive behaviour whatsoever, and played for 36% of her time with

the handler, and 36% of her time with the stranger. She looked into the eyes of the handler twice, and into the eyes of the stranger four times. Again, like her sister, these were quick glances lasting no more, on average, than 1 second. Mai's mean score for following her handler was 2.5 out of a possible 3, and her mean score for following the stranger was 2 out of a possible 3, slightly higher than her sister had shown. Her overall behaviour appeared juvenile in nature. Again, her standing by the gate behaviour and occasional scratching of it appeared to be directed at her pack-mates rather than her human carer, given that she scratched the gate and stood beside it when the handler and/or stranger were present, as well as when they were absent, although this behaviour was rather more prevalent than it had been with her sister Mosi, (standing by the gate in the absence of the handler, 20%; standing by the gate in the absence of the stranger, 23%: tally of door scratches with handler, 3; tally of door scratches with stranger, 3).

Mai's regular handler's predictions of her various behaviours were largely correct in that she was somewhat playful, not at all passive, and exhibited all of the proximity/comfort-seeking behaviours to some extent (predicted score for secure base behaviours, 2; predicted score for proximity/comfort-seeking behaviours, 7). She stood by the gate for 20% of her time in the absence of the handler, and 23% of her time in the absence of the stranger, and this was rather more than her regular handler had expected in terms of search behaviours.

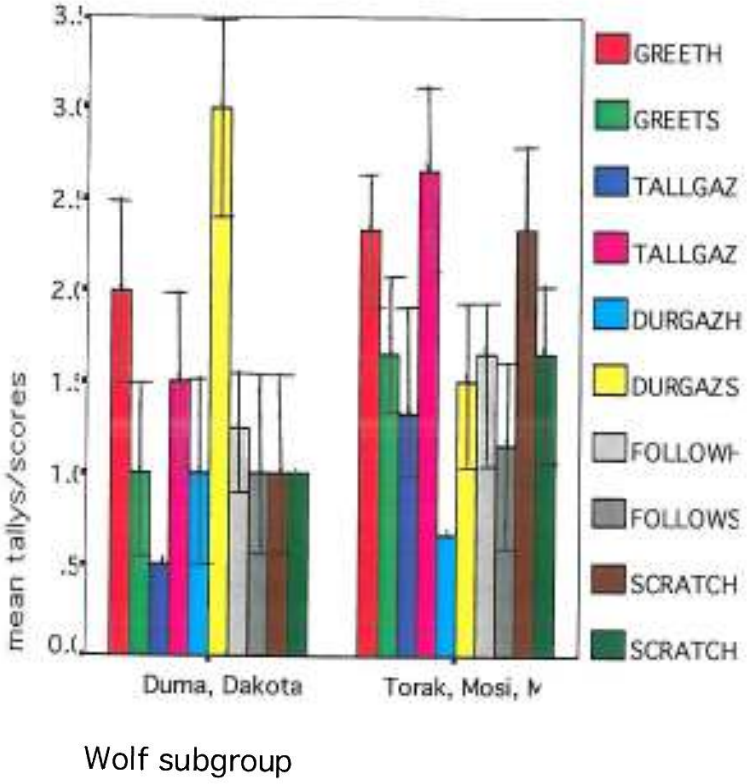
### 5.3.2. Wolf sub-groups

If we take the means of all the behaviours for the two adult wolves, and compare them to the means of all the behaviours for the three pups, a distinct difference is apparent. The difference is even more apparent if means for the behaviour of Duma, Dakota and Torak (the two adult wolves plus the male pup) are compared against means for Mosi and Mai (the two female pups).Different combinations of the pups grouped with the adults did not reveal any accentuated differences in the groupings and are not reported here. (see figures 5.2a-d below, a gap in the bars indicates a score of zero).



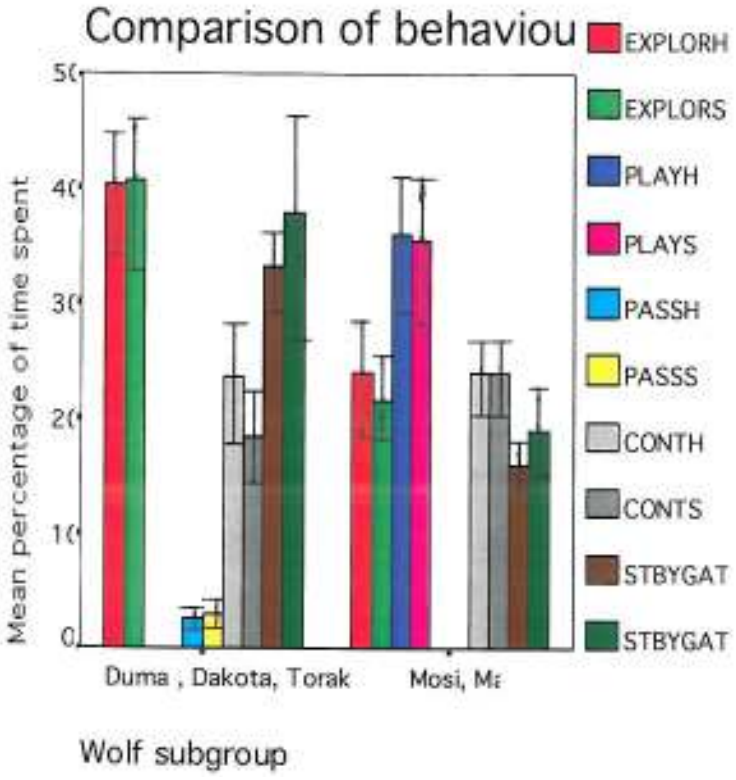

| Key | |
|---|---|
| EXPLORH | Exploration in the presence of the handler |
| EXPLORES | Exploration in the presence of the stranger |
| PLAYH | Play behaviour in the presence of the handler |
| PLAYS | Play behaviour in the presence of the stranger |
| PASSH | Passive behaviour in the presence of the handler |
| PASSS | Passive behaviour in the presence of the stranger |
| CONTH | Physical contact made with the handler |
| CONTS | Physical contact made with the stranger |
| STBGATEH | Standing beside the gate in the presence of the handler |
| STBGATES | Standing beside the gate in the presence of the stranger |

Figure 5.2a. Bar chart showing behavioural differences in mean percentage of time spent in various behaviours in adult/juvenile wolf sub-groups when in the presence of their handler versus the stranger. Standard error of mean is shown.



