University of Southampton

Aetiology, Characterisation, and Prediction of Separation Induced Behaviour in the Domestic Dog

By

Justine Amanda McPherson

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ABSTRACT

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The excessive reaction of dogs to social isolation, usually compromising persistent vocalisation, destruction, or inappropriate elimination, is a common complaint of many pet owners. It has been suggested that a reaction to separation is part of the normal attachment process in social animals, facilitated by the existence of developmental *sensitive periods*, and is instigated by the absence of a figure to whom the dog has become attached.

Dogs exhibiting "problem" separation behaviour are often observed to be over-attached to one or more persons by those working in the field of behaviour counselling. Nevertheless, there are also a significant number of dogs with similar symptoms which do not appear to be pathologically attached. The first part of this thesis describes an investigation of 192 dogs referred to behaviour counsellors for inappropriate behaviour during separation, in an attempt to elucidate the motivation for this behaviour, particularly in those animals not considered to be hyper-attached to their owners. There appeared to be at least two fundamental motivational states underlying the separation "problems", one over-attachment and one a generalised state of fearfulness or "anxiety"; these occasionally occurred in the same dog and are therefore not mutually exclusive.

The second part of this thesis describes the design and implementation of a test of behaviour in kennelled rescue dogs, which are particularly prone to exhibiting separation behaviour. This test revealed that dogs displaying a reaction to a five minute absence of a person with whom they have spent minimal previous contact were also likely to react to social separation in the home environment, although not necessarily in the same manner. The test predicted separation behaviour in 60% of the dogs displaying a reaction to social isolation during testing.

The final section of this thesis describes a longitudinal investigation of the development of separation behaviour in seven litters of Labrador retrievers and five litters of Border collies, from initial baseline temperament tests at seven weeks of age and post-homing observations at three, six, nine, twelve, and eighteen months. The maximum incidence of separation behaviour was at twelve months (55% of the dogs); this had reduced to 38% by eighteen months. Similar instances of an increased incidence of separation behaviour during the juvenile period (up to two years of age) had been found in both the other studies. The level of socialisation and social referencing the puppies had received was also found to influence their subsequent manifestation of separation behaviour. High levels of diverse social interaction whilst the puppies were still in the litter apparently increased the likelihood of their showing symptoms later in life. Low levels of extra-household social interaction after the age of six months also appeared to encourage the separation reaction.

for Simpkins and the boys

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INTRODUCTION

1.0 *Background to the study*

At the time of writing, there are approximately 6.6 million pet dogs in the UK (PFMA, 1997). Many of these dogs live harmoniously as "one of the family" and will remain in the same household having been resided there since puppyhood. However, there are also many households where the pet is not such a biddable family member but where the strains of the animal's unwanted or inappropriate behaviour become no longer tolerable and the dog becomes a "problem". The owners of these dogs may chose to seek professional help through one of the pet behaviour counselling organisations (e.g., the Association of Pet Behaviour Counsellors, or the Companion Animal Behaviour Therapy Studies Group), or the dog may be given up for adoption. Unfortunately thousands of dogs entering rescue centres have known behaviour problems (estimated at 33%, Bailey, 1991), inevitably many of which, in otherwise good health, are euthanased.

One of the most common behaviour problems encountered by animal behaviourists and in particular rescue centres, is that of unacceptable behaviour when the dog is left alone. Such separation behaviours, commonly known as *separation anxiety*, are manifested in many forms and are widely believed to arise from an overattached canine-human relationship. It is extremely difficult to assess the incidence of such behaviour in the general pet dog population, nevertheless various figures exist for the prevalence of such behaviour in dogs resident in rescue centres and the population of dogs referred to behaviour counsellors.

It is estimated that separation behaviour is the second most common behaviour problem following aggression, although it is likely that these are the two most objectionable behaviours from the human point of view and may therefore not necessarily represent their actual incidence (Fisher, 1990). Within the population of dogs referred to behaviour counsellors, estimates of separation behaviour range from 40% (Borchelt, 1983), to 23% (Mugford, 1981), 20% (Fisher, 1990; McCrave, 1991) and 12% (Magnus and Appleby, 1994). This variation in incidence is likely to

reflect different diagnostic criteria and classification of behaviour problems. Indeed confusion of terminology and inconsistent diagnoses are an inherent problem of behaviour counselling, with some quoting statistics of "separation anxiety", others "isolation anxiety", and yet others "attachment related problems".

The field of pet behaviour counselling is a successful and expanding industry. Many behaviour problems are apparently successfully treated, although negligible published data exist to support these claims. Unfortunately the scarcity of clinical behavioural studies of the domestic dog have led to behaviour counsellors relying on scant scientific evidence and considerable anecdotal evidence for the treatment of behaviour problems. Currently much is postulated but little is actually known about the underlying causes of separation behaviour, hence there is a need for large scale exploratory studies. Moreover, the dog-human relationship is becoming an increasingly popular area of research, although the breakdown of this relationship has apparently been largely neglected.

The following introduction outlines current understanding of the behavioural development of the domestic dog, the process of attachment and the related separation reaction, and finally details the excessive separation reaction. Unfortunately the literature available on the separation response in dogs is limited, frequently anecdotal, or based on opinion rather than carefully controlled scientific studies.

1.1 *Social behaviour in the domestic dog*

The combined results of studies of behaviour (Scott, 1950, 1967; Scott & Fuller, 1965; Fox, 1971*b*; Zimen, 1981), vocalisations (Zimen, 1981), morphology (Wayne, 1986 *a*, *b*, *c*; Hemmer, 1990) and molecular biology (Wayne & O'Brien, 1987; Wayne, Nash & O'Brien, 1987; Vilà *et al.*, 1997) indicate that the sole ancestor of the dog, *Canis familiaris*, is the wolf, *Canis lupus*. Both species are highly social and rely on the processes of intra-specific socialisation and the formation of attachments for the maintenance of social contacts (McCrave, 1991). In the wolf, social relationships are established early on in life and nurtured through constant intra-species contact, lasting social relationships being formed over a long period of time (Woolpy & Ginsburg, 1967). In the early development of social behaviour, four common stages or phases exist in the two species. The following description of these stages relates only to the dog since the onset and timing of events is known to differ in the wolf, indeed variation has been noted even within differing geographical races of wolf (Zimen, 1987).

races of wolf (Zimen, 1987).

1.1.1 *Developmental stages in behaviour*

Scott and Fuller (1965) were largely responsible for determining the behavioural ontogeny of puppies via a major programme of research encompassing both detailed descriptive and experimental studies. There follows a generalised summary of developmental events; further comprehensive descriptions of each period of development can be found in articles by: Scott & Marston, 1950; Scott & Fuller, 1965; Fox & Bekoff, 1975; Houpt & Wolski, 1982; Markwell & Thorne, 1987; Nott, 1992; and McCune, McPherson & Bradshaw, 1995. It should be noted that the onset and duration of a particular period is not fixed but that substantial breed, and to a lesser extent, individual variation exists between animals.

The ***neonatal*** period lasts from birth to approximately two weeks of age, during which time the puppy is comparatively helpless and dependent on the mother. Throughout this period, the puppy's neurosensory system is still relatively immature, permitting only limited motor capacities and several primitive reflexes; the ear canals are not yet open, the puppy is blind and is unable to eliminate without maternal stimulation of the inguinal region. Thermal and tactile responses predominate, although it is thought the pup is able to respond to certain tastes and possibly smells. The major behaviours formed are et-epimeletic in nature, relying on yelping or whining to attract maternal attention.

For many years it was generally assumed that due to the restricted development of the neurosensory system, canine neonates were incapable of associative learning (Scott & Marston, 1950). It has however been subsequently shown that neonatal puppies can learn simple associations, although with less rapidity than older pups and only within the limits of their own specialised and behavioural capacities (reviewed in Serpell & Jagoe, 1995).

The ***transition period*** is temporally relatively brief (lasting approximately one week), but is marked by a series of rapid fundamental transformations whereby neonatal patterns of behaviour diminish and are replaced by more advanced behaviours. By the end of the third or fourth week, all of the senses are active and motor capacities have increased to the level where the pups are capable of walking. Independent elimination is now possible and the puppies begin to urinate and defecate

outside of the nest site. The puppies become aware of their environment at approximately three weeks of age, paying attention to littermates and displaying the first auditory "startle" response.

The ***socialisation period*** is associated with the development of all major social behaviours. Commencing at around three to four weeks of age, it lasts until weaning would occur under natural circumstances (8-10 weeks). Play fighting appears early on in the socialisation period encouraging the development of active pain regulation by the use of distress vocalisations and corresponding bite inhibition. By 4-5 weeks the pups show the first signs of allelomimetic behaviour. Maturation of motor patterns continues throughout the socialisation period, culminating in the ability to run, climb and chew. Facial expressiveness also develops, along with an increased repertoire of vocalisations. Most species-characteristic behaviour patterns including fragments of sexual behaviour, can be observed by six weeks of age. The level of fighting increases throughout the socialisation period and it is at this time that the first dominance hierarchies are established, although these tend to be highly unstable (Bradshaw & Nott, 1995). At 3-5 weeks of age, puppies readily approach new individuals, this behaviour beginning to decline by 5 weeks and strong avoidance behaviour developing in response to noxious stimuli. By twelve weeks, this "fear response" is fully functional.

The ***juvenile period*** exists from natural weaning to sexual maturity, which is widely variable between breeds. Food begging becomes increasingly apparent up to 16 weeks of age and social signalling becomes well developed. Leg lifting in males appears at around 5-8 months as does scratching following defecation. Dominance relationships become more stabilised allowing the formation of defined hierarchies.

1.1.2 *The concept of critical and sensitive periods*

That early (infantile) experiences have a great influence on later (adult) behaviour is beyond dispute. It is also generally accepted that such experiences are more important in terms of their effect on subsequent behaviour than those occurring at other stages of development (Bateson, 1979). In terms of the level of influence exerted on later behaviour, the socialisation period can be considered the most important. This is when, in the natural situation, animals learn their species identity and in the case of domesticated species, broaden this recognition to incorporate other species including ourselves.

The socialisation period in puppies was initially described as a "critical period" for the formation of primary social relationships or social attachments (Scott, 1962; Scott, Stewart & DeGhett, 1974). The term "critical period" was originally borrowed from embryology to describe the narrow and clearly defined developmental window during which specific stimuli produced long term and irreversible effects. Critical periods were first applied to behavioural development by Konrad Lorenz (1935) to account for the phenomena of filial and sexual imprinting in precocial birds. Imprinting is the process or processes by which various kinds of social preferences can be influenced by experience and is generally thought of as a narrowing of pre-existing preferences (Bateson, 1979). It reflects a period in development when an organism is particularly sensitive to outside influences, and is thought to arise as a result of interactions between many internal and external factors. The process is both pre-emptive and self-perpetuating in the sense that it limits social preferences to that which is familiar and also tends to prevent fresh experience from further modifying those social preferences (Bateson, 1979). Although imprinting is a term usually associated with birds, the fundamental concept of the period of sensitivity can be applied to the developmental process in mammals.

Early research into infantile development tended to favour the notion of sudden, rigidly defined "critical periods" outside of which little influence on adult behaviour took place (e.g., Elliot & Scott, 1961). More recent evidence suggests, however, that the boundaries of such periods are inclined to be gradual and that behaviour or preferences acquired within them can usually be modified or reversed at later stages. In accordance with this, most authorities favour the term "sensitive period" which implies less distinct periods or phases in life when particular responses or preferences are acquired more readily than at other times. It has also been suggested that deprivation or environmental insult during a sensitive period is far more likely to destabilise the developing animal (Scott & Marston, 1950; Bateson, 1979). Scott and Marston (1950) hypothesised the existence of three sensitive periods in a puppy's life in terms of the development of social relations: the formation of the parent-infant bond, the development of littermate associations, and finally around the time of sexual maturity in terms of potential mate pair formation. Research has largely focused on processes and events occurring during only one of these periods, namely the socialisation period, and it is this which I shall now go on to describe.

1.1.3 *Determination of the socialisation period in puppies through inter-specific experimentation*

The original experiments of Scott & Marston (1950) were designed to assess the development of the relationship between young puppies and their handlers. It was found that the biggest change in this relationship occurred between five and seven weeks of age; furthermore in timidity/confidence tests, the most dramatic alteration in reaction took place at 5-6 weeks. The results of these experiments provided the foundation for several subsequent studies into the significance of these limited few weeks in a puppy's life when the formation of new social relationships is seemingly so important. One of the earliest and most definitive studies was that of Freedman, King and Elliott (1961), who reared puppies in a field devoid of all human contact (but with a "tame" mother) up to the age of 14 weeks. Throughout this period, each pup was removed from the field and received one week of testing and handling before being returned to the litter. The age at which the pups received this human contact varied between a minimum of two weeks and a maximum of nine weeks. Five control pups received no socialisation. All puppies were subsequently tested for their reactions to a series of standardised tests in the presence of a human handler. Those pups socialised between five and nine weeks of age scored most favourably in the test of attraction to a human handler, those being socialised thereafter displaying an increasing tendency to avoid the handler. The control group were extremely fearful and largely untrainable, remaining so even after many weeks of careful handling. On the basis of these findings, the workers concluded that an optimum period for socialisation exists at 3-12 weeks of age and that, if, by the age of 14 weeks, the animal has had no experience of people, it never becomes socialised and will remain essentially wild. Fox and Stelzner (1966) noted that puppies isolated from human contact for one week at the age of 4-5 weeks behaved essentially the same as puppies reared in social isolation for a much longer period of time, the only difference being the lack of an avoidance response.

Further evidence for the existence of a socialisation period lasting until 12 weeks of age emerged from a study of German Shepherd puppies. Pfaffenberger and Scott (1959), in an analysis of the success rate of puppies destined to become guide dogs for the blind, revealed that of those dogs removed from the kennel situation and placed in family homes at 12 weeks, 90% went on to become accepted as guide dogs. Those animals left in kennels for a further 2 weeks or more showed a severe decline in their rate of success, frequently exhibiting fearful reactions and a general lack of confidence. Taken together, these studies tend to support the original critical period hypothesis: that the time when puppies are open to influence by external events is limited and has a clear end point;

this end point, as suggested by Scott and Fuller (1965), being brought about by the increasing tendency for organisms to react fearfully to novel situations. Within this 9 week period, an optimum socialisation period was thought to occur at 6-8 weeks (Scott & Fuller, 1965; Freedman, King, & Elliott, 1961) when a puppy's motivation to approach and make new social contacts outweighs its natural wariness.

Subsequent studies and observations indicate that the upper boundary for the socialisation period is less clear cut than originally proposed and that the situation is much more complex than once thought (Bateson, 1979). Nevertheless, a comment by Scott (1963) indicates that even as far back as the early 1960's it was appreciated that the situation was far less distinct than some researchers tended to suggest:

"there are enough changes in behaviour associated with 7 weeks of age to justify calling this the end of the period of socialisation. However, the ***process*** *of socialisation does not end at this point, nor does the capacity to form new social relationships disappear immediately, but rather slowly declines"* (Scott, 1963).

Studies of captive wolves have provided further insight into the complexities surrounding the socialisation process and illustrated that it is not restricted to early development alone but that it is an ongoing process requiring reinforcement throughout adolescence and into adulthood. Evidence exists that wolves (and dogs) socialised to humans at three months regress and lose their socialising capacity in the absence of periodic social reinforcement (Rabb, Woolpy & Ginsburg, 1967; Woolpy & Ginsburg, 1967; Fox, 1971*b*, 1978). It is also known that adult wolves may become socialised to humans having had no prior experience of people (Woolpy & Ginsburg, 1967) although this is a considerably more difficult process than socialising a wolf cub. Nevertheless, once properly socialised, adult wolves appear to remain so despite long periods of isolation from human contact (Woolpy & Ginsburg, 1967).

The "end" of the socialisation period is thought to arise with the development of the fear response. Once the fear response is fully functional, the initial response of the animal to a stranger becomes avoidance (Fox, 1968). Investigations of the fear response in wolves support this hypothesis, Woolpy and Ginsburg (1967) commenting that:

"the principal obstacle to the acquisition of positive social responses to humans is the wolf's fear

of the experimenter"

Evidence for this was provided by the use of tranquilisers in experiments of socialisation on captive adult wolves. It is thought that four stages exist in the process of socialising adult wolves to humans, a process which normally takes 6 to 7 months:

1. The escape response
2. The avoidance response
3. Approach
4. Exhibition of friendly behaviour

Use of the tranquillizing drugs chlorpromazine, librium, and reserpine in the socialisation process revealed that stages 1 to 3 could be considerably temporally compressed from a duration of several months to a period of 4 days. Nevertheless, although approach occurred within a relatively short time, it was frequently more aggressive than the approach of non-tranquillised wolves and accompanied by repressed threat gestures. The tranquillised wolves never became fully socialised to the extent of displaying overtly friendly behaviour, moreover on withdrawal of the drug treatment they regressed to stage 1. Woolpy and Ginsburg (1967) thus concluded that the drug was reducing fear rather than inducing approach or aggression and that the blocking of this fear was the essential step in the advancement of the socialisation process.