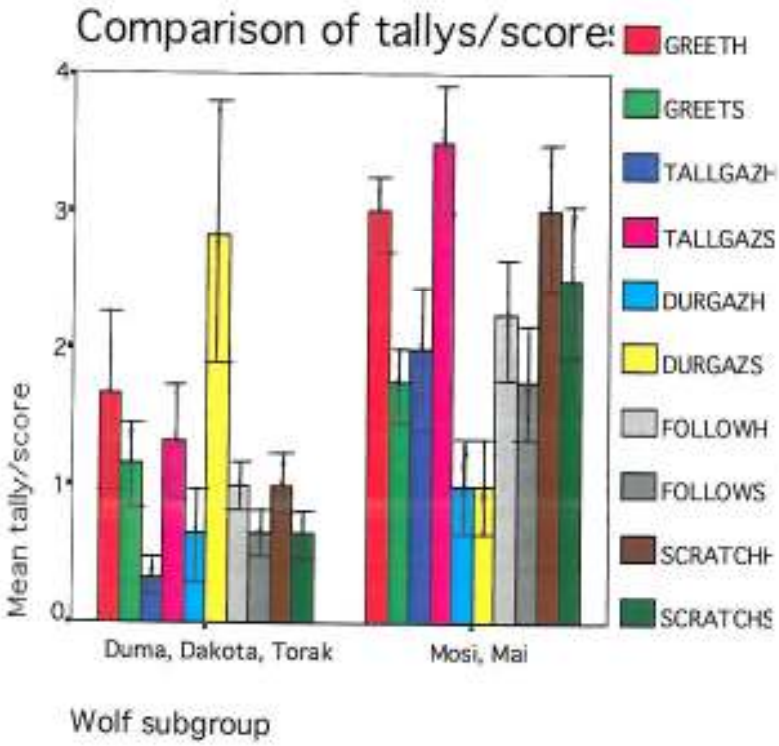

| | |
|---|---|
| GREETH | Greeting behaviours in presence of handler |
| GREETS | Greeting behaviours in presence of stranger |
| TALLGAZH | Tally of gazes at handler |
| TALLGAZS | Tally of gazes at stranger |
| DURGAZH | Duration of gazes at handler |
| DURGAZS | Duration of gazes at stranger |
| FOLLOWH | Following handler |
| FOLLOWS | Following stranger |
| SCRATCHH | Scratching the gate in the presence of handler |
| SCRATCHS | Scratching the gate in the presence of stranger |

Figure 5.2b. Bar chart showing tally/score behavioural differences in adult/juvenile wolf sub-groups when in the presence of their handler versus the stranger. Standard error of mean is shown.




| Key | |
|---|---|
| EXPLORH | Exploration in the presence of the handler |
| EXPLORES | Exploration in the presence of the stranger |
| PLAYH | Play behaviour in the presence of the handler |
| PLAYS | Play behaviour in the presence of the stranger |
| PASSH | Passive behaviour in the presence of the handler |
| PASSS | Passive behaviour in the presence of the stranger |
| CONTH | Physical contact made with the handler |
| CONTS | Physical contact made with the stranger |
| STBGATEH | Standing beside the gate in the presence of the handler |
| STBGATES | Standing beside the gate in the presence of the stranger |

Figure 5.2c.Bar chart showing differences in mean percentage of time spent in various behaviours for wolf sub-groups (adults with male juvenile /juvenile females) when in the presence of their handler versus the stranger. Standard error of mean is shown.




| | |
|---|---|
| GREETH | Greeting behaviours in presence of handler |
| GREETS | Greeting behaviours in presence of stranger |
| TALLGAZH | Tally of gazes at handler |
| TALLGAZS | Tally of gazes at stranger |
| DURGAZH | Duration of gazes at handler |
| DURGAZS | Duration of gazes at stranger |
| FOLLOWH | Following handler |
| FOLLOWS | Following stranger |
| SCRATCHH | Scratching the gate in the presence of handler |
| SCRATCHS | Scratching the gate in the presence of stranger |

Figure 5.2d. Bar chart showing tallys/scores of behavioural differences in wolf sub-groups (adults male juvenile/juvenile females) when in the presence of their handler versus the stranger. Standard error of mean is shown.

The difference between the adult wolves' (Duma and Dakota) behaviour and that of the pups (Mosi Mai and Torak) is relatively unsurprising in that pups are more likely to play for more of their time than adults, and are less likely to behave passively in a novel situation than adult wolves with years of experience of a variety of humans (Fox, 1980; Mech, 1988a). What is perhaps more surprising is the behaviour of the pup Torak compared to the other pups, Mosi and Mai. Even in this very small sample, individual differences between the wolves are apparent. Torak is a cross between a North American wolf and a European wolf, so perhaps some of his behavioural differences compared to the other pups in this sample are down to inheritance, or it may simply be that even at the young age of eight months he is showing his potential to become a bold adult wolf.

In the context of his very small pack at the UKWCT (just him and two females his age), Torak is, according to his regular handlers, already the boldest and most aloof wolf in his immediate grouping, and has no other males of any age to contend with. Thus, his bold behaviour (given that he is the only male) is exaggerated by the lack of male competition and this allows him to retain his current social rank.

However, it must be noted that the classic linear dominance hierarchy of wolf packs, first formally described by Schenkel in 1947, is considered too simplistic by many writers (Lockwood, 1976; Mech, 1970, 1999; Packard, 1980; Zimen, 1981), and differs considerably between wild packs and captive packs of various kinds (orphaned siblings, parents and offspring in nuclear or extended family groups, etc.). A full discussion of wolf dominance hierarchies, and variation in individual temperaments is beyond the scope of this chapter, but a point of discussion for further research is the notion that behavioural states in wolves may well be predictable as long as there is a stability of internal state in the individual, but that fluctuations occur when internal states change.

This is especially true in relation to external conditions, so it is not the dominance level of a wolf per se which is hard wired (there are no 'born-alphas' in either captive or wild packs according to Packard & Mech, 1983, and Mech, 1999), but rather the predisposition of individual animals to reduce or escalate conflicts in specific social contexts which is inherited, and thus it is this which influences group dynamics. Packard and Mech (1983) suggest we should not be asking ourselves which wolf fights, but which wolf is more likely to be in an assertive or aggressive versus avoidance or peace-making state more often?

**5.4. Discussion**

The results of this study show that in a modified version of Ainsworth's SST with hand-reared wolves living in small captive packs, wolves show very little discrimination between their familiar handler and a female stranger, in terms of secure base behaviour. The two female pups in this study showed more secure base behaviour than the two adult wolves or than the male pup did, but there was still very little of this behaviour when compared to the behaviour of domestic dogs exposed to a very similar experimental set-up. It seems likely that the male pup had adopted an exaggerated 'alpha' position in his very small pack given that he is the only male and remaining unchallenged by the two young females, and so exhibited behaviour somewhat akin to that of the two adult female

wolves observed here.

Similarly, Topal *et al.*, (2005) found that hand-reared and highly socialised wolves were no more responsive to their owner than to an unfamiliar stranger in a similar experimental set up to this. It seems highly likely that the process of domestication has had a significant effect on dog-human attachment given that even after extensive socialisation coupled with hand-rearing, the attachment systems of wolves are not activated by the SSW, in the way that has been reliably demonstrated by dogs in this situation (Prato-Previde *et al.*, 2003; Topal *et al.*, 1998; Topal *et al.*, 2005). The differences between the living contexts of the wolves in the Topal et al. (2005) study, and that of the wolves in the present study, namely that Topal et al's. wolves were hand-reared by people and lived in domestic homes as companion animals, whereas the wolves in the present study were hand-reared by humans but lived in small captive groups in large enclosures with daily contact with familiar handlers, seemed to have little or no effect on their behaviour in the SST. Thus from these studies it seems that socialisation history and living context are not a factor in the development of captive wolf-human attachment behaviour.

This finding thus conflicts with theories suggesting that dog-human attachment is directly derived from the mother-pup relationship in wolves (Coppinger & Coppinger, 2002). Mech's (1970) suggestion that both dog and wolf puppies develop in similar ways from birth to maturity (Mech, 1970; Scott & Fuller, 1965) strongly implies that the most intense period of proximity and contact-seeking in mother wolves and their pups is already decreasing after weaning takes place at around 6 to 8 weeks of age. (Detail of the development of wolves and dogs from birth to the period of socialisation (after Mech, 1970) is given in appendix E) After this time social attachments are directed towards the pack as a whole rather than individuals (Beck, 1973), and by the mid juvenile period the mothers of both wolf and dog puppies play only a minor role in reducing separation stress (Elliot & Scott, 1961).

In the present study, the wolves' regular handler's ability to predict each wolf's behaviour in the SST was remarkably accurate. This is in direct contrast to dog owners' ability to do the same (see chapter 4) under the same conditions. However, it must be noted that the wolves all had the same handler whereas each dog had a single owner, so there would have been greater consistency in the wolf handler's scores. Data from our SST study indicated a positive correlation between owner's perceived attachment to their dog (assessed by questionnaire; see previous chapter this thesis) and

the level of secure base behaviour they predicted their dog would exhibit in the Strange Situation context. In fact, most of the dogs tested exhibited lower levels of secure base behaviour than predicted by their owners. This was especially true of owners whose own score for perceived attachment to their dog was very high; so the more attached an owner felt, the more likely they were to predict high levels of attachment behaviour in their dog, and the less likely their dog was to actually exhibit those behaviours.

We were not able to assess the wolf handler's perceived attachment to each wolf in this study, but further research in this area may be able to clarify the possible correlation between a human's attachment level (and type) to a canine, and the canine's attachment level (and type) to him or her. Of course, the leap from a pet dog who shares your home, to small numbers of wolves who are in your care at your place of work, is a very large one, but perhaps the differences in emotional input and levels of objectivity adopted, are what is at the heart of a greater understanding of human attachment to dogs.

Many of the social influences on the dog-owner bond, such as household size and associated relationships with different members of that household as well as further emotional bonds with friends, etc. simply cannot be applied to the wolf-handler bond. Almost certainly, the wolf handler was able to accurately predict the wolves behaviour because he was used to thinking of their behaviour in terms of the wolf pack template (Zimen, 1982) and in the context of his place of work, and not in terms of a human domestic setting in which a dog finds a niche, analogous to a position in a pack, but considerably less stable (due to the enormous variety of domestic settings/family types and members etc. in human society) and without the more predictable and well organised pack behaviour repertoire we associate with the wolf.

The wolf handler's knowledge of wolf pack behaviour was derived from the work of Mech (John Dennes WCT Personal Communication). To clarify, Mech's (1999) summary of the wolf pack template is thus: *Canis lupus* usually live in packs consisting of the adult parents and their offspring of perhaps the last two or three years. The adult parents are usually unrelated and other unrelated wolves may sometimes join the pack but show deference to the alpha pair, for example, allowing them to eat first. The alpha pair are usually the only ones to reproduce (Mech, 1999). Eye contact may be used as an indicator of dominance or submission, but they also often also show physical superiority through playing or fighting. The concept of absolute alphas in a pack is outdated, rather

the pack centres around the breeding pair, in the sense that the pack leaders are the common parents of at least some of the other pack members (Mech, 1999). Smaller and more nuclear packs are therefore unlikely to establish the alpha status via fighting, and young wolves instead leave the pack to find a mate and produce their own offspring. Larger or less-nuclear packs may operate differently and possess more complex and flexible social structures (Mech, 1999).Armed with this knowledge, the wolves' regular handler had no expectation of a dyadic relationship marked by a dependence on him from any of the wolves in his care as he was fully aware of the wolves' attachments to the pack rather than to an individual person (John Dennes WCT Personal Communication).

Given the above, it seems there is no direct functional link between puppy-mother attachment in wolves and attachment behaviour between a dog and its owner. Rather, dogs have evolved a predisposition to attach to humans in ways which are remarkably similar to the attachment system present in human infants. This has been facilitated by the emergence of communicative ability in dogs as the result of genetic changes (Belyaev, 1979; Coppinger & Coppinger, 2002). This highlights the need for species specific tools to study the human-animal bond, even where the animals under study share relatively recent ancestry and some physical and behavioural traits (Marinelli *et al*., 2007). The behaviour of the wolf may well be an informative model for some behavioural origins in dogs, such as their role-oriented tendencies (as opposed to the more outdated notion of dominance or status-driven models of canine-behaviour) and especially for their early development (Mech, 2000), but ultimately *Canis lupus familiaris* inhabits its own unique niche in human society and given this, an understanding of the interactions between humans and pet dogs can only realistically come from extensive studies of dogs in their natural setting of the human domestic household in its various forms.

However, as previously mentioned, for some writers the atypical membership of assemblages of captive wolves (e.g. unrelated, unacquainted, adult, juvenile, male, female, as opposed to the more typical family group seen in the wild), makes their behaviour much more like that of domestic dogs in domestic homes, than of free-ranging wild wolves (Mech, 1999; 2002). The results of the present study, and that of Topal *et al*., (2005) indicate that observing the behaviour of highly socialised, group-living captive wolves does not allow an insight into an underlying attachment system with respect to their human handlers.

## Chapter 6: Overview and conclusions

The literature review for this thesis reveals a plethora of papers on human-companion animal relationships, most of which focus on human attachments to their pets. This appears in part to be a reflection of the importance placed by humans on the bonds arising from pet –ownership, and in particular from specific types of working dog ownership (Johnston, 1995). The Guide Dogs for the Blind Association (GDBA) has become so aware of the importance of the bond between Guide Dogs (GDs ) and Guide Dog Owners (GDOs) that they initiated research into the effects of severance of the bond due to death of dog or owner, or simply due to the dog retiring from guiding work. Nicholson *et al.* (1991) have shown how, on occasion, rather than be 'disloyal' to their faithful and much-loved GD after it has retired, some GDOs will give up their mobility and delay retraining with a new dog until after their retired dog has died. Some GDOs described the loss of their companion at retirement as akin to being forced to divorce a beloved partner.

Associated with this very intense type of bond as expressed by the GDOs in Nicholson *et al.*'s (1991) study is the concept of co-operative behaviour in domestic dogs towards humans. Research by Naderi et al. (2001) shows that successful GDs are those whose desire and ability to co-operate with their blind owners is very high. According to Naderi *et al*. (2001*)* leading a blind person involves complex behaviour that depends upon the GD and GDO's ability to both give and accept information to and from each other in the course of their joint actions such that the leader/initiator role may vary from one act to the next. This hints at the complex inter-communicative abilities of both humans and dogs.

Given the popularity of pet keeping it is no surprise to find that there are several attachment instruments available for measurement of the perceived attachment of people to a variety of animals. For example, the Companion Animal Bonding Scale (Poresky *et al.,* 1987), the Pet Attitude Inventory (Wilson *et al.*, 1987, the Pet Attitude Scale (Holcomb *et al.,* 1985), the Pet Relationship Scale (Lago *et al.*, 1988), the Lexington Attachment to Pets Scale (Johnson *et al.,* 1992), and the Comfort from Companion Animal Scale (Zasloff, 1996).

This thesis has focused in part on two such instruments, the Comfort from Companion Animals Scale (CCAS) (Zasloff, 1996), and the Lexington Attachment to Pets Scale (LAPS) (Johnson *et al.*,

1992). These scales were chosen because they are highly correlated with each other thus revealing good construct validity, as well as being shown to be highly reliable in use (Zasloff, 1996; Johnson et al., 1992) These instruments do not include reference to any possible drawbacks in owner-pet relationships but are still good candidates for merging into a new scale which, with some additions and adjustments, can measure perceived low-level attachment to dogs as well as perceived high level attachments. The new Companion Dogs Attachment (CDA) scale allows for the expression of negativity within owner-pet relationships. This is an important dimension given the number of dogs who are returned to dog shelters for various reasons, and even in relation to GD and GDO pairings that do not work out. Mismatches such as these have been linked to poor attachment, whereby dog owners who report weaker attachments for their pets are consistently less satisfied with most aspects of their dog's behaviour compared with owners who report stronger attachments (Serpell, 1999), so a scale which can measure low levels of attachment as well as high levels may well be very useful in assessing the likely outcome of human-dog pairings in a number of contexts. As attachments in both people and dogs can develop very rapidly (Hare *et al.*, 2002; Miklosi *et al.*, 2003), the CDA scale could, in future research, be used as an early indicator of future likelihood of success or failure, thus saving time, money and emotional upset in some cases.