It is postulated that the reduction in the flight response (or fear of the unfamiliar) of dogs permits socialisation with humans (Zimen, 1981). It becomes increasingly difficult to socialise wolf pups after the age of 3 weeks, indeed the process is facilitated if commenced before the eyes have opened; however dog pups may be socialised with humans from 6 to 10 weeks of age. The early development of flight behaviour in wolves therefore acts to inhibit the possibility of socialisation. From these observations Zimen (1981) concluded that socialisation and flight were incompatible systems but that socialisation is possible at any age provided the affective components of fear can be brought under control (Woolpy & Ginsburg, 1967).

On reflection, this evidence provides confirmation of why cautionary endorsement of conclusions drawn from laboratory experiments in the development and implementation of fundamental behavioural theories is advisable. Although such experiments are invaluable in providing fundamental concepts, one must always be hesitant of wide scale adoption into practice,

particularly, as I shall go on to elaborate, in relation to companion animals. In the majority of cases, the consequences of extreme manipulations of the behaviour of experimental animals into adulthood were never recorded. In addition, continuation and modification of early rearing procedures would have undoubtedly provided further clarification of the socialisation process.

1.1.4 *The development of intraspecific and interspecific attachments*

If one explores the process of *socialisation* fully, the phenomenon of *attachment* inevitably ensues and this is where considerable confusion arises. In an examination of the literature available, it appears that the terminology has become somewhat misconstrued, with some authors referring to "attachment" where the word socialisation would perhaps have been more appropriate. The lack of definition when applying such terms does not facilitate matters as one is largely left to speculate on what is actually being described. Used correctly, *socialisation* refers to a process or processes during which animals are particularly receptive to stimuli and when various social preferences are established. An animal is said to be "socialised" to *x* (where *x* is another animal or type of animal) when it displays a recognition and acceptance of *x* and behaves accordingly towards it. Socialisation reflects a process of generalisation to one or more species, or species "type(s)", through a familiarity with of one or more individuals of that type. *Attachment* is usually thought of as a relationship between two or more individuals and need not be extrapolated to include others of the same type or species. The important features when defining attachment are: (1) the formation of a special emotional relationship (i.e., an affective bond), (2) with a specific individual (i.e., specificity of the bond), (3) towards whom responses are directed rather than towards other individuals (i.e., differential responding). These assume the recognition and discrimination of the attachment figure from other figures (Gubernick, 1981).

It must be noted that there is a discrepancy between attachment as an affectional tie or bond and *attachment behaviour* (Gubernick, 1981). Attachment behaviours are considered to be those behaviour patterns which result in proximity to a specific (attachment figure) and through which the attachment bond is formed, maintained and mediated (see references in Gubernick, 1981, p.244). The affectional bond is not any of these behaviours but rather is inferred from such behaviour. In terms of the measurement of attachment, two viewpoints prevail:

1. That the intensity or strength of an attachment cannot be directly measured but the existence of affectional bonds may be inferred. What can be measured is the intensity or

degree to which attachment behaviours are activated.

2. That attachment is definable in terms of attachment behaviours and that these indices reflect the strengths and intensity of this bond.

Both viewpoints consider the attachment bond as a construct but differ in how the bond is reflected in behaviour. Unfortunately, as Gubernick (1981) points out, problems may arise when attachment as a construct is used as a motivator or organiser of behaviour or as an explanation for the very behaviour from which it was inferred. He uses the example of the young animal separated from its caregiver to illustrate: the behaviour exhibited by such an animal has often been attributed to the disruption of the bond between them (using attachment as an explanation), yet this bond is often inferred to exist from the very observation that the infant is distressed upon separation from its caregiver. Consequently, several workers have chosen to reject the attachment bond construct and view attachment in terms of the stimulus-response contingencies within the relationship itself. Their focus is on the interactions of the individuals concerned and the various conditions controlling the expression of these interactions. The term attachment is considered by Gubernick (1981) to be *a preferential responding between parents and infants* (in this context) *as demonstrated by various operational criteria* including: a tendency to remain in close proximity to one another, showing an active preference for a particular individual over another when given a choice, and an inclination to display a separation reaction in response to the departure of the presumed attachment figure (Gubernick, 1981). The situation is further complicated by the observation that attachment can exist in various forms, i.e., mutual attachment between two individuals, mutual attachment between more than two individuals, one way attachment, and asocial attachment (Scott, 1992).

Although the processes of socialisation and attachment are distinct, they overlap considerably and it logically follows that when an animal, S, is maintained in close proximity to an object, O, (either animate or otherwise), and some crucial condition, or set of conditions, is fulfilled, social bonds are likely to be formed (Cairns, 1966). At one time circumstances known as primary conditions were thought to be essential for the formation of such social attachments. As a result of further research, it is now accepted that attachments are capable of developing even in the absence of "primary conditions" such as: lactation by O (Harlow, 1958; Igel & Calvin, 1960); immaturity of S (Altmann, 1963); physical contact between O and S, (Cairns & Johnson, 1965); or non-punitiveness of O with respect to S (Fisher, 1955; Rosenblum & Harlow, 1963; Seay, Alexander & Harlow, 1964). Indeed Scott (1963) concludes that from the available evidence, various conditions facilitate but are not necessary for the formation of social attachments, with the exception of

proximity. In other words, an animal may develop a social attachment to any object, animate or otherwise (particularly in the absence of alternative social contact), with which it has been maintained in a proximate relationship. It therefore follows that under natural circumstances in, for example, species such as the wolf the process of socialisation usually precedes attachment (except for initial parent-infant bonding), and ensures that the young animals form primary social attachments for their littermates, parents and other group members. The initial parent-infant attachment develops prior to the socialisation period, and is only succeeded by socialisation given sufficient opportunity. Scott (1963) summarises the findings of research into socialisation in animals with the following statement:

"...every highly social animal has a short period early in life in which the formation of primary social relationships takes place. Normally this determines not only the species to which the animal will be closely attached but also the special group of individuals within that species with whom he will have close social relationships."

In domestic animals such as the dog, the formation of interspecific attachments as well as intraspecific attachments is permitted through exposure of the animals to non-conspecifics during the socialisation period. The development of non-conspecific attachments during the socialisation period has been demonstrated experimentally in several studies of interspecific cohabitation including the rearing of: mice with rats (Denenberg *et al.*, 1964); lambs with dogs (Cairns & Johnson, 1965); puppies with mature lagomorphs (Cairns & Werboff, 1967); and Chihuahua puppies with kittens (Fox, 1969).

Inter-species socialisation and restricted intra-species socialisation may result in one or more of the following behavioural changes (Fox, 1969):

1. A social preference for alien foster parents or foster peers
2. A reduction of normal social reactions to the foster species, such as aggression and predator-prey relationships
3. Inter-species sexual behaviour
4. Asocial relations to conspecifics (Fox & Stelzner, 1967)

None of the above behavioural changes necessarily persist for the lifespan of the individual(s) concerned. Given sufficient exposure to conspecifics, many inappropriate species behaviours are at least partly reversible. This latter observation demonstrates that the period of socialisation not only

determines the young animal's future social partners but also defines its *species identity.*

For inter-species socialisation and attachment to occur, non-conspecific encounters do not need to be particularly frequent or protracted: Cairns and Werboff (1967) stated that 88 hours of cohabitation was enough for the formation of an interspecific attachment during the peak of the socialisation period; Fuller (1964) found that puppies could be socialised to humans with as little as two 20 minute periods of exposure per week, indeed merely a few minutes of eye contact per day produced an increased positive response towards humans (Scott & Fuller, 1965). In a more recent study of enrichment in laboratory housed dogs, Hubrecht (1995) concluded that an additional 2.5 minutes of human contact per day towards pups aged 5-11 weeks produced dogs more likely to approach technical staff up to 6-11 months after enrichment. The fact that such low levels of interspecific socialisation can have a marked effect on individual behaviour to a large extent reflects the relatively asocial and unstimulating conditions in which the majority of the aforementioned studies were conducted.

The development of canine-human attachment and factors contributing to the attachment process were a major subject of investigation during the 1960's and 70's. As previously stated, it was postulated that certain "primary conditions" were required for the formation of social attachments; experimental evidence subsequently proving that although these conditions facilitated attachment, proximity was the only necessary prerequisite. It was established that external rewards and punishments were not essential to the attachment process but may be responsible for modifying it. In many cases, a heightened level of stress appeared to encourage the attachment process, whether that be in the form of food deprivation (Elliot & King, 1960), maternal and nest site deprivation (Scott, Deshaies & Morris, 1962), or using punishment as the only form of human contact (Fisher, 1955). Scott (1992) proposed that under normal circumstances exposure to noxious stimuli, e.g. punishment, escape behaviour would typically be observed. If, however, escape is prevented, the attachment process is accelerated and intensified by the emotions generated through punishment. As a general hypothesis, Fox states that: *"the occurrence of any strong emotion, whether pleasant or noxious, will speed up and intensify the process of attachment".*

In a review of the phenomenon of attachment in human-nonhuman relationships, Scott (1992) concludes that the process of attachment in all vertebrates is essentially similar, however it is questionable whether the attachment process in essentially non-social precocial vertebrates can be compared to highly social altricial mammals. He postulates that since the process of attachment has undergone relatively little evolutionary modification in diverse species, that this is a process so

fundamental to existence that an *evolutionary stable strategy* has evolved[1], although this seems a somewhat presumptuous and generalised statement. If attachment *is* viewed to be an ESS, the following conclusions may be drawn as to the mechanisms of attachment (from Scott, 1992):

1. Rapid social attachment among wild species is normally confined to a brief period early in life (a critical or sensitive period). Together with the normal behavioural patterns of the species, this ensures that an infant animal will become attached primarily to its own species and to close genetic and social relatives within that species. In addition, most highly social species are capable of forming attachments in later life, but they do so at much slower rates and are limited by earlier attachments that may either restrict or enhance contacts with other individuals.

2. The process of attachment is an internal one and not dependent on rewards or punishments. All that is necessary is that the object of attachment, whether animate or inanimate, be noticed by the individual concerned and that the contact be maintained long enough for the attachment process to take place.

3. External rewards or punishments are not essential to the attachment process but may modify it.

4. The function of the attachment process varies from one species to another, being related to the usual social organisation of the species concerned.

1.1.5 *The role of the separation reaction in the attachment process*

A mechanism for attachment requires fulfilment of the following conditions (Scott, Stewart & DeGhett, 1974):

1. The development of a memory of a stimulus previously experienced - a process of

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[1] An Evolutionary Stable Strategy (ESS) is defined as "a (preprogrammed, non-conscious behavioural) strategy which, if most members of a population adopt it, cannot be bettered by an alternative strategy" (Dawkins, 1989). Once an ESS has been established, it will remain within the population and selection will penalize deviation from it.

familiarisation

2. The ability to discriminate the familiar from the unfamiliar

3. The reaction of emotional distress in response to separation from the familiar.

The latter implies that attachment is influenced by separation from the attachment figure. Such separations occur naturally in the wolf and other wild carnivores when the mother periodically leaves the den site to hunt for food. Observations of parent-infant relationships in domestic canine litters suggested that vocalisations facilitate the re-establishment of maternal contact following separation from the dam. Distress vocalisation in puppies appears almost immediately after birth, yelping occurring in response to cold, hunger or pain. Yelping presumably has the effect of attracting the attention of the mother during any unpleasant or harmful stimulation and can therefore be classified as a care-soliciting or et-epimeletic behaviour. As the pup matures, vocalisations are used in response to factors other than physical discomfort, including isolation from littermates and the nest site as well as from the mother; the reaction to the absence of the familiar being fully developed by three weeks (Scott, 1971*a*). Emotional reactions such as distress vocalisations are thought to be caused initially by distress due to absence of the familiar and then later by an associated fear of the unfamiliar. These two factors are compatible with each other and produce an additive effect (Scott, Stewart & DeGhett, 1974). The expression of discrete vocalisations under circumstances of separation led researchers to utilise the yelp as a quantifiable measure of presumed internal distress. Several studies were undertaken to examine the effects of short-term social isolation on puppies and the factors required to alleviate the ensuing separation distress.

The research into canine separation originated as a model for the human psychiatric condition known as *anaclitic depression.* Frequently infants (aged 6-8 months) hospitalised for up to three months displayed symptoms unrelated to the original physical illness following separation from the mother; these symptoms (listlessness, immobility and a failure to thrive) abating on being returned to the mother (Scott, Stewart & DeGhett, 1974). Elliot and Scott (1961) were some of the first workers to investigate the development of emotional distress reactions to separation in young puppies using levels of yelping and activity as measures of distress. The greatest decrement in disruption was found to occur during the first 4 hours of social isolation, with a gradual return thereafter towards pre-separation levels of activity. Puppies which had been moved to an unfamiliar area displayed a similar trend in reaction but over a much shorter period of time (10 minutes). The rate of vocalisation in the home pen was consistently lower than in the strange pen, this rate being further reduced by the presence of the mother and littermates. The level of distress was found to

peak in puppies aged 6-7 weeks after which it steadily declined, although animals experiencing no separations until 9 or 12 weeks exhibited more distress when first tested than previously tested puppies of the same age. In an earlier study, Ross, Scott, Cherner and Denenberg (1960) revealed that restraining puppies also influenced the level of yelping. For the rate of yelping to be brought back to zero, the puppies needed to be unrestrained with both mother and littermates present. Having established that isolation, restraint and an unfamiliar environment induce distress vocalisations, Pettijohn, Wong and Ebert (1977) went on to examine the alleviation of this distress through various stimuli. For adequate alleviation of distress in an isolated puppy, soft, warm social interaction appeared to be necessary; food and solitary play serving as unsatisfactory substitutes.

Distress at absence of the familiar is relieved by the reappearance of familiar objects or individuals. Scott (1971) suggests that this relatively simple emotional reaction acts as an internal reinforcing agent and the mechanism of repeated brief periods of separation during early development is sufficient to account for an emotional attachment. The attachment will then be strengthened by reinforcement generated through prolonged contact and many short separations. Once the social relationship has been established, external reinforcements, such as food, warmth and contact may then modify behaviour within the relationship but ordinarily they do not serve to produce the constant contact which first establishes the relationship (Scott, 1971). It has indeed been shown that food is not necessary for attachment to take place (Brodbeck, 1954), along with various other external stimuli.

In conclusion, it would appear that for an attachment to develop and perpetuate, the following are required:

1. A process of familiarisation
2. The ability to discriminate familiar from non-familiar
3. The reaction of emotional distress in response to separation from the familiar
4. Repeated brief separations from the familiar
5. The provision of external stimuli by the familiar
6. The response of fear of the unfamiliar

Habituation to brief separation from the attachment figures eventually develops although the process can take a considerable length of time. On separation, the distress vocalisation tends to increase in proportion to the duration of such separation, with pauses in vocalisation only as the infant becomes exhausted (Scott, 1971). Prolonged separation becomes possible as a result of

habituation, with the individual tolerating extended periods of separation before the distress reaction ensues.

The effects of separation are apparently species specific, depending to some extent on the social organisation of the species involved. In experiments on two species of macaques, it was found that pig-tailed monkeys reacted to separation from the mother with immediate vocalisation and high levels of activity within the first 24 hours. Later, an extreme lack of activity, absence of social interaction and a huddled posture became apparent, lasting for approximately 5-6 days, after which time recovery began to take place (Kaufman, 1973). Moreover, In the bonnet monkey, comparative separation procedures revealed an absence of the severe depressive reaction although some agitation and increased vocalisation was evident. On the contrary, the bonnets displayed a dramatic increase in social interaction with adults and were occasionally adopted by an alternative female. This difference in reaction to maternal separation appears to reflect differing socio-dynamics within the two species.

When discussing the response of the domestic puppy to periods of isolation, it is interesting to compare the behaviours displayed with the natural development of the ancestral species. The neonatal period in the wolf is thought to terminate sooner than that of the domestic dog (Frank & Frank, 1982; 1985; Zimen, 1987). Once this developmental phase is over, the pups begin to venture outside of the den but do not begin to follow pack members until they are at least 10 to 12 weeks old (Gray, 1993). During this period, the mother periodically leaves the nest site, gradually increasing the duration of absence up to 18 hours per day (Ballard *et al.*, 1991). In such circumstances, it would be inappropriate for the pups to respond vociferously to the absence of the dam since not only would this expend considerable energy but increase the likelihood of attracting the attention of potential predators. Moreover, the presence of littermates (and possible alternative pack members already familiar to the pups) would serve to alleviate the distress due to the absence of the dam by providing the necessary warm social interaction. The situations described in experiments of partial or complete social deprivation are therefore unlikely to arise in a highly social animal such as the wolf. If, however, for whatever a reason a wolf pup happened to become separated from the pack, the vocal distress response *would* convey a considerable survival advantage. It would also be beneficial to exhibit early recognition of and "attachment" to the natal den, since removal from the nest site may expose the pup to considerable danger.