In use, the CDA scale shows high overall alpha internal consistency, and consists of four factors, each with good levels of alpha internal consistency in their own right. The construct validity of the CDA scale is also good and was explored by analysis of some respondent characteristics (demographics, social network, and pet-related variables). In addition the new scale shows temporal reliability as evidenced by test-retest procedures with three samples of respondents (251 respondents in total). However, the CDA scale was self-administered and 151 of the 251 respondents were self-selected. This may be seen as a drawback but attitude measures in other studies have been shown to be robust in the face of variations in data collection (van Tilburg *&* de Leeuw, 1991).

The SST used in the study in chapter four of this thesis is a modified version of Ainsworth and Bell's (1970) methodology used for assessing the attachment type of human infants. Previous applications of this approach to canines have concentrated on clusters of behavioural types in relation to attachment, anxiety and acceptance of the stranger (Topal *et al.*, 1998), or had concluded that the Strange Situation approach did not yield secure-base activity across the whole range of behaviours originally described by Ainsworth and Bell (1970), when modified for use with canines

(Prato-Previde *et al*, 2003). The SST as reported in this thesis however attempts to both isolate behavioural clusters as factors equating to attachment, acceptance and eye-contact behaviour, and measures safe-base behaviour by analysing pairs of specific behaviours in relation to what Ainsworth and Bell (1970) originally described as the four safe-base behaviours (secure-base effect, proximity-seeking, search behaviours and comfort-seeking behaviours).

However, at least one writer has drawn attention to the dangers of adopting and ultimately persisting in believing in a well-known and well-used model such as the SST procedure. Semyonova (2003) suggests one should be cautious of adopting any measure as "fool proof " as this, she believes, puts the researcher in danger of producing trivial data which can serve to mask rather than reveal the underlying mechanisms of suites of behaviours. Adopting an apparently "tried and tested" approach like the SST, she asserts, can act as a filter which distorts perceptions to the point that observations, however careful or detailed, lose all value. This has merit as a reminder that the longevity/reliability of a method does not necessarily indicate that it has validity.

It is likely that the modified SST as used to date with canines misses some of the detail of canine behaviour in this very controlled, albeit naturalistic (for domestic dogs), context. First-hand accounts of extensive amounts of time spent amongst various canine species tend to highlight the split-second appearance of specific behavioural gestures such as wrinkling a tiny portion of lip, or showing a tooth (Mech, 1970, 1988 ;Semyonova, 2003: Crisler,1956). Future research, therefore, must undertake to observe the behaviour of both dogs and owners in a version of the SST in considerably more detail than was possible in the present study. One especially important element may be associated with eye contact and gaze-length of dogs to people and vice-versa. Guo *et al.,* (2007) have shown that the left-gaze bias well documented in humans is also present in companion dogs, whereby dogs show a strong left-gaze bias when presented with human faces, but not when presented with other images including canine faces. If dogs are scanning the right side of human faces in order to gauge emotions, this should be apparent in the dogs' behaviour during the modified SST and may form an important element of attachment behaviour previously not measured in this procedure. Observations in this much detail will require the use of several cameras filming at numerous angles in order to capture every nuance of behaviour during the modified SST .

The study detailed in chapter four of this thesis also incorporates a measure of dog-owner

attachment (the previously devised CDA scale) and dog-owner predictions of what they believe their dogs will do in the SST (the "What will…?" scores). This has allowed not only a correlational analysis to be carried out on the dogs' attachment/secure-base behaviours and on the owners' expressed attachment to their dogs, but also on the dog-owners' predictions of behaviour and their dogs' actual behaviours in the study. The data indicate that in this study a dog's attachment behaviours towards his/her owner are not correlated with how attached their owner feels towards them. However, a strong correlation does lie between the dog-owners' predictions of how their dog will behave and the owners' scores on the CDA scale.

This is important because it has implications for our understanding of the dog-human bond. It is possible that what is important in relationships of this type is not a mutual depth of attachment, but simply feelings of attachment on the part of the owner coupled with at least moderate levels of positive social behaviour (such as some safe - base behaviour) towards humans on the part of the dog. Archer (1997) has gone as far as to say that an acceptable dog is one which is: neotenous in appearance, as this seems to activate parental behaviour in many humans, warm to the touch and bearing fur, as this feels appealing, can be accommodated into a human domestic life, i.e., is awake in the daytime and asleep at night, on the whole does not urinate or defecate in the house, or attack their owners and his/her family and friends, and largely does not eat or attack the furniture.

What is striking about Archer's essay is the knowledge that we have on the sizeable minority of dogs who do not fit into these criteria and yet are kept and cared for at length by long-suffering owners (Brown *et al*. 2007). It might be true to say that most pet dogs do stick to most of Archer's 'rules' as it were, but under close observation and analysis it may be that dog-owners' perceptions of their human-canine relationships are just as important as the dogs' actual behaviours in those relationships. Perhaps in order to be satisfied with the situation dog owners need to 'feel' an attachment to their pet even if this is belied by modest or even low-level safe-base behaviours from their dog in tests such as the secure-base scale of the SST. As long as the dog can fit into the social system imposed by human domestic arrangements, and show at least a minimum level of sociability in that setting, then both parties may conform to what may be referred to as a 'successful' relationship. Further study into the complexities of dog-owners' perceptions of their dogs in conjunction with a further detailed observational study as outlined above will go some way to clarifying this idea.

It seems clear that wolves' behaviour in modified versions of the SST is very different from that of domestic dogs (Miklosi *et al.*, 2003; Topal *et al.,* 2005; chapter five this thesis). Choices made by humans in relation to breeding in traits and specific appearance in dogs have had many unintentional side-effects which have contributed to the creation of the world's most phenotypically diverse sub-species, *Canis lupus familiaris* (Wayne, 1986a, b; Wayne & Leonard, 2006). One of the most striking tendencies of the dog is its disposition to attach to humans, so much so in fact that when separated from their owner in mildly stressful circumstances such as that of the SST, dogs respond very similarly to human infants in the same situation (McFarland, 1987). It is this tendency which stimulates parental-type behaviour in many thousands of humans and explains why quite so many people are prepared to spend vast amounts of time and money on an animal which writers such as Budiansky (1999, 2001) have termed 'social parasites' given a similarly striking and well-known attribute of theirs, the fact that by far the majority of them do nothing to 'earn their keep.'

Chapter four in this thesis, in which a version of the SST was applied to domestic dogs, has shown that the Ainsworth methodology is one way of assessing canine attachment behaviour in relation to humans. However, what is also clear is the apparent inability of dog-owners to reliably predict their dog's behaviour in this context. This is interesting, as it raises questions about the importance of owners' personal perceptions of their dogs in relation to their dogs' actual attachment behaviours. It appears there is a mismatch between what owners believe their dogs will do in the specific circumstance of the SST and the observed behaviours elicited in their dogs.