1.2 *The application of laboratory research to the domestic dog as a companion animal*

Although the literature discussed relates primarily to laboratory experiments conducted in highly restrictive environments, the findings of such research may be applied, if somewhat cautiously, to the domestic dog as a companion animal. Most canine developmental research has been carried out on the Beagle, commonly used as an experimental animal because it is both physically and temperamentally adaptable to an impoverished environment. The timing of changes in behaviour and in the quality and quantity of stimuli required to trigger them may therefore exhibit considerable variation in breeds more representative of the pet dog population. Nevertheless, the results of socialisation studies gave rise to various practical recommendations regarding the husbandry and training of domestic dogs: firstly, that the ideal time to generate a close canine-human relationship is between six and eight weeks of age, and that this is therefore "the optimal time to remove a puppy from the litter and make it into a house pet" (Scott & Fuller, 1965); secondly, that puppies should be introduced to the circumstances and conditions they are likely to encounter as adults, preferably by eight weeks, and certainly no later than twelve weeks of age (Scott & Fuller, 1965; Pfaffenberger & Scott, 1976). Removing a puppy from the dam and littermates at 6-8 weeks facilitates attachment to the new owner in several inter-related ways: by making maximum use of the peak in the socialisation period; encouraging attachment through the various stresses of leaving the home environment; and ensuring new social and situational changes take place before the fear response is fully manifested. Nevertheless, it has recently been suggested (Slabbert & Rasa, 1993), that the recommended practice of removing pups from the maternal environment at such a young age may prove detrimental to their physical health. They concluded that puppies taken from the mother and nest site (but not littermates) at six weeks exhibited loss of appetite and consequent weight loss, increased distress, mortality and susceptibility to disease compared to pups remaining with the dam until 12 weeks of age. Both groups, however, showed the same level of socialisation towards their human handlers. In light of these findings, it may be better in terms of animal welfare to allow puppies to remain in the nest site with the mother for longer than 6 weeks provided adequate social and environmental stimuli are available.

In terms of the experience a puppy receives up to the age of twelve weeks, it is now generally accepted that not all eventualities need to be covered prior to this age for a puppy to develop into a well balanced, well adjusted pet. It is advisable however, to expose the young animal to as many different circumstances as possible before the fear response becomes fully manifested. Anecdotal evidence suggests that puppies experiencing various stimuli in early life tend to accept novel

experiences and events in adulthood, implying that exposure to stimuli during the socialisation period has a priming effect (McCune, McPherson & Bradshaw, 1995). In addition, familiarity with people improves trainability via the learning of interactive tasks and enhancement of problem solving abilities (Fox & Stelzner, 1966). Less well socialised animals tend to behave in an inappropriate manner when confronted with new individuals, objects or situations and are consequently more susceptible to stress. In relatively extreme circumstances of social and environmental deprivation, a general fearfulness and lack of confidence tend to ensue in unfamiliar situations and towards unfamiliar individuals. Animals exhibiting such behaviour are said to be suffering from a condition commonly known as *kennelosis*, since it is most frequently observed in dogs reared in restrictive kennel environments.

It has already been shown that acceptance of previously unencountered stimuli outside of the socialisation period is possible but considerably more difficult than during the first weeks of a young animal's life. It is also known that reinforcement of experience is required throughout later life to prevent regression of the socialisation capacity. Broadening of the animal's experience outside of the socialisation period is often confusingly referred to by laymen as "socialisation"[2]. To avoid such confusion the term *social referencing* will be used in preference to socialisation for the broadening of experience during the juvenile and adult periods. Social referencing also encompasses the ability to become familiarised with various inanimate objects encountered in human civilisation. Although it is infinitely easier to accustom a puppy to social and environmental cues before it reaches 14 weeks of age, programmes of vaccination discourage the exposure of young animals to many potential experiences. Methods for overcoming restrictions brought about by vaccination regimes are discussed in McCune, McPherson and Bradshaw (1995).

1.2.1 *The development of an excessive reaction to social isolation in pet dogs*

Inadequate socialisation and social referencing undoubtedly contribute towards, if not directly precipitate, various forms of antisocial behaviour in domestic dogs. If the subsequent behaviour displayed is sufficiently obnoxious, the animal is considered to be a "problem". When discussing problems and problem behaviour it must be emphasised that the use of the word "problem" is arbitrary and anthropocentric. Dog-owner attachment has also been implicated in the development of undesirable behaviours with particular respect to *overattachment*. The attachment behaviour of

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[2] Strictly speaking, the term *socialisation* refers only to the primary species socialisation period

dogs people find so endearing, i.e. effusive greeting, approach to be petted, attempting to remain in close proximity *etc.* are thought to be the root of a common behaviour problem, that of ***separation anxiety*** (discussion of the terminology used with respect to such a syndrome may be found in ***Section 1.3)***.

This particular class of problem characterises patterns of behaviour that occur only in response to separation from one or more individuals to whom the animal is presumably attached. The behaviours exhibited are usually triggered by departure of the attachment figure, although a denial of access may also stimulate the separation reaction (Borchelt & Voith, 1982). The nature of the separation reaction may take many forms:

1. *Separation-related destructiveness* - biting, chewing and scratching of objects both fixed and loose. Frequently entrances and exits are targeted, often at the site of the owner's most recent departure. Items bearing the owner's scent may also serve as a focus for destructive tendencies.

2. *Separation-related vocalisation* - barking, whining, or howling

3. *Separation-related elimination*

The latter may be symptomatic of a general anxiety-like state while the two former may be interpreted as attempts by the dog to restore contact with the owner (Borchelt & Voith, 1982; Voith & Borchelt, 1985; McCrave, 1991).

At this point it may be useful to note the behavioural context of vocalisations. Fox (1978) describes the various vocalisations in domestic dogs and ancestral wolves in terms of five categories:

1.	Infantile	crying, whimpering, whining
2.	Warning	barking, growling
3.	Eliciting	howling
4.	Withdrawal	yelping
5.	Pleasure	moaning

In general, wolves exhibit exceptionally low levels of barking but in two different contexts: the first is an alarm bark which is usually short and followed by silence (Joslin, in Mech, 1970); the second

is used in response to an approach by non-pack members. The prevalence of the bark as a mode of auditory communication in the dog, although this to some extent breed specific (Scott & Fuller, 1965; Fox & Bekoff, 1975), is therefore assumed to be an artefact of the domestication process (Bradshaw & Nott 1995). Notably, Coppinger and Fernstein (1991) point out that young animals of many canid species tend to bark more than adults. It is therefore possible that during domestication (and the presumed selection for juvenile characteristics[3]), the propensity to bark was inadvertently selected for (Bradshaw & Nott, 1995). Barking in domestic dogs is exhibited in several different contexts - defence, play, greeting, as a *lone call*, a *call for attention,* or a warning. The lone call in the wolf is generally observed to be the howl, solitary individuals howling to seek contact with other pack members (Scott, 1967; Mech, 1970), or to attract other wolves during the breeding season (Klinghammer & Laidlaw, 1979). The howl is therefore assumed to be a social coordinator. Dogs howling during social isolation (although howling is occasionally observed in alternative situations) are apparently seeking social contact.

It is generally assumed that dogs displaying destructive behaviour are also seeking social contact but via a more direct means, i.e., through attempting to escape. This difference in approach may reflect differences in the inherent temperament of the dog, its relationship with the human members of the household and its normal (non-separation) state. Further elucidation for the motivation for the symptoms expressed may be provided through obtaining detailed behavioural and environmental histories for specific individuals.

A reluctance to eat/drink in the owner's absence, lack of play activity, general hypoactivity, depression of facial and body postures resembling a depressive-like state, have also been observed during separation. Furthermore, physiological stress responses including tachycardia, hyperventilation, diarrhoea and vomiting (Senay, 1966) have been noted; self-mutilatory behaviours have also been recorded in some animals. Voith and Borchelt (1985) report that during prolonged periods of separation, anorexia and marked lethargy may develop.

Frequently, pre-departure indicators of distress are exhibited by the dog. In such instances, the dog has learned the cues associated with departure and expresses anticipatory behaviour in response, e.g. persistent following, flattening of the ears, lowering or tucking of the tail, shaking, shivering,

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[3] The tendency for some dogs to react strongly to separation from the primary human care-giver has been interpreted by some as a side-effect of unconscious (or conscious) selection for increasingly affectionate, socially dependent, and infantalised pets (Fox, 1978; Serpell, 1983; Mugford, 1995), or those exhibiting *behavioural neoteny.*

whining, excessive salivation, facial and body postures described as "depressed or frightened" (Borchelt & Voith, 1982). In general, the separation reaction is displayed soon after departure of the owner, normally commencing within a 30 minute time span (Voith & Borchelt, 1985). Many authorities are of the opinion that inappropriate behaviour beginning after a longer period of isolation implies a more complex interaction of motivational states, not necessarily including that of distress at separation from the familiar.

On return, the owners of such dogs are often greeted with overwhelming intensity which may prolong over a considerable period (Borchelt & Voith, 1982). The intensity of greeting is usually greater than that shown by dogs without separation problems, indeed pronounced greeting or "arrival elation" is frequently used as a diagnostic indicator of such problem behaviour.

Separation related behaviour is manifested in equal male/female ratios and is independent of sexual status (Wright & Nesslerote, 1987). The majority of workers state a lack of breed predilection, although Mugford (1983) makes reference to an unusually high prevalence in Labrador retrievers, German shepherds and English cocker spaniels. In addition, Landsberg (1991) states that German shepherds, Labrador retrievers, golden retrievers and springer spaniels tend to be more destructive but does not specify whether this behaviour is with particular reference to during social separation. It is generally accepted that cross-bred animals are far more prone to separation problems than any pure bred dog (Mugford, 1983; Voith & Borchelt, 1985; McCrave, 1991). McCrave (1991) proposes that the increased incidence in cross-bred dogs is associated with the observation that many non-pedigree animals referred to behaviour counsellors are obtained from rescue centres. It is suggested that dogs who experience the loss of a primary attachment figure are more likely to develop insecure attachments to subsequent owners (Borchelt & Voith, 1982; Voith & Borchelt, 1985; McCrave, 1991).

Other than brief maternal-infant separations, the first major social separation a puppy receives is that occurring during adoption by the new owners (usually between 6 and 8 weeks of age). The puppy normally suffers a strong separation reaction which is subsequently relieved by the human foster parents as it becomes familiarised with them. The result is a rapidly formed attachment and a high level of dependency on the human care-givers (Fox, 1971*a*). The process of forming social attachments outside of the sensitive period does not cease but takes place throughout life. Fox (1971*a*) suggests that primary attachments tend to become deeper and stronger as the infant matures, and that older individuals are inclined to generalise attachments, although little experimental evidence exists to support this proposal. In addition, adults more quickly form

attachments to individuals who seem familiar. Assuming this familiarity is extended towards humans in general, this mechanism may account for the rapid, intense relationships developed on rehoming of dogs outside of the socialisation period.

A reaction to a period of separation from an attachment figure can be considered normal. A response which results in extreme levels of distress and escalates to the level of pathological symptoms cannot be considered normal, although it is unfortunately not uncommon (Mugford, 1981, 1983; Borchelt, 1983; McCrave, 1991). Many factors have been implicated in the development of such maladaptive behaviours, however scant scientific evidence exists to support the hypotheses. One of the most frequently cited features of a dog exhibiting a separation problem is overattachment to one (or more) owners (Fox, 1978; Mugford, 1981; Voith & Borchelt, 1985). An animal is said to be *overattached* if it displays several of the following behaviours:

1. Remaining in close proximity to or in actual contact with the person whenever possible
2. Displaying a reaction to being denied access to that person
3. Showing excessive greeting behaviour on reunion with the attachment figure

These behaviours are exhibited by individuals who are within the realms of *normal* attachment, and can indeed be used as measures of that attachment; however, animals which are preoccupied with performing one or more of these behaviours may be said to be overattached. The distinction between "normal" attachment and "overattachment" is essentially arbitrary and may be modified according to the researcher's requirements.

If overattachment contributes towards the separation behaviour, what is it that encourages an animal to form such a profound and potentially maladaptive relationship? As previously mentioned, additional homing following development of the primary social attachment may promote the formation of subsequent intense attachments. It has been noted that animals with a history of traumatic separation have a higher likelihood of developing separation problems (Borchelt & Voith, 1982); this being supported by the observation that rescue dogs are particularly prone to separation problems, irrespective of breed. Repeated rehoming of an individual may therefore be expected to exacerbate the problem and indeed this has been validated by several authors (Borchelt, 1983; Bailey, 1993; McBride *et al.*, 1995). The former proposal, for the development of a separation problem as a result of rehoming whether or not that be through a rescue shelter, assumes the animal was not overattached to the primary attachment figure. In many cases, the history of a rescue dog is largely an unknown entity and it may well be that an individual was already showing signs of

developing an intense relationship before being given up for adoption and that the rehoming process merely initiated the separation behaviour (Bailey, 1993). Anecdotal evidence from behaviour therapists suggests that the more cycles of attachment and separation an animal experiences, the more severe its separation reaction will be. This finding is in agreement with attachment theory which states that separation intensifies the social attachment (although usually applied to a constant attachment figure).

Overattachment may also arise as a consequence of a *lack of social separation*, hence the animal has never habituated to brief periods of separation. Hetts (1989) in a study of the distress vocalisation in puppies, found that those experiencing frequent but brief (10 minute) separations habituated by the age of 12 weeks whereas puppies isolated less frequently but for longer (1 hour) had not habituated over the same time period. It may therefore be recommended from these and other findings that the pet owner acquiring a young puppy should familiarise it with the concept of separation at a young age, gradually introducing short but regular periods of social isolation. Jagoe (1995), in a retrospective study of canine behaviour problems, revealed a significant association between puppies suffering illness at 0-16 weeks and the development of separation-related barking at a later age. This may reflect the increased levels of exclusive and constant care and attention lavished on sickly puppies which, during the socialisation period, appears to encourage over-dependent adult dogs.

It has been suggested that animals experiencing early attachment deprivation may display a predisposition to the development of overattachment later in life (Borchelt, 1983). Indeed Jagoe's (1995) study revealed that puppies obtained initially from pet shops and animal shelters were over-represented in terms of problem behaviour when compared to dogs from other sources. It may be tentatively suggested that such establishments have neither the time nor facilities to provide adequate socialisation for the numbers of puppies in their care, consequently the opportunity for establishing attachment relationships are infrequent. In addition, the general ambience of the kennel/pet shop environment is likely to expose the puppies to a higher level of stress which tends to intensify attachments once the opportunities for bond formation has arisen. Hand-rearing and early weaning also seem to contribute towards the development of overattachment. A dog that has been prevented from interacting with members of its own species tends to become excessively human orientated (Houpt & Wolski, 1982).

Separation problems were for many years considered to be age independent (Mugford, 1983; Voith & Borchelt, 1985; McCrave, 1991). Recent evidence and considerable anecdotal evidence has now

prompted a review of the situation regarding age. There appears to exist a peak in the number of cases of separation destruction at around 6-9 months. The juvenile period of development has been largely ignored by academic research although it appears a well-recognised concept within the canine fraternity that there exists a time during adolescence (from 4 to 18 months of age depending on breed) when behaviour problems in general become more prevalent. In a study of behaviour in dogs rehomed from an animal shelter, McBride *et al.* (1995) found that animals aged 6-12 months were two to three times more likely to display some form of separation behaviour in the new home than any other age group. In light of these findings, it seems increasingly apparent that considerable changes in social relationships occur throughout the juvenile period. In wild canids such as the wolf, this is a time when social upheaval would naturally occur as the maturing cubs begin to disperse and form new social relationships (Scott, 1967). There is some anecdotal evidence for a second phase of heightened sensitivity (outside of the primary socialisation period) to fear-evoking and territorial stimuli in wolves at around 4-5 months of age (Fentress, 1967; Fox, 1971*b*). If a similar scenario exists in the domestic dog, then this may go some way to explaining the onset of potential "problems" around this time. Referring back to early scientific literature, Scott and Marston (1950) proposed that three sensitive periods exist in the lifespan of a domestic dog, the final phase occurring at the onset of sexual maturity. They also hypothesised that during such sensitive periods an animal is especially vulnerable to psychological damage and the subsequent development of abnormal behaviour. It may not therefore be so surprising that behaviour problems appear to develop or are more likely to develop at 6-12 months (when most dogs are reaching sexual maturity). What is surprising is the lack of investigation into sensitive periods outside of the primary socialisation period. Houpt (1985) comments that dogs frequently rehomed as juveniles are apparently more susceptible to behaviour problems in adulthood; a remark which further implicates the repeated cycle of attachment and separation, particularly during a sensitive period, as an instigator of abnormal behaviour.

In any comparison of domestic dog and ancestral wolf behaviour[4], it is important to remember that although behavioural systems in the two are apparently very similar, considerable changes have occurred as a result of the domestication process. One of these is the early development of sexual maturity in the domestic dogs. Wolves reach sexual (and social) maturity at approximately 2 years (Sheldon, 1992) of age and only experience one reproductive season per year in the female, and seasonal reproductive ability in the male (the reproductive status in individual pack members being

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[4] It is also important to remember that the wolves in existence today are probably behaviourally quite different to those originally domesticated 10,000+ years ago, not least as a result of persecution by *Homo sapiens*

additionally limited by the hierarchical social dominance system). In the dog, however, it is generally accepted that sexual maturity is acquired between 6 and 9 months of age, the female exhibiting two reproductive seasons per year and the male continuous reproductive ability. This advancement in the age of sexual maturity is thought to have arisen through conscious selection in the domestication process, although it is interesting to note that many authorities do not view the dog to have reached *social* maturity until it is 12 to 18 months old, or even up to 36 months (Bradshaw & Brown, 1990; Overall, 1997). This discrepancy in the age of attainment for sexual and social maturity may go some way to displaying the "abnormal" behaviour in some animals. The sexual maturation process has been brought forward by up to 18 months in the domestic dog, hence enforcing the development of adult relations (the so-called third sensitive period) long before the dog is fully socially adept.

A sudden change in circumstances or a disruption of routine are factors which have been implicated in the activation of a separation reaction (Borchelt & Voith, 1982; Borchelt, 1983). Such alterations in a normally stable environment inevitably cause disruption to a resident animal, consequently increasing the level of stress the dog experiences. That elevated stress (either direct or indirect) affects the development of separation problems is a widely accepted philosophy amongst behaviour counsellors, nevertheless attempting to scientifically monitor the level of stress in the home environment, let alone prove the association, is fraught with difficulty. That stress affects the formation and quality of primary social attachments has already been established; it would seem reasonable that attachments in later life are also influenced by elevated states of arousal.

1.3 *The physiological and psychological basis of the separation reaction*

In general, separation from presumed attachment figures elicits behavioural responses which can approach the extreme. That these changes occur implies a necessary internal state of distress which is reflected in the measure of various physiological parameters including hormones. Physiological measures of stress utilised experimentally so far include (from Overall, 1997):

1. Catecholamines (adrenalin / noradrenalin) and resulting secondary measures of tachycardia (short term response) or bradycardia (long term response)

2. High corticosteroid levels resulting from the stimulation of the pituitary adrenal axis. Increasing levels are associated with crowding/isolation during transportation, the level of

response varying according to the relative sociability of the species concerned

3. Neutrophil/lymphocyte ratios - a reduction in the ratio is a secondary effect of an increase in corticosteroid levels and predisposes the animal to infectious diseases

4. Responses to adrenocorticotropic hormone (ACTH) stimulation. Prolonged and profound stress (associated with adrenal exhaustion) results in poor stimulation responses obtained after administration of ACTH

Changes in glucocorticoid function are also found to occur under stressful circumstances resulting in: metabolic alteration, inflammation, changes in immune functions, gastrointestinal alteration; the production of ADH in response to exogenous or endogenous stress causing decreased urine production in acutely stressful circumstances. The effect of stress on measures of β-endorphins and substance P from the sympathetic terminals (affecting small intestinal contractility, arteriolar vasodilation, and salivary gland secretions) have also been made (Overall, 1997). In addition, several studies have been performed as to the internal instigators of distress and the associated biochemical relief of this distress.

In one of the earliest drug trials (cited in Scott, Stewart & DeGhett, 1974), no significant effect was found in the pharmacological relief of separation vocalisation in young puppies except at dosage administration levels incurring sedation or near toxicity. The only drug adequately reducing vocalisation with no abnormal behavioural or adverse physiological side effects was *imipramine* (one of the tri-cyclic antidepressants) and this was restricted in its effectiveness to particular breeds. It has since been found that the tricyclic antidepressants are the most efficacious treatment for separation-related behaviour. Alongside imipramine, both amitriptyline and clomipramine have been successfully used together with alprazolam for those patients experiencing "panic" at the departure of social attachment figures (Overall, 1997). Clomipramine, fluexetine and more recently seleginine (Dehasse, 1997) have also been used in the treatment of separation "anxieties".

The fact that anxiolytic drugs are successful in the alleviation of separation symptoms appears to confirm the diagnosis of a *separation anxiety* as correct terminology. However, it is now generally accepted that under most circumstances use of the word anxiety is both inappropriate and misleading. Although many of the symptoms exhibited during periods of social separation resemble those displayed during periods of anxiety (hyper-ventilation, tachycardia, pupil dilation, excessive salivation, shaking, frequent urination and defecation, hyper-attentiveness) the term is more

frequently used in relation to human behaviour, indeed some consider the word anxiety to be *"a psychiatric term that is only applicable to humans"* (cited in Rowan, 1988). It is suggested that anxiety is part of a conscious experience and as such portrays a typically human function or attitude (Cassano, 1983 in Rowan, 1988). Indeed, there is a tendency to deny that animals can experience anxiety although it is accepted that they can experience fear, so what then is the difference between fear and anxiety? Cassano (1983; in Rowan, 1988) states that:

"fears are states of apprehension which focus on isolated and recognisable dangers.... anxieties are diffuse states of tension....which magnify and even cause the illusion of an outer danger, without pointing to appropriate avenues of defense or mastery"

Anxiety is thereby considered to encompass a sense of the future, and being non-specific in nature may be a product of consciousness. That an anxiety-*like* state exists in animals is beyond dispute. The fact that anxiolytic and anxiogenic agents work on both humans and animals to alleviate or induce physiological and behavioural symptoms lends supporting evidence that an emotional state analogous to anxiety in humans also occurs in mammals. Gray (cited in Rowan 1988) states that an anxious state is the result of a behavioural inhibition system that creates a heightened state of arousal and attentiveness in novel situations, probably conferring an evolutionary advantage on those that possessed it. Moreover, if the behavioural inhibition system in some way fails, a pathological anxiety may result, i.e. an anxiety that is biologically maladaptive.

It is parsimonious to conclude that although the state of anxiety in people greatly resembles a similar state in other mammals at a behavioural, physiological, pharmacological and receptor level, it is unfounded to use the term anxiety in a non-human context. Nevertheless, since the term anxiety seems most appropriate to this analogous state in animals, I shall hereafter refer to the said state as one of "anxiety", "anxiousness" or "anxiety-like". Similarly "depression", "depressive-like" *etc.* refer to states in animal's which are analogous to human psychiatric conditions.

1.3.1 *The genetic basis of fear and its relationship with the excessive separation reaction*

Most practical breeders believe nervousness to be relatively strongly inherited, and there is empirical evidence to suggest that breeding from nervous dogs leads to increased proportions of nervous progeny (Serpell & Jagoe, 1995). A generalised state of "anxiety" in some dogs is well

documented and such behaviour has indeed been found to be at least partly heritable. The early experiments of Scott and Fuller (1965) revealed that the symptoms of fearfulness in dogs were also breed-specific, beagles displaying a significant decrease in activity and conversely Scottish terriers exhibiting frenzied activity. The genetic factors associated with fearful individuals appear to show a response not generalised to any specific conditioning event, as in most clinical fear cases (Tuber & Hothersall, 1979). Individuals said to be in a generalised "anxious" state display consistent autonomic hyper-reactivity, increased motor activity, increased vigilance and scanning that interferes with normal social interaction (Overall, 1997).

That fearfulness or "shyness" is a heritable trait was first investigated by Thorne (1944). In a long term breeding program using a Bassett hound bitch nervous in the presence of unfamiliar people, he concluded that shyness was inherited via a simple dominance mechanism. Subsequent studies have since indicated that the mode of inheritance is much more complex than this, although it is apparently very easy to produce a strain of inherently nervous animals (e.g., Murphree, 1973). Using the strain of nervous pointers bred in these studies, it was possible to separate nervous and normal individuals with 95% accuracy using either behavioural or autonomic measures, but with absolute certainty taking both measures together.

Fearfulness is of tantamount importance in the breeding and training of Guide Dogs for the Blind since this is the most common reason for the rejection of animals as guide dogs (Goddard & Beilharz, 1982), although this fearfulness does not necessarily become apparent until the second year of life. In a guide dog breeding programme of Labrador retrievers in Australia, the heritable value of fear was estimated to be 0.58 (sire=0.67, dam=0.25). As Serpell and Jagoe (1995) point out, widely varying systems of classification of aversive or fearful behaviour make the comparisons between studies difficult, some researchers regarding fears as distinct and others treat them as symptomatic of some global temperament trait such as "emotionality" (Scott & Fuller, 1965; Scott & Beilfelt, 1976) or "stimulus reactivity" (Wright & Nesslerote, 1987).

Interestingly, Fält (1984) in a study of the inheritance of behaviour in Swedish service dogs, found a high degree of heritability (without the use of cross-fostering experiments) in the vocal separation response of puppies at eight weeks of age (h^2=0.66). Unfortunately in any test of heritability, the maternal and litter environment prior to testing inevitably influences the value obtained. In almost all studies of heritability so far, dam effects were found to be considerably higher than sire effects, an observation likely to result from the maternal environment (Fält, 1984; Pfaffenberger *et al.*, 1976). These studies highlight the importance of the quality of the dam as a mother with respect to

the behaviour of her progeny in the short term, an effect which possibly declines with maturation (Goddard & Beilharz, 1986).

The association between a generalised state of fear and the exhibition of separation behaviour has been quoted throughout many studies (including Tuber *et al.*, 1982); indeed, separation behaviour is often classified as a "fearful" behaviour. Regardless of the categorisation, the fundamental concept of fearfulness is at least in part heritable. Overall (1997, p43) makes reference to a strain of dogs bred for veterinary use at the University of Pennsylvannia whereby subjects display intractable, unresponsive fear to unfamiliar humans and that this behaviour appears to be inherited in a simple dominant manner. These dogs do *not* respond to anxiolytic drug treatment and may therefore be said to be profoundly abnormal.

It has been postulated, particularly by those working in the field of companion animal behaviour, that the symptoms exhibited by some individuals during social isolation are not primarily a result of separation from one or more attachment figures but that these animals are in a general state of nervousness (anxiety) which is suppressed by the presence of familiar social contact and fully manifested during the absence of this contact (Appleby, *pers. comm.*). If this is true, it would be expected that such individuals should display indicators of nervousness under other circumstances such as in novel situations, towards novel objects or unfamiliar people. Overall (1997) states that:

"for the diagnosis of separation anxiety to be made in humans, three of eight specific behavioural signs have to be present (APA, 1995), and only one of these has to do with any assessment of attachment. The necessary and sufficient conditions for canine separation anxiety do not include attachment criteria."

She goes on to suggest that for attachment to be a necessary condition for the diagnosis of separation anxiety (or separation behaviour), overly attached animals would need to be statistically over-represented in the referred population and that this is not the case, although no supporting statistical evidence is provided. The acknowledgment is made that there are "needier" animals within this population, but that these may have a more profound or qualitatively different form of the behaviour.

"Separation anxiety is a phenomenological diagnosis; much variation in the phenotypic and genetic pools is to be expected."

If anything, this comment serves to highlight the confusion surrounding the use of the term "anxiety" since not only is it presumptive, but is also excludes a multitude of other phenotypically identical syndromes. A workshop at the International Veterinary Behaviour Meeting in Birmingham 1997 confirmed this confusion regarding terminology and concluded that the use of the term "separation behaviour", which although fairly ambiguous in nature, avoided inferring a psychiatric condition highly difficult to diagnose, if in existence at all, and encompassed all other causative motivational states including that of over-attachment to one or more persons.

1.4 Treatment of separation behaviours

Behaviour manifested by pets during separation from their owners frequently reaches "problem" levels. The most commonly *reported* symptoms, although not necessarily the most frequently *exhibited*, are destruction, vocalisation and elimination. These are by far the most objectionable from the human perspective, however it is likely that many dogs exhibit "unseen" symptoms such as inactivity and/or "depression". The treatment of such behaviour involves taking a detailed history of the household composition, daily routines, type and strength of social relationships with the dog, together with the timing and onset of symptoms, targets of destruction and general temperament of the dog. Information is usually gathered by means of owner interview and direct observation of the animal in question in the presence of a behaviour counsellor or *animal behaviour therapist*.

Animal behaviour therapy is a recent advancement in pet care, developing and rapidly expanding since the mid-seventies. Mugford (1995) describes animal behaviour therapy as:

"the application of scientific principles to modify an animal's behaviour for the ultimate benefit of both the animal and the owner",

ethological studies of the dog's wild relatives, such as the wolf, *Canis lupus*, and the coyote, *Canis latrans*, (Bueler, 1974) providing insights into "normal" and "abnormal" behaviour. Although ethological theory has had a profound practical impact on the way dogs are viewed and treated (for example the once commonly viewed "abnormal"epimeletic vomiting occasionally seen in domestic dogs has been found to be a "normal" aspect of parental behaviour in most wild canids), frequently comparisons of domestic dog behaviour with ancestral wolf behaviour tend to be based on scant scientific evidence and overused in animal behaviour therapy.

In many instances, modification of routines and behaviour towards the pet are enough to reduce the behaviour displayed, although occasionally drugs are prescribed alongside a behaviour modification programme. Currently, two professional behaviour therapy organisations are in existence in the UK, the Association of Pet Behaviour Counsellors (APBC) and the Companion Animal Behaviour Therapy Studies Group (CABTSG), the latter requiring a formal qualification in veterinary medicine for full membership. Both groups require veterinary assessment prior to referral since frequently there are underlying organic causes for the inappropriate or excessive behaviour being displayed, e.g., endocrinological, neurological, or metabolic disorders; localised pain; or nutritional effects. *Figure 1.1* illustrates the complex interaction of factors contributing towards the culmination of the behaviour problem.

Separation problems are highly prevalent in cases referred to behaviour counsellors both in Britain and abroad. They appear to be the second most common behavioural type following problems of aggression. Once again there is likely to be a discrepancy in the incidence of *reported* and *actual* behaviours since aggression poses a greater social problem to that of separation related destruction or vocalisation. Since the inception of the behaviour clinic, various estimates of the incidence of the problem have been made, ranging from to 20% (Fisher, 1990; McCrave, 1991) to 41% (Borchelt, 1983) in the referral population.

The specific treatment for such behaviour is beyond the scope of this thesis; protocols for reducing separation behaviour may be found in Borchelt and Voith (1982), Fisher (1990), Goddard (1993) , Askew (1996), Appleby (1997), Overall (1997) and many other non-scientific texts. Many treatments centre around reducing the dog's dependency on one or more persons to whom it is highly attached, introducing it to a programme of brief separations gradually increasing to those required of normal daily life, desensitisation of responses to known fearful stimuli, a programme of increased but controlled social referencing, and the use of anxiolytic drug treatments. Frequently considerable alteration in household routine and, more importantly, the behaviour of household members towards the dog is required, although treatment is usually very successful (Mugford, 1995, estimates that 73% of cases at his behaviour clinic are successfully treated). *Figure 1.2* describes the pet behaviour counselling process and the steps required for successful behaviour modification (from Askew, 1996). As previously mentioned, all behaviour consultations are usually preceded by veterinary assessment for the exclusion of causative physiological conditions.