When the Ainsworth methodology is applied similarly to captive socialised wolves, a different pattern emerges. Not only do wolves show little or no discrimination between their familiar handler and a stranger (Topal *et al.*, 2005; this thesis chapter five), but it appears that in direct contrast to dog-owners in this study, the wolves' regular handler was remarkably good at predicting their behaviour, and was very confident in stating that whilst the wolves would be somewhat more confident with familiar people, and briefly interested in a stranger, they would show no real affection or attachment to him in this situation. This is also very interesting because it highlights not only a behavioural difference between domestic dogs and extensively socialised captive wolves, but also a major difference in human perception of these closely related animals. A behavioural difference of this type is hardly surprising given the divergence of these canine sub-species from their common ancestor at least ten thousand years ago (Gould, 1977), but the differences domestication has brought (as revealed by use of the SST in the present studies) serve to illuminate

our understanding of the modern dog, and of the modern wolf.

It is important to understand the two-way nature of human-canine attachments and how they have evolved for a number of reasons such as the communicative nature of both humans and dogs, human interpretation of dog communication (in particular dog vocalisations) (Coppinger & Coppinger, 2002), trainability and intelligence of dogs according to humans (Beck & Katcher, 1983), biological determinants of behaviour in dog 'breeds', training methods and their influence on people's perception of their dog (Frank & Frank, 1982), and ultimately the behavioural and genotypic differences between the wolf and the dog from which pet dog attachment patterns have arisen (Vila *et al*., 1997, Nash *et al*., 2001, Goodwin *et al*. 1995; Gould, 1977). Further research utilising highly detailed observations of humans and dogs in interactive contexts is required to extend our understanding of these co-evolved behaviours.

Wolves are very adept at understanding the intentions of a conspecific from his or her behaviour (Krebs & Dawkins, 1984). For example, a wolf would never simply attack another wolf without first looking for signs of submission (no point in wasting energy attacking an animal which was never a challenge in the first place) such as cringing or averted gaze, or for signs of aggression such as a fixed stare or bared teeth (no point in getting injured if the other animal is sure to win anyway). Dogs, as the descendants of grey wolves have inherited these abilities at least to some extent (Krebs & Dawkins, 1984). In both wolves and dogs, submissive displays resemble puppy-like behaviours designed to make the animal look small and non-threatening, and which, in ritualised versions, such as face licking and jumping up or pawing, indicate subordinacy (licking the mouth and pawing of adults by puppies stimulates regurgitation and milk release in adult wolves and dogs). Adult canines are, it seems, hard-wired for forbearance of pups and so puppy-like behaviours in juveniles or adults are highly unlikely to result in them being attacked by 'superior' animals of their pack (Krebs & Dawkins, 1984).

This is important for human-canine relationships because it appears to be these puppy-like behaviours in the strongly paedomorphic domestic dog which dog-owners have a tendency to find both appealing and stimulating of parental responses in them (Goodwin *et al*., 1995, 1997). Human interpretation of dog behaviour is often tied up in the translation of what was originally wolf behaviour into human-like behaviour, so for example the dog 'smile' (a signal of submission in

wolves and wild dogs whereby the corners of the lips are retracted and canine teeth covered) is easily reinforced in pet dogs by their owners who find the expression appealing and give affection and petting to their dog whenever s/he exhibits it (Goodwin *et al*., 1995, 1997). As a consequence, many pet dogs exhibit submissive expressions and behaviours much more frequently, and in far milder situations than wolves do because of the anthropomorphic interpretations (and thus reinforcement of those behaviours) of their owners (Goodwin *et al*., 1995, 1997). This explains why submissive signals strongly reminiscent of wolf behaviour patterns are relatively easy to train dogs to do. Examples include; shaking hands, lying down, rolling over, and even crawling along on their belly. These behaviours are 'easy' for dogs to learn on command given their instinctive nature (Krebs & Dawkins, 1984). Further research, as outlined above, in this area will likely reveal the complexities of these submissive signals when displayed in relationships/contexts with humans in domestic settings

The visual signals of dogs are more limited in number compared to those of wolves. This is in part due to the morphological differences that exist between wolves and the myriad of dog types whose facial musculature, shape, body-type, etc., vary enormously, but also due to the lowered importance of social hierarchy in domestic dogs (Zimen, 1981). One effect of this appears to be the extensive vocal habits of dogs, especially barking, which are considerably more prevalent in dogs than in wolves. Morton and Page (1992) conducted an extensive survey of animal sounds in many species, and assert that growls and whines are relatively universal phenomena even in animals such as birds and reptiles. We tend not to describe certain animal vocalisations in this way, but audio recordings demonstrate the similarities in sound wavelength between different species calls used in similar contexts such as submission, aggression, etc. According to Morton and Page (1992) the important thing is not what the sounds mean but what they accomplish. Hence, a dog that whines signals a non-threatening status and is less likely to stimulate an aggressive or fearful response in its owner than one who growls in a similar context. A 'good' dog is thus often one whose whining/growling tendencies are socially acceptable in the domestic setting of human houses and society in general.

A major difference in the vocal habits of wolves and dogs is that wolves howl very regularly and purposefully, whereas dogs are much more likely to bark (Coppinger & Feinstein, 1991). Dogs do howl on occasion but not in the way that a wolf does given the lack of fellow-howlers which many dogs experience, and/or the lack of a response to their communications. Dog howls are simply not reinforced in the way that wolves' howls are (i.e., the pack members join in or reply, etc.)

(Mech,1988). Similarly, wolves do bark on occasion, but only very rarely, whereas dogs have been observed to bark for several hours at a time without stopping (Coppinger & Feinstein, 1991), something a wolf would never do. According to Riede and Fitch (1999) the bark is content neutral, meaning that the bark is mid-way between the extremes of aggression and appeasement in terms of its sound.

Wolves seem to bark when they detect something but do not have enough information to commit to a whine or a growl, thus alerting the approaching animal or novel object or whatever, that it has been spotted, but without committing meaning to the announcement (Mech, 1988). Dogs on the other hand have evolved to use the bark in almost any situation, and in response to virtually anything. Again, this is a trait that humans very often seem to find appealing and so dogs are relatively easily taught to 'speak' on command, or bark when there is an intruder, or simply when their owner returns home. This tendency of dogs to communicate in ways that are appealing to humans is at least part of the reason for the social relationships and attachments that exist amongst dog-owners and their dogs today (Coppinger & Coppinger, 2002). A further extension to the SST procedure as it has been used with canines to date would be to make high quality recordings of the vocalisations of dogs during the procedure, with a view to analysing the similarities and differences in sounds emitted by dogs in relation to the humans present, time spent alone and exactly where in the short procedure the sounds are being emitted.

Further to this it seems that there may be numerous other social tendencies in dogs that influence the perceptions and feelings of attachment in humans. Importantly, work by Miklosi *et al.* (2003) indicates the inferior performance of socialised wolves in locating food when the only available cues are the pointing finger of a human, when compared with the performance of domestic dogs in the same task. The dogs in this task readily looked into the face of the human helper and responded to her facial expressions and finger-pointing behaviour in relation to the hidden food. The wolves did not look into the researcher's face and instead glanced infrequently at her and did not respond well to her finger-pointing cues. Human communication relies heavily on looking behaviour because looking initialises and maintains communicative interactions. Hence, the readiness of the domestic dog to look at the human face allows for complex forms of dog-owner communication (see also Guo *et al*., 2007), which is not possible with wolves even when people have raised them.

This dog-wolf difference almost certainly arises because there is little or no significance in gazing at humans or responding to their finger-pointing for wolves whose evolution has primarily been concerned with social interactions within the wolf pack, not in and around human domestic settings as it is for dogs (Mech, 1988). Humans often mistake this kind of failure in animals to attend/respond to people as an indication of low intellectual ability, but it is clearly more to do with motivation than with intelligence, thus trainability should not be confused with actual (latent) ability to perform a particular behaviour.