Figure 1.1 Aetiology of pet behaviour problems (from Askew, 1996)

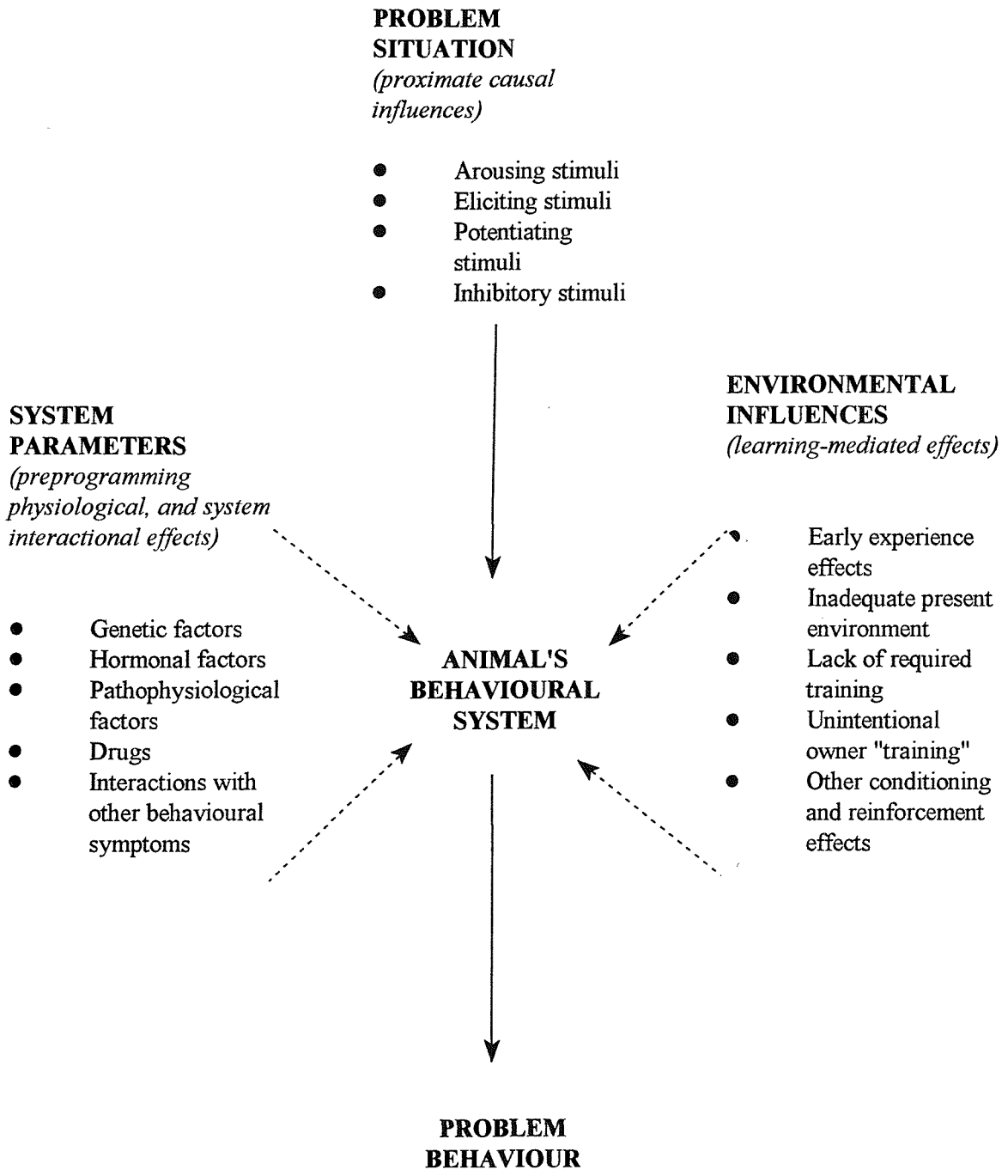
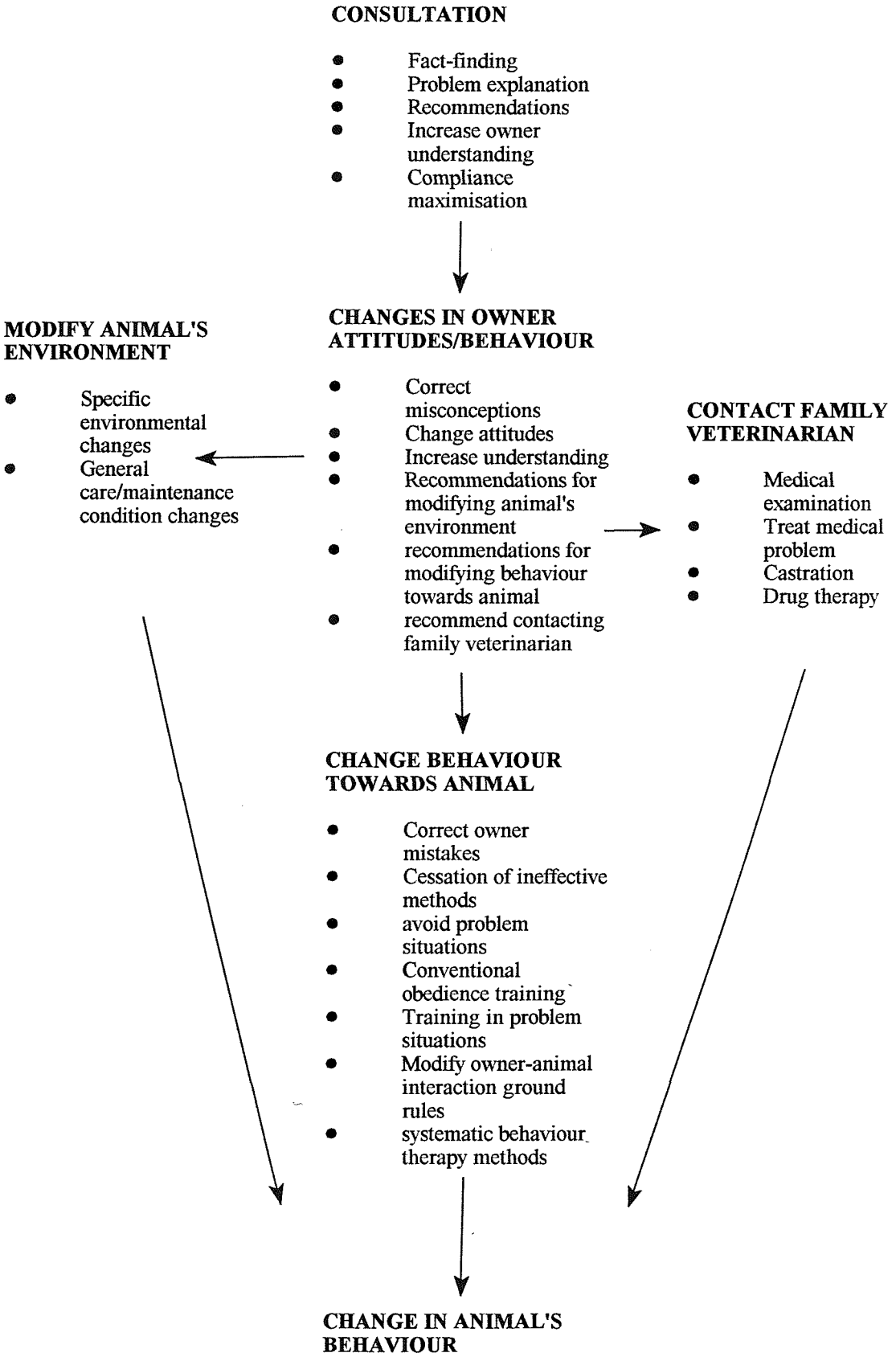


Figure 1.2 Schematic diagram of the pet behaviour problem counselling process



1.5 Is behaviour in adulthood predictable?

1.5.1 Puppy testing

Given the high failure rate of guide dogs and service dogs and the prevalence of unwanted behaviour in the pet dog population, it would be extremely useful, and cost effective, if tendencies towards the exhibition of appropriate or inappropriate behaviours could be predicted in puppyhood. Indeed the majority of guide dog associations, at least in Britain, America and Australia, make use of puppy selection tests for the retention or otherwise of suitable candidates.

Given that much behaviour has been demonstrated to have a heritable component, one would anticipate that it would be relatively easy to make use of selective breeding programmes to increase the success rate of the training and ultimate acquisition of suitable animals. Indeed the efficiency of training guide dogs for the blind in America increased from 30% to 60% over five years as a result of the implementation of a controlled breeding programme in German shepherds (Pfaffenberger *et al.* 1976, in Fält, 1984). Unfortunately the prediction of adult behaviour in potential guide dogs is still relatively poor (Goddard & Beilharz, 1986), fearfulness apparently being the only reliable predictive trait; activity and learning ability serving as poor indicators of adult behaviour. The most useful tests for assessment were found to be the puppy's reaction to a strange person, a strange dog, and certain unusual objects. In a previous paper, Goddard and Beilharz (1984) revealed that the ability to predict adult fearfulness in a puppy increased as the age of the puppy increased. Goddard and Beilharz (1986) concluded that selection against fearfulness at sexual maturity would be most effective in reducing adult fearfulness and that selection of breeding stock based on puppy tests alone could not be recommended.

The evolution of the puppy test as a selection procedure for companion animals suitable for particular owners began with the advent of the "Campbell puppy test" (Campbell, 1972). This test, designed to *fit puppies into environments best for both owner and dog* utilised five different test components to evaluate the puppy's basic temperament at approximately eight weeks of age. Components of the test included: social attraction of puppies to people, inclination to follow, response to restraint, relative social dominance and elevation dominance. A score was allocated according to the response displayed in each test part and the puppy's overall performance assessed according to the levels of response. Although this test has been widely used for many years, the predictive value of this test was never assessed by Campbell, Beaudet *et al.* (1994) performing

such an evaluation (on puppies re-tested at 16 weeks) over a decade later. The test used by Campbell at seven weeks was found to have no predictive value regarding future social tendencies, in fact the total value of the behavioural scores for social tendencies between the two age groups showed a trend towards regression from dominance to neutrality and submission. Nevertheless, the introduction of an additional criterion (a measure of general activity assessed by the number of movements made within each test part) generated some level of correlation between the test results, although this was found to be significant with respect to females only.

Numerous other largely unpublished and unvalidated tests are widely used to assess the training and companionship potential of a puppy, however these are often poorly accessible, difficult to apply and not standardised, as they are often based on subjective values (Beaudet *et al.*, 1994).

In a study of puppy behaviour at seven weeks encompassing nine test components and six subjective measures of behaviour (Hoffmann *et al.*, 1995), test-retest correlations were found to be reliable when duplicate testing occurred within a very short period of time (from 30 minutes to two days). Examination of the results by factor analysis revealed two factors: the first relating to activity, playfulness, curiosity and confidence; the second factor related to a tendency to stay with the person and responsiveness. From these results it was concluded that the second factor revealed a tendency for human interaction whereas the first indicated a preference for environmental interaction. Unfortunately at the time of writing, no results were available regarding subsequent testing at 5 and 12 months of age, although this information is in the process of being evaluated.

1.5.2 Temperament testing of adult dogs

Having determined that behavioural testing of puppies reveals little if any association with behaviour in adulthood, does measurement of behaviour at any age ever become predictive? Weiss and Greenberg (1996) report the success of animals obtained from rescue centres (usually aged between 8 months and 2 years) as assistance dogs (for use with various physical and mental handicaps). Previously, only 50% of the dogs selected successfully completed training and became assistance dogs. An eleven item selection test performed on a small sample of dogs obtained from rescue centres revealed little correlation between an animal's performance in the selection test and its ability to complete a retrieval task following training. Once again, the only predictable trait was found to be fear/submission, all dogs displaying this behaviour in the selection tests also doing so in the final task, whereas those that did not display fear/submission during selection did not display

the behaviour later.

Weiss and Greenberg (1996) remark that the level of stress experienced in a rescue shelter environment may be high. Stressors include high noise levels, an unusual environment, new food, and many unfamiliar visitors. They anticipate that these stressors add to the difficulty of predicting desirable and undesirable behaviours because the dogs are less likely to react in a "normal" manner to some of the stimuli presented.

The high prevalence of "problem" behaviour in animals rehomed via rescue centres has already been discussed. Many hypothetical reasons exist for the increased incidence of such behaviour, not least of which is that the rescuing process itself acts as a trigger for the exhibition of abnormal behaviour. That the process of kennelling is a stressful process is generally accepted, however Hennessy *et al.* (1997) in a recently published study provide physiological evidence for the disruptive effect of kennelling. It was found, by taking measures of cortisol in newly rescued dogs, that the greatest effect exists in the first three days of kennelling. After this time, cortisol levels gradually reduce until the lowest levels are found in dogs kennelled for more than 9 days. In a comparison with house pets, the cortisol levels measured during the first three days of kennelling were found to represent robust elevations from presumed baseline levels (although with considerable individual variation). Interestingly, 20 minutes of human petting during these initial few days had no effect on cortisol levels but the gender of the person interacting with the dog did; female handlers inducing a greater reduction in cortisol than males. Similar findings were obtained in an examination of avoidance reactions of domestic dogs to unfamiliar male and female humans in a kennel setting (Lore & Eisenberg, 1986), females instigating higher levels of approach than males. Interestingly, there appeared to be a difference in the sex of the dogs displaying a reluctance to approach male testers, females approaching largely indiscriminately whereas male dogs tended to approach female humans but not males.

The effect of group versus solitary housing in kennelled dogs has also been investigated with respect to the effect on social behaviour. Both Hubrecht *et al.* (1992) and Mertens and Unshelm (1996) found that individually housed dogs displayed lower levels of activity, spent more time in non-social interaction, and displayed higher levels of repetitive locomotory behaviour. In addition, in a follow-up study of the satisfaction of the new owners of these rescue dogs revealed that those taking on solitary housed animals experienced higher levels of problem behaviour (mainly aggression and separation behaviour).

Several studies have attempted to assess rescue dogs for the exhibition of behaviour whilst in the kennels in an attempt to identify so-called problem behaviours. As in the puppy tests, many of these assessments are unvalidated and are highly subjective. A comprehensive series of tests published by Van der Borg *et al.* (1991) indicated a high level of predictability in the level of inappropriate behaviour displayed by previously assessed dogs in the new home although for practical reasons, this test was not widely adopted by rescue centres (approximately 90 minutes being required for implementation of all test elements). A modified and restructured test was designed from the results of this comprehensive assessment although so far no published data exist to indicate its efficacy as a predictor of problem behaviour.

Returning of pets homed through rescue centres poses a considerable problem. RSPCA records indicate that 23% of dogs taken to shelters are given up because they have displayed behaviours perceived as problematic and intolerable by their owners. Of dogs found new homes by the RSPCA, 19% are returned; the incidence of reported problem behaviour in these dogs rising to 68% (Ledger *et al.*, 1995). Notably, successive owners of the same dog report different problems in 72% of cases suggesting that either symptoms differ according to variable environmental stimuli including the relationship with the owner, or that people perceive acceptable and non-acceptable behaviour differently.

In conclusion, it appears that fearfulness is the only reliable trait predictable from both puppy testing and testing of adult dogs, this predictability increasing with age. This observation is likely to stem from the relatively high heritability of fearfulness as previously discussed, although environmental influences will inevitably modify the extent and context to which the behaviour is displayed. The identification and prediction of problem behaviour particularly in rescue dogs suggests that many behaviours are context dependant.

1.6 *Aims and objectives*

The aims of this study are wide ranging and encompass several aspects of social separation behaviour in the domestic dog. For this reason, the thesis is divided into three parts, each part considering a different facet of separation behaviour, from indicators of incipient separation behaviour in a longitudinal study of pet dogs in the home environment to the symptomatology of clinically diagnosed problem cases.

I hypothesize that excessive separation behaviour is not necessarily associated with an over-attached relationship between dog and owner but may have other causes, several of which might be relevant in a particular case. The aim of the first study (***Part I***) was therefore to identify specific behavioural types and possible underlying motivational states in a clinical population of dogs exhibiting separation behaviour. Information was collected by means of a questionnaire issued to several members of the Association of Pet Behaviour Counsellors and details of household composition, household routines, behavioural symptoms and subjective measures of temperament, including degree of attachment, were recorded.

Part II describes the development and validation of an assessment of behaviour in kennelled rescue dogs. Since it is known that inappropriate separation behaviour is prevalent in animals experiencing one or more cycles of rehoming, it would be advantageous to all concerned if this behaviour could be predicted prior to rehoming. I hypothesize that the behaviour of a dog whilst in a rescue kennel can predict the probability of its exhibiting separation behaviour following rehoming. Specifically, it should be possible for a handler to induce separation behaviour in a dog by first initiating an affiliative interaction and then abruptly leaving it alone, and that separation behaviour under these circumstances should predict separation behaviour in the home environment. Since there are no validated assessments of separation behaviour in operation, this study aimed to develop such a test capable of full practical implementation in a busy rescue centre. Interview of owners adopting previously assessed animals served to evaluate the predictive value of the test as an assessment of potential problem behaviour. Background information collected from the owners of dogs exhibiting separation behaviour and those experiencing "normal" behaviour during separation permitted comparisons of the two populations and facilitated the identification of any behavioural triggers.

Previous studies and much anecdotal evidence suggest that the onset of separation behaviour problems peaks between 6 and 18 months of age. I hypothesize that differences in social experience

during the socialisation and juvenile periods predispose some dogs more than others to exhibit separation behaviour. The aim of the final part of this thesis was to undertake a full exploration of the changes occurring during the juvenile period, by considering the behavioural ontogeny of a sample of domestic puppies, paying particular attention to the development of interspecific social behaviour, social experience, and any incipient separation behaviours. The longitudinal study described in ***Part III*** followed the behavioural development of a sample of owned dogs throughout the socialisation and juvenile periods, utilising a series of standardised social situations and the provision of factual information from household members. Particular attention was paid to the level of socialisation and social referencing the puppies were receiving and to any pre-clinical indicators of separation behaviour. Periodically throughout the study, interactions with familiar and unfamiliar persons were recorded experimentally, and also the response of the puppy to a brief period of absence from both, as potential measures of attachment. Preliminary assessment of puppy behaviour at seven weeks of age permitted an examination of the predictability of behaviour throughout development, particularly in relation to the dog's relative sociability and its response to social isolation.