Following from this, potential future research could investigate the possible link between human perception of attachment and perceived levels of intelligence in their dogs. As the present study has shown with a modest sample, dog-owners are very poor at predicting their dogs' behaviour in the SST and tend to express it as a reflection of their own bond with their pet. Perhaps they also link canine attachment behaviours with canine levels of "intelligence", with "clever" dogs being those whose attachment behaviours, as perceived by their owners (and measured in the SST), are very apparent. Dogs showing limited interest in their owners may well be perceived as less intelligent than highly interactive dogs. Pet-owners' tendency to anthropomorphise (Breland & Breland, 1966) and view their pets 'through anthropocentric eyes' as it were (Masson & McCarthy, 1996) makes it likely that behaviours other than those traditionally associated with attachment will also be linked with scores on the CDA scale. Further questionnaire-based research in conjunction with detailed observational study of humans and dogs in the SST will yield more data on this issue.

Of course, dog-owners are used to the presence of their dogs within a domestic setting and as part of their daily lives, whereas the wolf handler works with wolves and is by definition at a distance from them in terms of the handler's domestic life, but the differences in perception revealed by the studies in this thesis (extremely subjective versus objective) are still very striking given that the wolf handler expressed verbally that he felt enormously attached to the wolves in his care, and yet he was under no illusion about the one-sided nature of his attachment to them (John Dennes, WCT, personal communication). The modified SST for socialised wolves as reported in this thesis is limited however due to the restrictions placed on the wolf handler and "stranger" by Health and Safety regulations at the Wolf Conservation Trust. This meant that the enclosure used for the wolves during the observational periods was not as controlled as that of the dog version of the SST.

The results may have been affected by this, and thus the comparison between the two canine species less robust than might have been achieved in identical circumstances. However, at least one other study with wolves observed in versions of the SST reports similar findings to the study presented in chapter five of this thesis (Topal *et al*, 2005) and it seems likely therefore that the outcome of the wolf study would not have differed to any great extent despite the limitations. Future research into attachment behaviour between humans and socialised wolves, should, as discussed above for a possible future dog study, concentrate on a highly detailed recording of both wolf and human behaviours in a fully controlled version of the SST to ensure that every nuance of wolf and human behaviour is captured.

This thesis addresses a number of specific aims and questions. The first aim was to develop and test a scale of human attachment to dogs which is both reliable and valid, and which is capable of measuring weaker attachments as well as strong ones. The CDA scale does this as it incorporates and reduces in number items from two existing scales measuring different but very important aspects of human-canine attachment, but also adds some negative ones to ensure that respondents can express the less desirable aspects of dog-keeping which are so well known and yet rarely measured in traditional instruments of this kind. The resulting thirteen- item CDA scale is concise and easy to administer and to score and is capable of measuring low-level, moderate and high levels of attachment as expressed by dog-owners.

The next questions addressed by this work are twofold: 1) is there a correlation between owners' scores on attachment scales and their dogs' behaviour in the SST?; and 2), Can dog-owners predict the behaviour of their dog in the SST? chapter four, which details an application of Ainsworth's SST to dogs indicates in relation to the first question that there is no such correlation. Owners scoring highly on the CDA scale do not have dogs that exhibit high levels of attachment/safe-base behaviours in the SST as a matter of course, any more than owners with lower CDA scores having dogs whose behaviour indicates lower levels of attachment to them. It seems that whilst the companion dogs in the SST methodology did differentiate between their owner and the stranger this was not linked in magnitude to the owners' expressed attachment on the questionnaire.

The dog-owners in this study were not at all accurate at predicting what their dog would do in the various episodes of the experimental set-up, invariably describing behaviour that, if actually

exhibited by their dog, would have indicated a very high level of attachment. In some cases owners predicted behaviours in their dog which would have verged on the pathological if they had actually happened, with dogs scratching frantically at the door and whining and urinating uncontrollably, etc., when away from their owner. There is little doubt that positive human contact with canines, and vice-versa strongly affects behaviour in both parties. However, just five minutes of human contact per week is enough to ensure that a dog will react positively to humans later in life (Wolfle, 1990), so it is possible that the extraordinary strength of feeling (and related caring behaviours) so often expressed by dog-owners is simply not necessary for their dog's response to them to be at least adequate in terms of attachment behaviour, given that minimum levels of relatively positive contact from humans would achieve the same end.

That is not to say that we need not behave very positively towards our dogs, as Wolfle (1990) also points out that human-canine relationships can be enormously rewarding and, therefore, beneficial for people and provide a high quality of life for canines. As Budiansky (2001) has asserted, the dog need not be seen as some sort of impoverished wolf – it may be that dogs are novel creatures exhibiting complex, original and creative behaviours. The interesting point raised by the findings of the SST in this thesis is that human perception of bond or attachment to companion dogs is not necessarily related to the dogs' observable behaviour. Therefore CDA scale scores should not be viewed in any way as an indicator of correspondent dog behaviour, not only would this be unscientific, but potentially very misleading too.

The final aim of the thesis has been to provide a case-wise study of captive and highly socialised wolves in a version of the SST to clarify if the methodology fails to activate the attachment system in wolves that we see activated in this procedure with dogs. The data gathered indicate very clearly that the wolves in this study did not differentiate between handler and stranger and did not exhibit the suite of attachment behaviours observed and detailed in the SST for dogs. The domestication process has changed the highly ritualised and social/dominance based hierarchy of wolf society into the less stable, highly neotenous and human-dependent behaviour we see in the wolf sub-species *Canis lupus familiaris* (Mech, 1988*).* The wolf handler's ability to correctly predict the behaviour of the wolves in the SSW was striking in comparison to the inaccuracy of dog-owners in this task and indicated a difference in perception of these animals. Future research in developing a measure of keeper attachment to various non-domesticated animals in captivity would allow us to establish whether or not human attachment score/perception of animals in their care affects objectivity in

predicting those animals' behaviours in various situations. If there is a correlation this could be a valuable tool in captive situations where animals have to be moved or introduced to new individuals of their species in terms of knowing what their behaviour is likely to be in response to such changes.

So, to summarise and conclude, this thesis details the development of a new scale for the measurement of companion dog attachments (CDA scale) in people; utilises a modified version of Ainsworth's SST procedure for assessing attachment behaviours in pet dogs, and correlates the findings of this with owner scores on the CDA scale, and with owners' predictions of their dogs' behaviour in the SST. Finally, a version of the SST was also applied to a small number of highly socialised captive wolves to assess their attachment to their regular handler. Some limitations regarding sample sizes and types should be noted for these studies, but ultimately the CDA scale shows good reliability and validity, and allows the measurement of a range of attachments strengths. The modified SST with dogs reliably elicited a suite of attachment behaviours, confirming previous research but also extending it in allowing successful measurement of safe-base behaviours and the length and frequency of dogs' eye-contact with their owners and a stranger. Dog attachment behaviour was not found to be correlated with owners' scores on the CDA scale, and dog owners' predictions of their dogs' behaviour in the SST were not linked with their dogs' behaviour in the procedure. Wolves behaviour in a modified version of the SST indicated that the wolves observed did not distinguish between their regular handler and a stranger in terms of their attachment behaviour, confirming previous research but also extending it in showing that in contrast to the dog owners the wolf handler was able to accurately predict each wolf's behaviour in the modified SST.

Further research suggestions for use of the CDA are twofold: 1. as an indicator of future "success" in human-canine pairings. This will require testing of a sample of new dog-person pairings such as individuals acquiring a dog from a rescue centre, with the people filling in the CDA scale early in the relationship and then at a later date to ascertain whether or not the persons feelings of attachment towards their dog have changed. It is expected that those reporting early high scores on the CDA will report similarly high scores some weeks later whilst those with a low score early on in the relationship may well report similarly low, or perhaps lower scores later on. 2. as an extended questionnaire study with dog-owners filling in the CDA scale in addition to further questions designed to measure dog-owners' perceptions of other traits in their dogs such as "intelligence."

Future research suggested for the modified SST involves a much more detailed observation of both human and dogs in the procedure, including dog vocalisation recordings and focus on dog behaviours derived from lupine submissive signals such as rolling over, paw-shaking and face-licking. In addition owner perception of attachment in light of their dogs performance in the SST will be investigated by means of an extended version of the CDA designed to measure the "minimum requirements" as it were, for a perceived attachment to a dog. It is also possible that filmed observational studies detailing human-dog interactive behaviours in other contexts such as free-running in an enclosed public place such as a park, may be considered for further study. A similarly detailed version of the SST for socialised captive wolves is also proposed.

Finally, a study involving various animal keepers perceived attachment to their charges and the animals' observed behaviour towards the keeper in controlled contexts is proposed whereby attachment scales akin to the CDA but appropriate for captive animals in a zoo or other setting will be devised and administered and correlated to the observed animal behaviours to ascertain whether or not the keepers perceived attachment levels are related to their ability to predict animal behaviour in novel contexts such as moving to a new enclosure or being introduced to a new individual. If animal keepers are able to retain their objectivity in predicting animal behaviour despite their own feelings of attachment this may prove useful in captive settings. It is hoped that all the above ideas for future research studies will go some way towards furthering our knowledge of perceived human-dog/animal attachments and their relationship to actual behaviour.

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## Appendices

Appendix A - Items from the Lexington Attachment to Pets Scale (Johnson *et al.*, 1992): and the Comfort from Companion Animals Scale (Zasloff, 1996).

**Table A: Wording of the modified scales as presented on the web. Emboldened statements indicate added negative items.**

The Lexington Attachment to Pets Scale (modified)

**DOG - DOG OWNER INTERACTION**

How attached are you to your dog?

Please respond to all the questions as honestly as possible

| | strongly agree | somewhat agree | somewhat disagree | strongly disagree |
|---|---|---|---|---|
| My dog means more to me than any of my friends | | | | |
| Quite often I confide in my dog | | | | |
| I believe that dogs should have the same rights and privileges as family members | | | | |
| I believe my dog is my best friend | | | | |
| Quite often my feelings towards people are affected by the way they react to my dog | | | | |
| **The feelings I have for my dog are not as intense as the feelings I have for my family and friends** | | | | |
| I love my dog because he/she is more loyal to me than most of the people in my life | | | | |
| I enjoy showing other people pictures of my dog | | | | |
| **My dog is not very loyal to me** | | | | |

< Thankyou for participating -if you would like feedback on this research please click here to email me @ j.wilshaw@exeter.ac.uk.

The Comfort from Companion Animals Scale (modified)

## DOG - DOG OWNER INTERACTION

How much comfort do you get from your companion dog?

Please respond to all the questions as honestly as possible

| | strongly agree | somewhat agree | somewhat disagree | strongly disagree |
|---|---|---|---|---|
| My dog provides me with companionship | 🍽 | 🍽 | 🍽 | 🍽 |
| Having a dog is a tie | 🍽 | 🍽 | 🍽 | 🍽 |
| Having a dog gives me something to care for | 🍽 | 🍽 | 🍽 | 🍽 |
| **Having a dog sometimes stops me from going away** | 🍽 | 🍽 | 🍽 | 🍽 |
| My dog provides me with pleasurable activity | 🍽 | 🍽 | 🍽 | 🍽 |
| My dog makes me feel loved | 🍽 | 🍽 | 🍽 | 🍽 |
| My dog is a source of constancy in my life | 🍽 | 🍽 | 🍽 | 🍽 |
| **My dog costs me too much money** | 🍽 | 🍽 | 🍽 | 🍽 |
| My dog makes me feel needed | 🍽 | 🍽 | 🍽 | 🍽 |
| **My dog has some unpleasant habits** | 🍽 | 🍽 | 🍽 | 🍽 |

| | strongly agree | somewhat agree | somewhat disagree | strongly disagree |
|---|---|---|---|---|
| My dog makes me feel safe | 🍽 | 🍽 | 🍽 | 🍽 |
| **My dog sometimes annoys me** | 🍽 | 🍽 | 🍽 | 🍽 |
| My dog makes me play and laugh | 🍽 | 🍽 | 🍽 | 🍽 |
| Having a dog gives me something to love | 🍽 | 🍽 | 🍽 | 🍽 |
| **My dog sometimes embarrasses me** | 🍽 | 🍽 | 🍽 | 🍽 |
| I get more exercise because of my dog | 🍽 | 🍽 | 🍽 | 🍽 |
| I get comfort from touching my dog | 🍽 | 🍽 | 🍽 | 🍽 |
| I enjoy watching my dog | 🍽 | 🍽 | 🍽 | 🍽 |
| **My dog is not effective as a guard dog** | 🍽 | 🍽 | 🍽 | 🍽 |

Thankyou for participating -if you would like feedback on this research please click here to email me @ j.wilshaw@exeter.ac.uk

**Appendix B**

Pearson's product moment correlation co-efficients for CDA scores and SST behaviours. (The correlation co-efficient is given above with the significance level below)

**Table B1. Correlations between CDA scores and SST behaviours.**

| SST behaviour | CDA overall score | CDA subscale 1 (companionship) score | CDA subscale 2 (feeling loved) score | CDA subscale 3 (dogs as friends) score | CDA subscale 4 (negative aspects) score |
|---|---|---|---|---|---|
| Attachment | -0.013<br>0.930 | 0.265<br>0.060 | -0.107<br>0.455 | -0.167<br>0.241 | -0.248<br>0.079 |
| Acceptance | 0.149<br>0.296 | 0.147<br>0.304 | 0.087<br>0.546 | 0.163<br>0.253 | -0.066<br>0.643 |
| Eye-Contact | 0.015<br>0.914 | 0.073<br>0.612 | 0.117<br>0.415 | -0.127<br>0.375 | -0.190<br>0.182 |

## Appendix C

Bonferroni post- hoc tests detailing significant effects of household size and favourite pet species on SST behaviours:

### Table C1. Household size against SST behaviours.

| SST behaviour | Independent variable<br>Household size (comparison) | Significance |
|---|---|---|
| Attachment | 1 person 2 persons<br>3-4 persons | 0.568<br>0.0005 |
| | 2 persons 1 person<br>3-4 persons | 0.568<br>0.003 |
| Acceptance | 1 person 2 persons<br>3-4 persons | 1.000<br>0.296 |
| | 2 persons 1 person<br>3-4 persons | 1.000<br>0.214 |
| Eye-contact | 1 person 2 persons<br>3-4 persons | 1.000<br>0.0005 |
| | 2 persons 1 person<br>3-4 persons | 1.000<br>0.008 |
| Safe-base behaviour with owner | 1 person 2 persons<br>3-4 persons | 0.157<br>0.0005 |
| | 2 persons 1 person<br>3-4 persons | 0.157<br>0.0005 |
| Safe-base behaviour with stranger | 1 person 2 persons<br>3-4 persons | 1.000<br>1.000 |
| | 2 persons 1 person<br>3-4 persons | 1.000<br>1.000 |
| Proximity-seeking owner | 1 person 2 persons<br>3-4 persons | 0.964<br>0.0005 |
| | 2 persons 1 person<br>3-4 persons | 0.964<br>0.001 |

| | | |
|---|---|---|
| Proximity-seeking stranger | 1 person 2 persons<br>3-4 persons | 1.000<br>0.0005 |
| | 2 persons 1 person<br>3-4 persons | 1.000<br>0.0005 |
| Search behaviour for stranger | 1 person 2 persons<br>3-4 persons | 1.000<br>0.194 |
| | 2 persons 1 person<br>3-4persons | 1.000<br>1.000 |
| Search behaviour for stranger | 1 person 2 persons<br>3-4 persons | 1.000<br>0.194 |
| | 2 persons 1 person<br>3-4persons | 1.000<br>1.000 |
| Comfort-seeking with owner | 1 person 2 persons<br>3-4 persons | 1.000<br>0.051 |
| | 2 persons 1 person<br>3-4persons | 1.000<br>0.076 |
| Comfort-seeking with stranger | 1 person 2 persons<br>3-4 persons | 1.000<br>0.009 |
| | 2 persons 1 person<br>3-4persons | 1.000<br>0.141 |