Part I

AN EXAMINATION OF THE SYMPTOMATOLOGY AND ENVIRONMENTAL BACKGROUND OF CLINICALLY DIAGNOSED SEPARATION CASES

2.1 *Introduction*

The wide range of symptoms displayed by dogs during social isolation is well documented (Borchelt, 1983; Borchelt & Voith, 1982; Voith & Borchelt, 1985). As yet it has not been possible to develop a theoretical framework for this diversity, although several suggestions have been put forward. One of the most plausible hypotheses is that symptoms are, at least to some extent, breed-specific: hence many are derived from a breed's behavioural repertoire. Symptoms that do not fall within this repertoire may imply that the causes of the behaviour displayed by atypical individuals are different to the others, i.e. there may exist a further, distinct syndrome. Furthermore, the "personality" of the dog may influence the manifestation of symptoms, for example generally nervous or submissive animals may be more inclined to display *introvert* behaviour such as self-mutilation or perceptible physiological symptoms, whereas more confident animals might exhibit *extrovert* behaviours such as chewing or general destruction (Fisher, 1991). It has also been suggested that the emotional state of the animal is reflected in the nature of the behaviour exhibited. It is not adequate to explain separation behaviour merely in terms of over-attachment; not all dogs displaying behaviour indicative of a reaction to separation are over-attached, conversely not all dogs that are over-attached show an obvious reaction to the absence of an attachment figure (Overall, 1997). I hypothesize that excessive separation behaviour is not necessarily associated with an over-attached relationship between dog and owner but may have other causes, several of which might be relevant in a particular case.

The main aim of this study was to identify associations between the symptoms displayed and thereby to generate distinct subgroups of symptoms. Subsequently, these associations could be examined in relation to specific dog *types*, and with respect to independent variables such as the age, sex and breed of individuals; the background of the dog in terms of its origin, housing and homing history; current circumstances and routines within the household; and the general temperament of the animal, including a subjective measure of attachment to one or more owners.

Once a framework of relationships has been established, it may then be possible to interpret these associations in terms of the diversity of symptoms displayed and to hypothesize on underlying causative factors. In addition, this study also aimed to support or refute popular conceptions and misconceptions regarding the background and "personality" of the typical separation case.

Details of symptoms were gathered by means of a questionnaire rather than by direct observation, thereby maximising the sample size of subjects and facilitating a full statistical analysis. Since it is likely that many dogs display inappropriate behaviour during a brief period of social isolation which can be attributed to conditions other than a reaction to social separation, e.g. puppy chewing/teething or lack of mental/physical stimulation (Borchelt & Voith, 1982; Voith & Borchelt, 1985), it is essential that the diagnosis made is correct. A decision was therefore taken to use referrals of cases from professional behaviour counsellors to eliminate diagnostic inaccuracies as far as possible.

The Association of Pet Behaviour Counsellors (APBC) is an organisation of professional behaviour counsellors (of which there are currently 25 in the UK) with a variety of backgrounds who work solely on referral by veterinary surgeons; the veterinarian's function being to exclude any physical or physiological cause for the abnormal behaviour being displayed. The Association works within a Constitution and its members agree to abide by a written Code of Conduct. The aims of the APBC are as follows:

1. *To establish and promote the practice of pet behaviour therapy as a recognised profession*
2. *To be recognised as the official body that represents practising pet behaviour counsellors*
3. *To maintain and ensure the highest professional standards of the practice of pet behaviour therapy*
4. *To act as a forum for the exchange of ideas and information about pet behaviour and offer advice and information to all interested parties in order to foster a greater understanding of pet behaviour and hence improve the welfare of pets in general*
5. *The APBC strives to ensure that the highest professional standards are maintained by all its members so that clients can be assured of effective, humane and appropriate advice at a reasonable cost*

Each APBC member advises the dog owners in the presence of the animal either at one of the 83 clinics or at the client's own home. Counselling sessions consist of amassing a detailed history of the animal mainly focussing on the dog's general behaviour as well as specific "problem" areas. Whilst this interview is being conducted, the behaviourist has ample opportunity to observe the dog's behaviour whilst in the presence of its owners and to assess their relationship with the dog.

Information was gathered from members of the Association of Pet Behaviour Counsellors throughout the UK on the characteristics of separation problem cases via a specifically targeted questionnaire. Each time a counsellor was referred a case which he or she suspected to have separation related problems as a root cause, a request was made that they complete one of the questionnaires supplied. The majority of the questions included would arise in the course of a typical consultation; however, additional questions were incorporated as a means to identifying genuine separation cases if any element of ambiguity existed.

2.2 *Method*

To facilitate a full statistical analysis, the majority of the questions within the questionnaire were multiple category resopnse in preference to open ended responses. This also allowed for minimum completion time on the part of the referring counsellor. The questionnaire itself (see ***Appendix A***) addressed both symptoms and putative causal factors commonly associated with dogs displaying separation problems. Section 1 collected information regarding the dog's home environment. Since the majority of cases referred to the APBC are pet dogs living in a house with one or more persons, the questions were constructed with this in mind. The second section concentrated on gathering details of symptoms and the relevant history of the dog. Several of these, as previously stated, were to assist in distinguishing the true cases from those which were a little more complex. The responses to the following questions were critical from a diagnostic perspective:

Question 17 How long after the dog is left do the symptoms begin?

Question 23 Does the separation behaviour occur when people are present?

The first question was anticipated to expected a response of not more than half an hour if the case

was to be classified as a separation problem. It is thought that most separation reactions begin almost immediately the dog is left, in fact many begin to display distress behaviour prior to owner departure (Borchelt, 1983). If symptoms commence after half an hour, it is possible that the dog is lacking mental stimulation, or anticipating the return of its owner (Voith & Borchelt, 1985), or is responding to disturbance by some external stimulus. ***Question 23*** was again crucial for accurately determining whether or not an animal was displaying a reaction to separation. If the dog displayed the "separation behaviour" whilst in the presence of people, one should be hesitant about making a positive diagnosis. Nevertheless, many dogs do display symptoms in response to a *denial of access* to one or more persons. In such instances the owners are present but not actually in social contact with the animal, such behaviour frequently occurring overnight and often at a lower intensity than during complete social isolation (Borchelt, 1983).

Section 2 referred mainly to the dog's reaction to specific circumstances in an attempt to determine the basic temperament of the dog and its level of dependency on its human companions. In addition, several questions relating to the *owners'* behaviour towards the dog were included; for example how they behaved towards the dog whilst preparing to leave, how they greeted it on their return, whether or not they punished it for displaying inappropriate behaviour and where they allowed it to sleep.

The third and final section was for the counsellor's own assessment of the dog and incorporated an analogue scale of subjective responses. Many of the questions throughout the questionnaire were based on ideas and beliefs which are widespread amongst dog trainers, behaviourists and psychologists, many of which have never been validated by research. It was hoped therefore that those participating in the study would not be influenced by such preconceptions but that each case would be considered individually.

The first questionnaire was presented to APBC members in December of 1993. They were asked for any comments regarding the wording of the questions, whether they felt any questions should be excluded, or if any aspects had been neglected. The following February, each member was issued with ten copies of the questionnaire. Unfortunately the rate of reply was extremely low, however from the few which were returned it became clear that several modifications were required. The document was altered accordingly and re-issued to all APBC members during the latter part of 1994. Information was subsequently gathered over a period of approximately 30 months.

2.3 *Results*

2.3.0 *Summary of statistical analysis*

Initial statistical analysis concentrated on the validity of combining the objective and subjective components of the questionnaire using Kruskal-Wallis one-way analysis of variance (ANOVA) and chi-squared as the statistical tests. The relationships between the subjective responses to ***Section 3*** were also examined using Spearman's Rank Correlation Coefficient.

Analysis of behavioural symptoms displayed firstly concerned the relative association of specific multiple symptoms (using chi-squared) followed by more complex multivariate statistics. Principal factor analysis (followed by varimax-rotation) was used to investigate the complex interrelationships between variables pertaining to the dog's behaviour when left alone. Having generated a number of factors, the effect of various independent variables (e.g, the age and sex of the dog) were examined using one-way ANOVA's and linear regression analysis.

Finally, in an attempt to identify any breed specific separation behaviours, hierarchical agglomerative cluster analysis was performed on the varimax-rotated factor scores. This analysis also facilitated the identification of distinct subgroups of symptoms within the sample.

2.3.1 *Numbers and distribution of questionnaire returns*

A total of 192 completed questionnaires was returned. Although this sample size is adequate, the distribution of APBC members actually returning information was rather disappointing. Despite efforts to encourage more members to participate in the study, and their agreeing to do so, only eight counsellors returned questionnaires, one member alone accounting for 43% of the replies (see *Table 2.1*).

Table 2.1 Distribution of questionnaire respondents

APBC member	No. returns	% returns
DA	83	43
EP	41	21
EM	22	11
AM	21	11
GB	9	5
AlS	8	4
CE	5	3
GG-P	3	2

Due to this bias in questionnaire returns, initial data analysis concentrated on the source of the information gathered, i.e. the validity of combining data from such an uneven distribution. Although the majority of the information collected was factual and might therefore be assumed to be objective in nature, the final section of the questionnaire (***Section 3***) by definition required subjective responses. It was therefore decided to examine these responses prior to investigating the data set as a whole. Significant differences in the interpretation of behaviour by individual counsellors would indicate that this final section should not be combined with the rest of the questionnaire.

The data from each of the 192 questionnaires was first coded into spreadsheet format (*Lotus 1-2-3 version 5.0*). Responses were scored either as presence/absence measures (1/0), categories (10, 11, 12...), or on a scale of severity (0, 1, 2, 3...). The complete scoring system may be found in ***Appendix A***.

2.3.2 *Analysis of subjective measures (Section 3)*

It is a recognised concept amongst behaviour counsellors that there exists a separation "personality type". In accordance with this, the measures relating to temperament (***Section 3***) were analysed to see whether there were any associations between specific variables. Unless stated otherwise, all statistical operations were performed via *STATGRAPHICS version 5.0, STSC, 1988.*

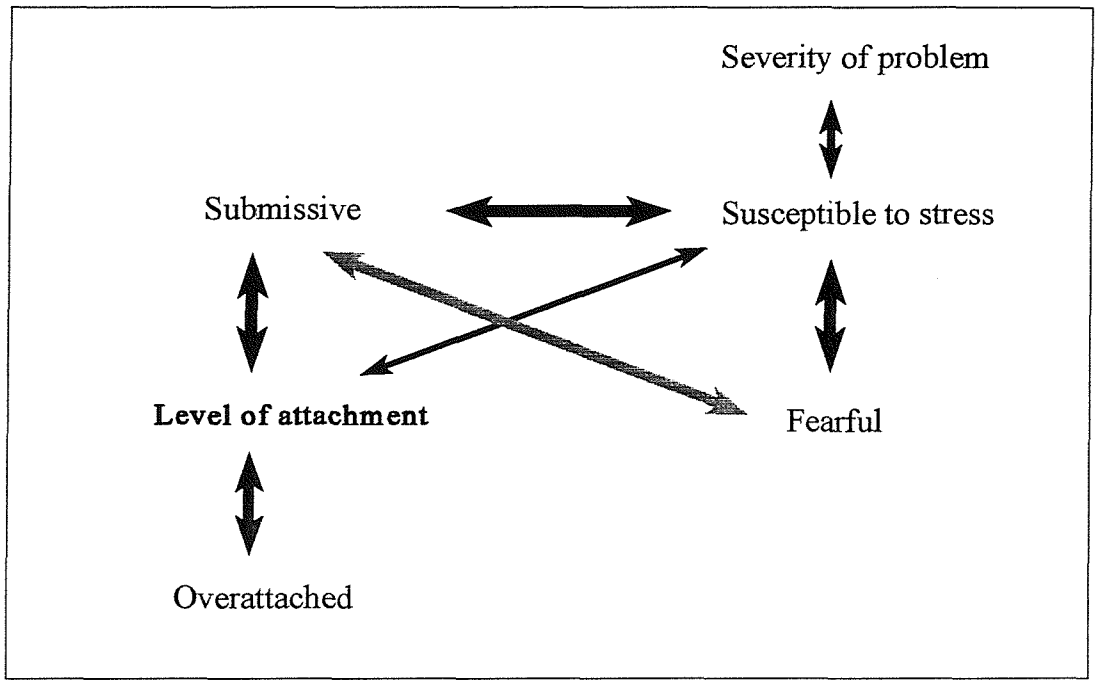
Spearman Rank Correlation analysis was used on ***Questions 40, 41, 42, 43, 44*** and *45* to investigate the existence of any relationships between the responses in the final set of subjective questions. The questions concerned requested the counsellor's assessment of the dog's: level of submission/dominance, level of fearfulness/confidence, how likely it is to react to stressful family circumstances, whether it is over-attached to one or more persons, how attached the dog is to its owner(s), and the overall severity of the presenting problem.

The majority of the variables were found to be correlated to some extent although none significantly so (see *Table 2.2*). The highest level of correlation, although even this was very low, was between those dogs which were most susceptible to stressful family circumstances and who were strongly attached to their owner. Those dogs which showed an overattachment to more than one person tended to show slightly negative correlations with most categories, i.e. much lower intensities of these ratings in general. *Figure 2.1* displays a diagrammatic representation of positive variable associations.

Table 2.2 Correlation scores for seven subjective measures. Figures in bold have a correlation value of > 0.3

Measures	Submissive	Fearful	Susceptible to stress	Over-attached	Over-attached to more than one person	Attachment to owner
Fearful	0.284					
Susceptible to stress	**0.367**	**0.340**				
Over-attached	0.113	0.105	0.066			
Over-attached to more than one person	-0.165	-0.001	-0.145			
Attachment to owner	**0.317**	0.023	**0.447**	**0.382**	-0.090	
Severity	0.041	0.091	0.261	0.123	0.035	**0.366**

Figure 2.1 Positive associations between subjective variables.



A Kruskal-Wallis one way analysis of variance (due to the non-normal distribution of data) was used to examine whether individual APBC members were completing the questionnaires uniformly or whether significant differences existed between the responses given. Only those members contributing more than 5% of questionnaire returns were used in this analysis. Each counsellor's scores were compared for each of the final section questions which were on a scale of 1 to 5 (***Questions 40, 41, 42, 44*** and ***45***). For those questions generating a 1/0 response (subsections of ***Question 43***), cross-tabulations were used and corresponding chi-squared values generated.

Table 2.3 Results of counsellor scores for each of the seven ***Section 3*** measures, significance levels for K-W one way ANOVA and cross-tabulations. Values highlighted in bold are significant at the 5% level.

Measure	Test	Test statistic	Probability
Submissive	**K-W**	17.731	**0.001**
Fearful	K-W	8.332	0.08
Susceptible to stress	**K-W**	9.744	**0.045**
Attachment to owner	**K-W**	21.445	**<0.001**
Severity of problem	**K-W**	19.572	**<0.001**
Overattached	**Chi^2 (4 d.f)**	41.648	**<0.001**
Overattached to more than one person	Chi^2 (4 d.f)	2.452	0.648

The responses given by individual counsellors to the set of questions requiring subjective interpretation were generally significantly different, sometimes considerably so (*Table 2.3*). Two potential hypotheses were therefore suggested to account for such variation in response:

1 The counsellors were utilising the scales differently in response to the subjective questions, i.e. variation was at the counsellor level.

2 The dogs being referred to particular counsellors were in fact quite different, originating from discrete populations, i.e. variation was at the subject level.

The latter hypothesis was investigated by referring back to the original data set and examining the origin of the problem animals. It was expected that some APBC members would be referred considerably more rescue dogs than others, a factor mainly dependant on clinic/rescue centre locations. However, a cross-tabulation of APBC member versus origin (breeder/ rescue centre/ other) was non-significant (chi^2=6.63, 8 d.f., p=0.058).

To investigate the effect of the origin of the dog further, five of the subjective measures were analysed using Kruskal-Wallis one way ANOVA and the remaining two using cross-tabulations.

Table 2.4 Effects of dog origin categories on scores obtained for ***Section 3*** measures, significance levels for K-W one way ANOVA and cross-tabulations. Values highlighted in bold are significant at the 5% level.

Measure	Test	Test statistic	Probability
Submissive	**K-W**	**15.266**	**<0.001**
Fearful	K-W	1.168	0.557
Susceptible to stress	**K-W**	**7.062**	**0.029**
Attachment to owners	K-W	2.951	0.229
Severity of problem	K-W	1.745	0.418
Overattached	Chi^2 (2 d.f)	0.212	0.899
Overattached to more than one person	Chi^2 (2 d.f.)	1.236	0.539

It appeared that those dogs obtained from breeders (n=84) were significantly less submissive than those obtained from other sources (rescue, n=67; other, n=22). In addition, they were significantly less likely to be affected by stressful family circumstances. None of the other variables was significantly influenced by whether the dog had been obtained from a breeder, a rescue centre or elsewhere.

In conclusion, analysis of the final part of the questionnaire, referring to subjective measures of behavioural character, showed that the counsellors completing the questionnaires varied significantly in their responses to the questions, apart from their assessment of over-attachment to more than one person. This may have been due to differences in the interpretation of the dogs' behaviour, however the specialisation of particular counsellors and the population demographics of regionally practising APBC members may also have influenced the apparent high subjectivity of responses. Furthermore, no independent data set was available from which to calculate correction factors for each counsellor. This set of information was therefore not combined with the other factual information supplied in the remaining majority of the questionnaire.