**Table C2. Favourite pet species against SST behaviours**

| SST behaviour | Independent variable<br>Favourite pet (dog/cat/other) | Significance |
|---|---|---|
| Proximity-seeking owner | Dog Cat<br>Other | 0.042<br>1.000 |
| | Cat Dog<br>Other | 0.042<br>0.047 |

## Appendix D

Frequency data for CDA scale scores and respondent demographics, social network ties and pet-related variables

**Table D1. Frequency data for CDA scale scores and respondent demographics.**

| | Gender | | Age-group | | |
|---|---|---|---|---|---|
| **CDA scale scores** | **Male (%)** | **Female (%)** | **18-31 (%)** | **40-51 (%)** | **60+ (%)** |
| <30 (17-29) | n=63 (81) | n=0 (0) | n=44 (56) | n=0 (0) | n=0 (0) |
| >30 (30-43) | n=14 (18) | n=174 (100) | n=35 (44) | n=74 (100) | n=95 (100) |
| Totals | 77 | 174 | 82 | 74 | 95 |

**Table D2. Frequency data for CDA scale scores and respondent social network ties.**

| | No of persons in household (%) | | Children in household (%) | | Marital status (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CDA scale scores** | **1** | **2** | **3-4** | **5+** | **Yes** | **No** | **Married** | **Co-habiting** | **Separated** | **Divorced** | **Widowed** | **Never married** |
| <30 (17-29) | 2 (.02) | 2 (.03) | 37 (45) | 4 (50) | 44 (58) | 1 (.01) | 42 (91) | 3 (.04) | 30 (94) | 6 (10) | 6 (100) | 0 (0) |
| >30 (31-43) | 85 (98) | 70 (97) | 45 (55) | 4 (50) | 32 (42) | 174 (99) | 4 (.09) | 65 (96) | 2 (.06) | 54 (90) | 0 (0) | 38 (100) |
| Totals | 87 | 72 | 82 | 8 | 76 | 175 | 46 | 68 | 32 | 60 | 6 | 38 |

**Table D3. Frequency data for CDA scale scores and respondent pet-related variables.**

| | Grew up with animals (%) | | Favourite type of pet (%) | | | Main carer of dog in household (%) | | |
|---|---|---|---|---|---|---|---|---|
| **CDA scale scores** | **Yes** | **No** | **Dog** | **Cat** | **Other** | **Respondent** | **Others** | **Shared** |
| <30 (17-29) | 7 (.05) | 45 (45) | 10 (.05) | 20 (54) | 22 (81) | 21 (33.33) | 20 (16) | 12 (19) |
| >30 (31-43) | 143 (95) | 54 (55) | 178 (95) | 17 (46) | 5 (19) | 42 (67) | 103 (84) | 52 (81) |
| Total | 99 | 150 | 188 | 37 | 27 | 63 | 123 | 64 |

**Appendix E**

**Development of wolves and dogs from birth to the period of socialisation (after Mech, 1970)**

1. During the neonatal period the mother wolf is driven to care for her helpless young by hormones released pre, during and after birth (Mech *et al.*, 1996). The neonatal pups' behaviour is little more than a set of reflexes associated with survival such as heat-seeking, sucking, elimination in response to maternal licking, and whimpering when cold, hungry, or isolated. (Fox, 1971b; Scott & Fuller, 1965).

2. Towards the end of the neonatal period and crossing over with the beginning of the transition period, wolf and dog pups' eyes open and growing coordination allows for standing and then walking, and pups gradually venture further and further from the birth site Sensory systems, size and muscular coordination develop rapidly during the transition phase (McLeod & Fentress, 1997), and interactions with their mother and siblings may well determine the manner in which neuronal connections develop in the brain during the first few weeks of life (Klinghammer & Goodman, 1987). The rapid learning which follows during the rest of the transition phase, and during the socialisation period is thought to have important implications for the social context of learning in later life (Scott & Fuller, 1965).

3. The socialisation period sees wolf pups approaching family members in a somewhat indiscriminate fashion, although their tendency to follow a departing adult moving in an intent, directional manner is almost certainly shaped by the mother wolf's interruption of suckling bouts in order to investigate disturbances (Packard *et al*.,1992), whereby the pups' initial motivation for following is to resume suckling at the earliest opportunity. This following response is vital in moving puppies at this age from one den site to another, particularly when the puppies cease to rely on milk and move on to meat, given that following any pack member and nudging their muzzles around the mouth, when they return to the den, is highly likely to result in the pack member's regurgitation of recently consumed prey items (Mech *et al.*, 1999). The socialisation period is also the time when pups become familiar with their pack-mates'

individual differences, and acquire social behaviours, which will influence how they conduct themselves later in life, and in hostile encounters with outsiders.

## Appendix F

## Descriptive statistics for raw data of dogs' behaviour in the presence of the owner versus the stranger.

| **Behaviour** | **Mean** | **Standard deviation** | **N (dog-owner pairs)** |
|---|---|---|---|
| 1. Exploration with Owner | 19.0522 | 16.6389 | 51 |
| Exploration with stranger | 9.7711 | 16.0791 | 51 |
| 2. Play with Owner | 50.4548 | 23.6560 | 51 |
| Play with Stranger | 49.9252 | 22.1233 | 51 |
| 3. Passivity with Owner | 23.9237 | 15.6020 | 51 |
| Passivity with Stranger | 42.4359 | 24.5406 | 51 |
| 4. Duration of contact with Owner | 55.3726 | 19.0587 | 51 |
| Duration of contact with Stranger | 52.2781 | 15.0566 | 51 |
| 5. Stands by door when with Owner | 22.3387 | 22.4035 | 51 |
| Stands by door when with Stranger | 57.4322 | 27.1608 | 51 |
| 6. Tally of gazes with Owner | 8.1763 | 3.0040 | 51 |
| Tally of gazes with Stranger | 7.2426 | 2.6526 | 51 |
| 7. Duration of gazing with Owner | 5.3093 | 2.7699 | 51 |
| Duration of gazing with Stranger | 4.7881 | 2.6365 | 51 |
| 8. Physical contact with Owner | 45.7507 | 23.4047 | 51 |
| Physical contact with Stranger | 57.1444 | 8.4602 | 51 |
| 9. Tally of contact-seeking entering Owner | 7.6007 | 4.5179 | 51 |
| Tally of contact-seeking entering Stranger | 7.3704 | 3.9628 | 51 |
| 10. Delay of contact-seeking to Owner | 6.7407 | 3.6857 | 51 |
| Delay of contact-seeking to Stranger | 5.1852 | 2.6023 | 51 |
| | | | 51 |