2.3.3 *General characteristics of the sample*

The trends outlined hereafter refer only to modal values obtained from the sample of 192 dogs, unless stated otherwise.

2.3.3.1 *Symptoms displayed during separation*

The median number of symptoms per individual was two. The median latency for the onset of separation symptoms was a period of a few minutes. If the dog was destructive, the target of destruction was likely to be entrances and exits. Many owners cited personal belongings as targets of destruction (28% of those with destructive dogs), although frequently the target appeared to be random. Some of the more commonly encountered targets of destruction were: wooden items, carpets, sofas, furniture, room corners, the animal's bed, and bins. Most dogs had at least one identifiable fear. Typically, the dog would not voluntarily stay in a room without company, persistently followed one person, and reacted (usually by vocalising) to a denial of access to human companions. The separation symptoms were never exhibited in the presence of people.

2.3.3.2 *Household routine*

Most dogs were left for two to four hours during the day and not at all in the evening, this routine having been the same since the dog was first obtained. Symptoms were always displayed if the dog was left out of this routine, e.g. for an occasional evening. In most instances, the dog in question had not been trained to be left alone as a puppy. Many dogs were verbally scolded on the owners' return.

During a period of separation, access to most areas of the house was restricted, probably as a result of the inappropriate behaviour displayed during isolation. Overnight, almost half (47%) of dogs were allowed to sleep in their owner's bedroom. Most others were restricted to one or more areas of the house, only 9% were permitted free run of the. In most instances, the dog's sleeping place had not been changed over the period of ownership.

2.3.3.3 *Individual temperament*

Generally, the animals referred were extremely affectionate, given affection freely, and tended to demand affection.

For responses requiring subjective measures (***Section 3***), APBC members considered the dogs to be moderately submissive (median 3), moderately fearful (median 3), susceptible to stressful family circumstances (median 4), overattached to one person (commonly a female), and highly attached to the owners in general (median 4). Cases referred were relatively severe (median 4).

Most of these responses are in agreement with the generally accepted *separation temperament* (Borchelt & Voith, 1982; McCrave, 1991); however given that Section 3 has proven to be highly subjective, it would be inappropriate to interpret these results further.

2.3.4 *Household composition*

Of the 192 dogs referred, all originated from different households, apart from ten littermate pairs (1 male entire German Shepherd pair aged 11 months, 1 female neutered GSDx pair aged 34 months, 1 female neutered/male neutered Labrador Retriever pair aged 6 years, 1 male entire Cocker Spaniel pair aged 12 months, and 1 male entire/male neutered Border Terrier pair aged 4 years) and two unrelated Boxers (male neutered aged 19 months/female neutered aged 28 months). Almost a third of the sample (31%) lived in a house with at least one other dog.

The sample of cases was therefore derived from a total of 186 households. The number of household members ranged from one to seven, with an average of 2.4 and standard deviation of ±1.1. The majority of households did not have any children, and only 43 contained any children at all. Sixty-nine percent of households contained 2 adults or less, indeed many consisted of only one adult, often no other pets and usually no children.

It therefore seems that the typical separation case referred to APBC counsellors is derived from a household environment with few human members (median value 2), no children, no canine companions and no other pets. This may be an artefact of APBC clientele, or it may suggest that a

restricted number of social contacts[1] (both human but possibly more importantly canine) may facilitate the development of problematical separation behaviour.

2.3.5 *Analysis of symptoms displayed*

2.3.5.1 *Frequency of symptoms*

The total numbers of animals displaying each symptom (either singly or as one of a number of symptoms) can be found in *Table 2.5*. Some of the more commonly encountered "other" behaviours included: aggression shown towards owner during departure, self-mutilation, vomiting, excessive salivation, pacing, panting, whirling (so-called Obsessive Compulsive Disorder), hyperventilation, escaping from confinement, movement but non-destruction of belongings/objects. The exhibition of separation behaviour in the car was encountered in only 51 of the 192 dogs.

Table 2.5 Frequency of individual symptoms displayed

Behaviour exhibited	Number of individuals	% of sample
Destructive	151	78.6
Bark	85	44.3
Howl	50	26.0
Elimination	48	25.0
Other	39	20.3

2.3.5.2 *Analysis of multiple symptoms*

Since the measure of severity as assessed by each APBC member had previously been shown to be unreliable, a more objective measure of qualitative severity was calculated via ***Question 14***, totalling the number of distinct symptoms displayed. Initially the category "other" included the total

1

Although attempts were made to find comparative dat on household composition within the general dog owning population, this information was not available for public use

number of infrequent behaviours displayed which were not covered under the terms barking, howling, destruction, or elimination. The maximum number of behaviours shown by any one animal during a period of separation from the owner was six, with a median of two. No significant difference was found to exist between the number of symptoms displayed and where the dog came from (p=0.26, K-W ANOVA) however there was a difference in the number of symptoms presented by each dog to individual counsellors (p=0.0014, K-W ANOVA). The latter appeared to result from a difference in the scoring of "other" behaviours by counsellors, some simply noting whether additional behaviours occurred or not, others detailing specific behaviours. For this reason the *other* category was converted to a presence/absence measure (1/0) for all subsequent analysis.

2.3.5.3 *Association of multiple symptoms*

The actual frequency of symptoms displayed and their distribution amongst individuals is illustrated in *Figures 2.2* to *2.5*. Axis label codings are: D destruction, B barking, H howling, E elimination, O other.

Figure 2.2 Frequency distribution of animals exhibiting a single behavioural symptom

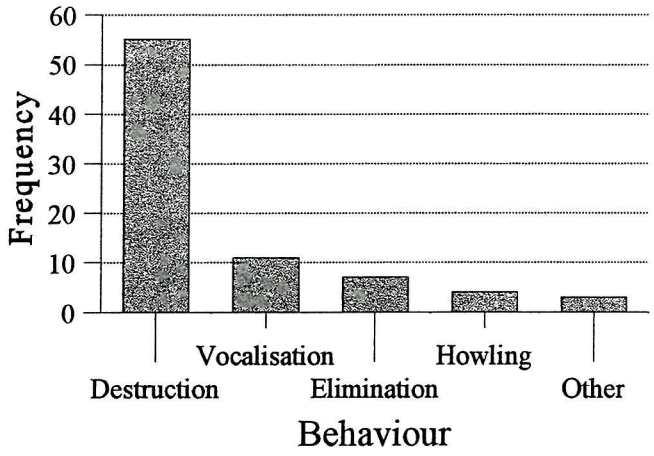


Figure 2.3 Frequency distribution of animals displaying 2 behavioural symptoms

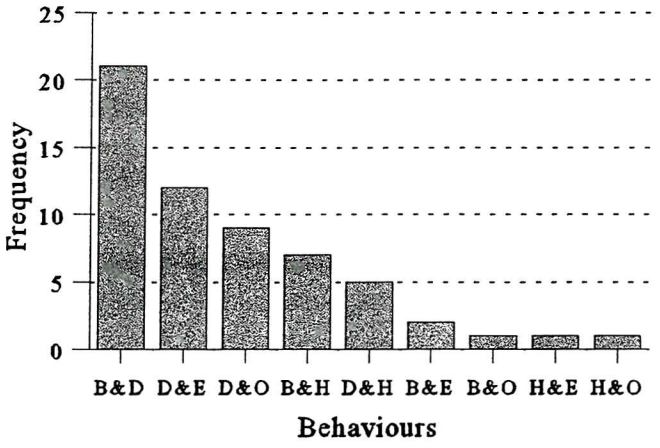


Figure 2.4 Frequency distribution of dogs displaying 3 behavioural symptoms

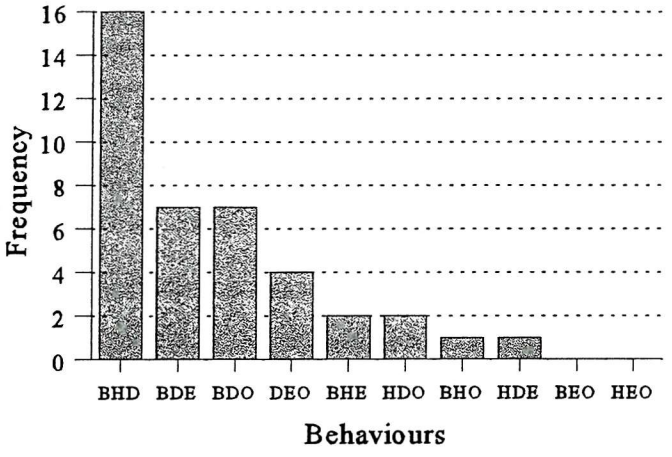
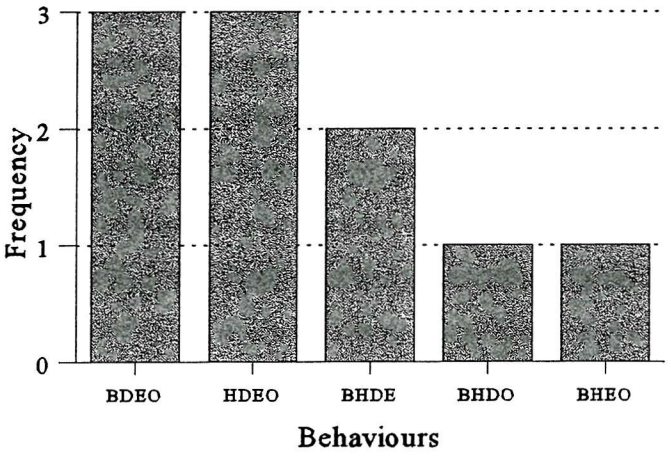


Figure 2.5 Frequency distribution of dogs displaying 4 behavioural symptoms



Three dogs exhibited all five categories of behaviour.

The co-occurrence of paired symptoms was investigated using cross-tabulations for all possible pair combinations (*Table 2.6)*.

Table 2.6 Levels of association between pairs of symptoms. Values highlighted in bold are significant at the 5% level

Variable 1	Variable 2	Chi^2 (1 d.f.)	Probability
Bark	**Howl**	**12.94**	**<0.001**
Bark	**Destructive**	**5.90**	**0.015**
Bark	Elimination	0.18	0.675
Bark	Other	0.009	0.924
Howl	**Destructive**	**6.44**	**0.011**
Howl	Elimination	0.04	0.849
Howl	Other	0.56	0.451
Destructive	Elimination	1.25	0.263
Destructive	Other	0.33	0.561
Elimination	Other	3.10	0.078

A significant association was found between the incidence of barking and howling, barking and destruction, and howling and destruction. None of the other seven pairs were sufficiently related, although elimination and other behaviours were found to be loosely associated (p=0.078). Only barking and howling were *positively* associated; both barking and destruction, and howling and destruction were negatively associated, i.e., the symptoms were displayed together less often than would be expected by chance. Since the barking and howling behaviours appeared to be so intrinsically linked, a decision was made to combine the two symptoms and use the composite measure "vocalise" in subsequent analysis. A cross-tabulation of vocalise and destruction suggested a relative scarcity of dogs displaying both vocal and destructive behaviour (chi-squared=10.58, p=0.001), thereby justifying the combination of the barking and howling variables.

The modified distribution of symptoms, combining barking and howling to introduce the composite measure *vocalise* (V), is illustrated in *Figures 2.6* to *2.8*.

Figure 2.6 Frequency distribution of animals exhibiting a single behavioural symptom

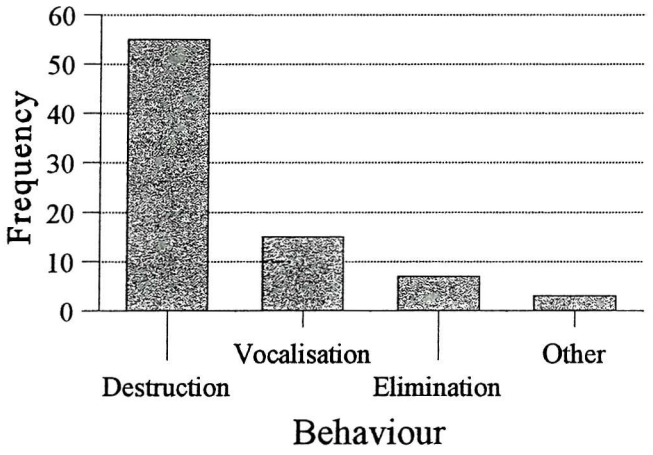


Figure 2.7 Frequency distribution of animals displaying 2 behavioural symptoms

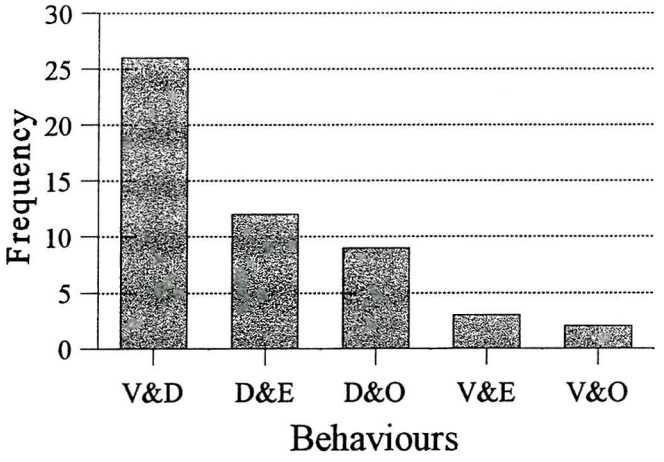
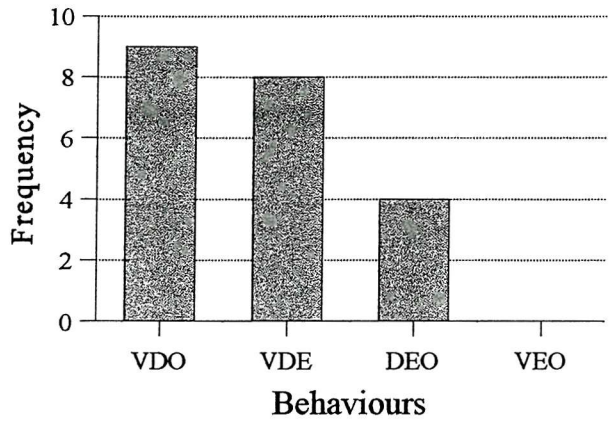


Figure 2.8 Frequency distribution of dogs displaying 3 behavioural symptoms



Three individuals displayed all four behavioural symptoms.

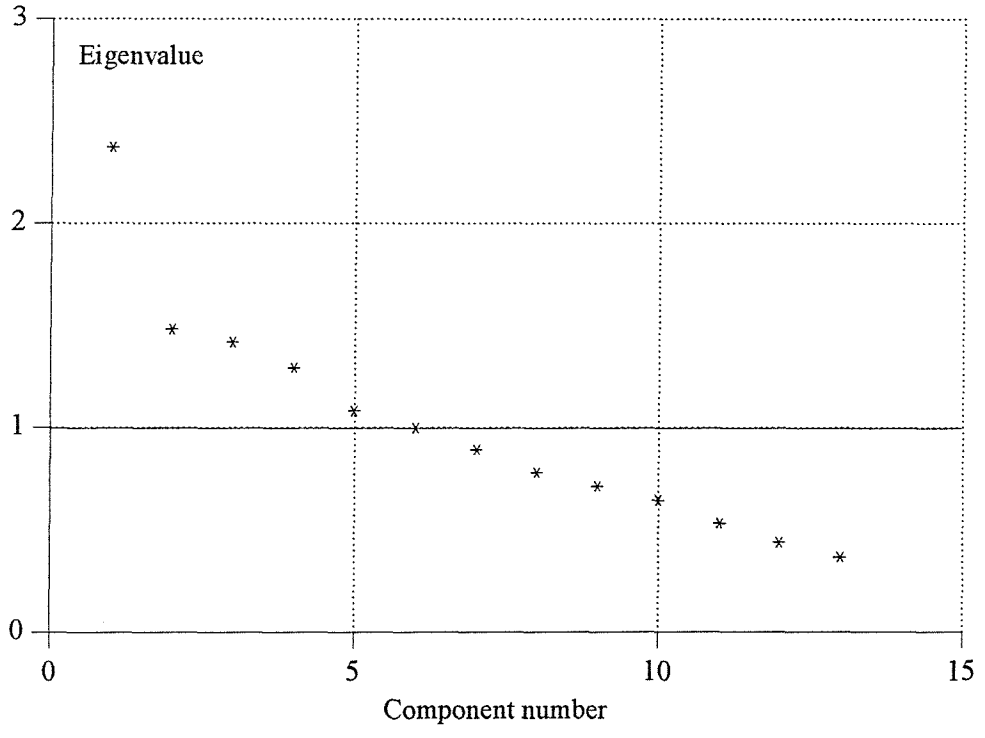
2.3.5.4 *Multivariate statistical analysis of behaviours displayed during separation*

Principal Components Analysis was carried out on 13 variables pertaining to the symptoms displayed during separation. This mode of analysis looks for linear combinations of the variables to explain most of the variability between cases, these linear combinations being known as *principal components* or *factors*. Each principal component has a numerical value called an *eigenvalue* associated with it. The eigenvalue is a measure of the explained variance per component, larger eigenvalues indicating components that are of more importance in the overall data set. Generally only components that have eigenvalues greater than 1.0 (equivalent to a single item on the questionnaire) may be assumed to be meaningful. The variables entered for analysis were obtained from questions numbered: ***14***, the symptoms displayed when the animal is left alone (4 measures - ***vocalisation, destruction, elimination, other***); number ***15***, how long after the dog was obtained did symptoms begin (***sympcomm***); ***17***, how long after the dog is left do symptoms commence (***latency***); ***20***, whether or not the behaviour occurs if the dog is left out of normal routine (***leftunexp***); ***28***, whether or not the dog has any fears (***fears***); ***33***, whether the dog stays in a room voluntarily (***roomvol***); ***34***, does the dog follow the owners from room to room (***follow***); ***36***, the dog's reaction to being denied access to the owners [3 measures - vocalising (***voc***), scratching/digging at the door (***scratch***), waiting outside the door (***wait***)].

Unfortunately due to considerable amounts of missing data, a full factor analysis could only be performed on 142 of the original 192 dogs. All subsequent analyses utilising information generated from this analysis therefore include these 142 individuals only.

Following the generation of principal components, a *scree diagram*, which plots eigenvalues against components on a scatterplot, was constructed to give a clearer indication of the pattern of variance (*Figure 2.9*).

Figure 2.9 Scree diagram of 13 variables entered into Principal Components Analysis. Components above the solid line were retained for varimax rotation



Initial Principal Components Analysis generated five factors with eigenvalues greater than 1.0. Examination of scatterplots of factor weights (*Figure 2.10*) suggested that varimax rotation was required to align the variables further; consequently five factors were retained for rotation along with a sixth factor (eigenvalue 0.996), these 6 factors accounting for 66.4% of the total variance. Varimax rotation (via factor analysis) correlates the groups of measurements further and should ideally align each variable with one factor only. Subsequent scatterplots of varimax-rotated factor

scores (*Figure 2.11*) illustrated a much clearer alignment of variables with factors.

Figure 2.10 Scatterplot of Factor 1 against Factor 2 (prior to varimax-rotation)

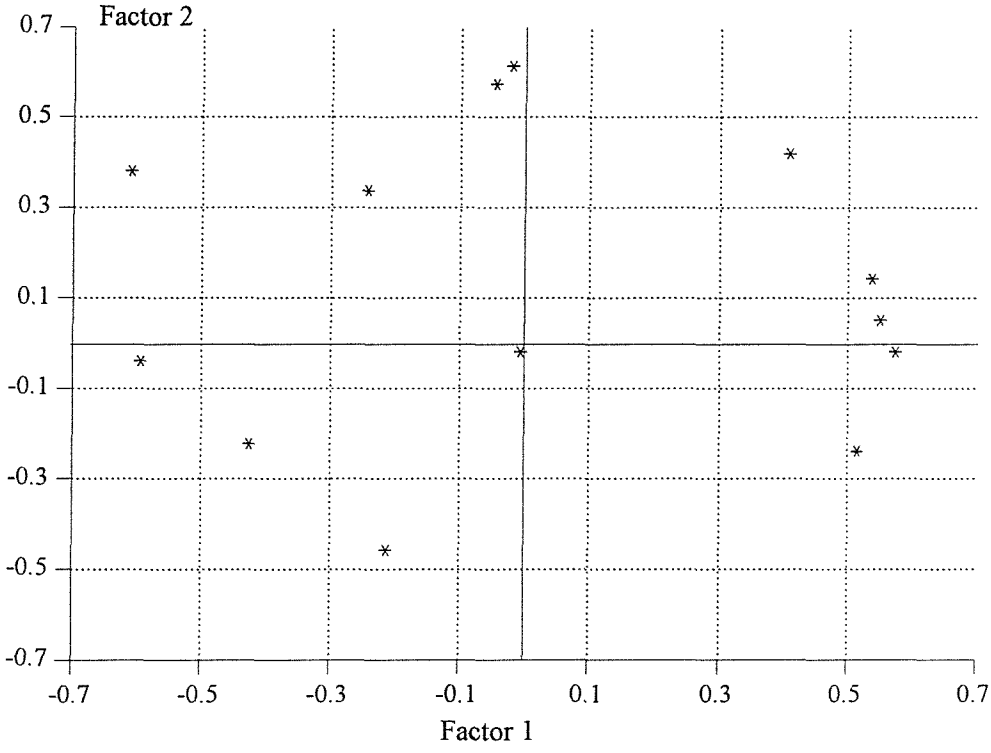
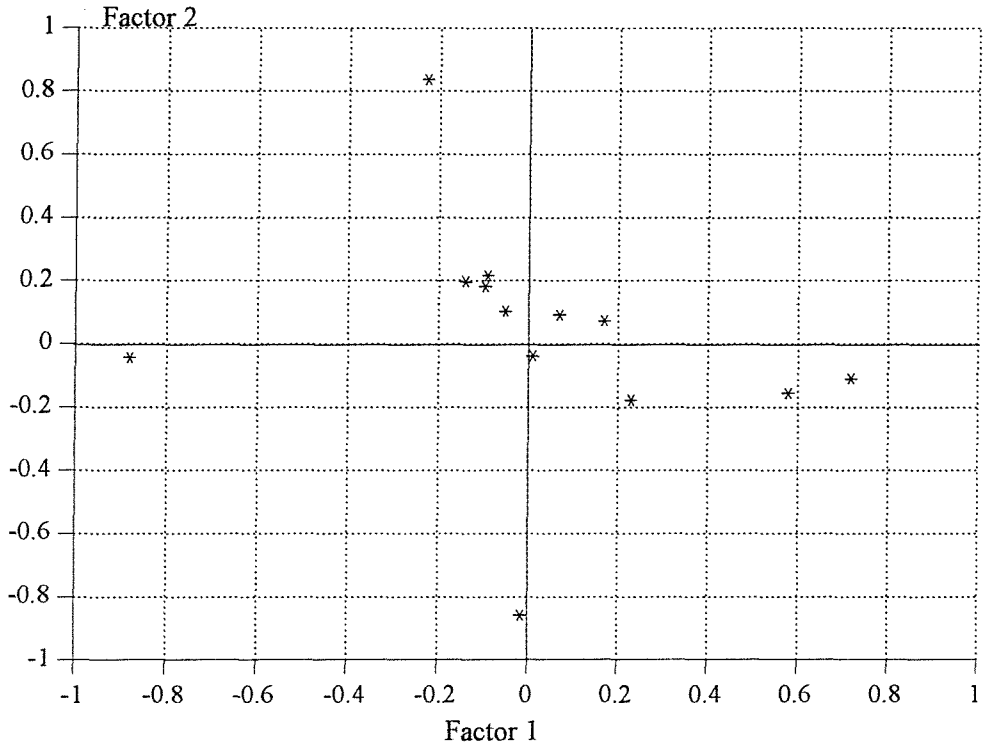


Figure 2.11 Scatterplot of varimax-rotated Factor 1 against varimax-rotated Factor 2



The measures representative of a factor were selected by taking the maximum value (irrespective of sign) for each factor and halving this value; all variables with values exceeding this 50% threshold, again irrespective of sign, were used for interpretation of a given factor. *Table 4.5* shows the variables comprising each factor along with each factor score.

Table 2.7 Weightings for the original variables on the six varimax-rotated factors. Values highlighted in bold are those variables used to interpret a given factor, i.e. those accounting for 50% or more of each factor's maximum score.

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
vocalise			**0.527**			**-0.446**
destructive						**0.907**
elimination				**0.771**		
other					**0.754**	
sympcomm				**-0.653**		
latency					**-0.728**	
leftunexp			**0.667**	0.408*		
fears			**-0.759**			
roomvol		**0.835**				
follow		**-0.862**				
voc	**0.725**					
scratch	**0.576**					
wait	**-0.882**					

* Although this value represented more than 50% of Factor 4's maximum value, it was excluded from factor four since a higher value was obtained, and was therefore more appropriate to inclusion, in Factor 3. [2]

Details of individual variables and descriptive factor names are illustrated in *Table 2.8*. Since ordering of factors is lost following varimax-rotation, hereafter letters are used to arbitrarily name

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[2] The signs attributed to a value generated via factor analysis, i.e. positive or negative, are arbitrary. It is therefore acceptable to reverse the signs within a given factor provided consistency is maintained, for ease of factor interpretation. Since many dogs exhibiting separation problems display a tendency to follow persistently and show a reluctance to remain alone in a room, it would therefore seem acceptable to reverse the signs of Factor 2. I have, however chosen not to adopt this process of reversal, which would result in a factor pertaining to dependency and over-attachment, since on further examination of associated variables and canine characteristics relating to Factor 2, animals scoring highly on this factor appear to differ from the typical "over-attached" separation type.

factors in preference to numbers.

Table 2.8 Behavioural measures loaded positively on each of six varimax-rotated principal factors with descriptive names. Descriptors of measures loaded negatively have been reversed.

Factor	Descriptive name	Measures
A	Immediate reaction to denial of access	Vocalising when denied access to human contact Scratching/digging at doorway when denied access *Not* waiting at the door when denied access
B	Independent, not overly-attached	Voluntarily remaining in a room without company *Not* following from room to room
C	Vocal, non-fearful	Vocalising during separation Displaying separation behaviour when left unexpectedly *Absence* of fears
D	Eliminatory, highly stressed	Elimination during separation Exhibition of separation behaviour very soon after acquirement (Displaying separation behaviour when left unexpectedly)
E	Miscellaneous symptoms, immediate reaction to separation	Exhibition of other separation behaviours Rapid response to separation
F	Destructive, not vocal	Destruction during separation *Absence* of vocalisation during separation

The non-association of vocal and destructive symptoms was once again highlighted, presenting as a single factor (Factor F) following varimax-rotation.

2.3.6 *Analysis of independent variables/potential causative measures*

Following the generation of six discrete factors, further analysis focussed on the effect of the independent variables, together with possible causative measures, on the factor scores (dependent variables). In the majority of cases, one-way ANOVAs were employed as the test statistic since many of the variables under investigation were non-metric or were present as categories (e.g., nominal measures or 1/0 measures). If the variables were metric, or if many categories existed (for example scaled measures), linear regression analysis was used in preference to ANOVA. This

allowed the dependent variables (factor scores) to be expressed as a linear function of the independent variables[3].

2.3.6.1 *Independent variables*

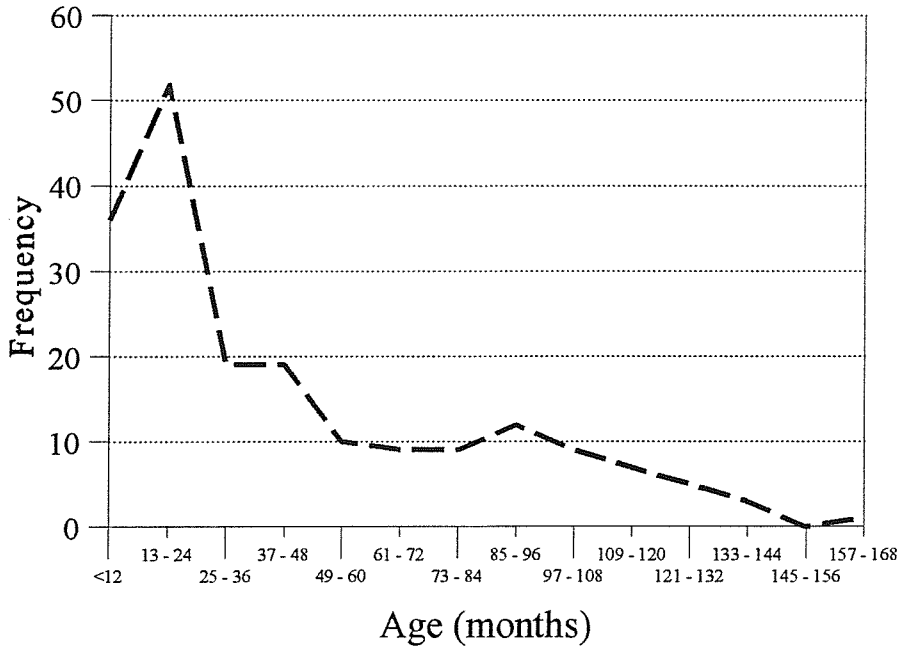
The age and sex of the animals in relation to Factors A-F was examined using a one-way ANOVA for each of the independent variables.

2.3.6.1.1 *Age*

The age of dogs presented with separation problems ranged from 3 months to 14 years. The full distribution of ages is shown in *Figure 2.12*.

It was decided to categorise all subjects into three age groups (*Table 2.9*) rather than using actual age in months.

Figure 2.12 Frequency distribution of the age of dog presented (entire sample of 192 dogs).



3
Variation in n values was due to the return of incomplete questionnaires

Table 2.9 Categorisation of ages and sample numbers

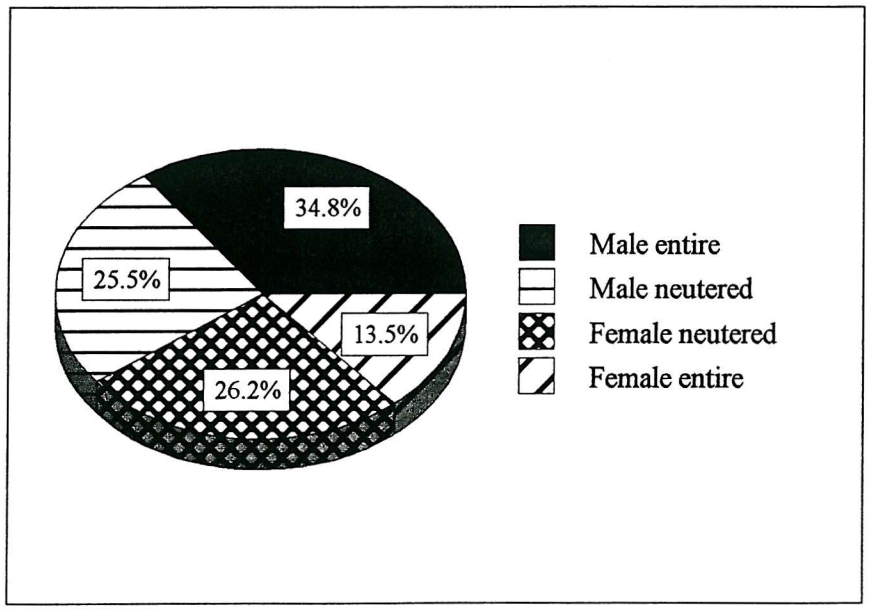
Category	Age (months)	Number	%
ya (young adult)	<25	67	47.5
a (adult)	25 - 99	57	40.4
e (elderly)	>100	17	12.1

A one-way ANOVA was used to look at the effect of age on each of the six factors. Significant results were found only in relation to Factor D (eliminatory, highly stressed) (F=6.548, df=140, p=0.002); on average the adult dogs generated the highest Factor scores, followed by the young adults, and lastly elderly dogs. A result of p=0.07 which although just outside the significance level of 5%, was obtained for Factor F (destructive, not vocal) (F=2.704, df=140). Young adults scored much higher on Factor F, followed by the elderly dogs, and finally by the adults. None of the other four factors were found to be significantly affected by the age of the dog.

1.3.6.1.2 *Sex*

The sample of 142 dogs consisted of 85 males (49 entire, 36 neutered) and 56 females (19 entire, 37 neutered).

Figure 2.13 Distribution of sexes within the sample



No significant effect of sex/sexual status was found on any of the six Factors.

2.3.6.1.3 *Household members*

Linear regression analyses were performed on each of the six factors for the number of adult members and the number of children to see whether any relationship existed. No relationship was found with any of the factors and the number of adults, however a positive linear relationship was found to exist with the number of children in a household and Factors A (immediate reaction to a denial of access) (t=1.987, df=140, p=0.049) and C (vocal, non-fearful) (t=2.812, df=140, p=0.006). An additional regression analysis was performed excluding households without children, which was significant for Factor C (t=2.413, df=26, p=0.024) but not for Factor A (t=0.783, df= 26, p=0.441).

As well as the linear regression analysis, a T-test (two sample analysis) comparing households with children and those without was performed on the data for both Factor A and Factor C. Again a significant result was generated with respect to Factor C (t=-2.115, df=26, p=0.036); the result for Factor A was just outside the level of significance (t=-1.912, df=26, p=0.058). It therefore seems that the presence of children significantly affects the exhibition of vocal, non-fearful symptoms and that this relationship becomes stronger with increasing numbers of children. The dog's reaction to a denial of access is also positively influenced by the presence of children; however this effect does not increase with the number of children in the household.

2.3.6.2 *Predisposing factors*

Several potential predisposing factors were investigated for their influence on each of the six factors. These measures all related to the dogs' past experiences as opposed to current circumstances.

2.3.6.2.1 *Age of the dog when obtained by current owner*

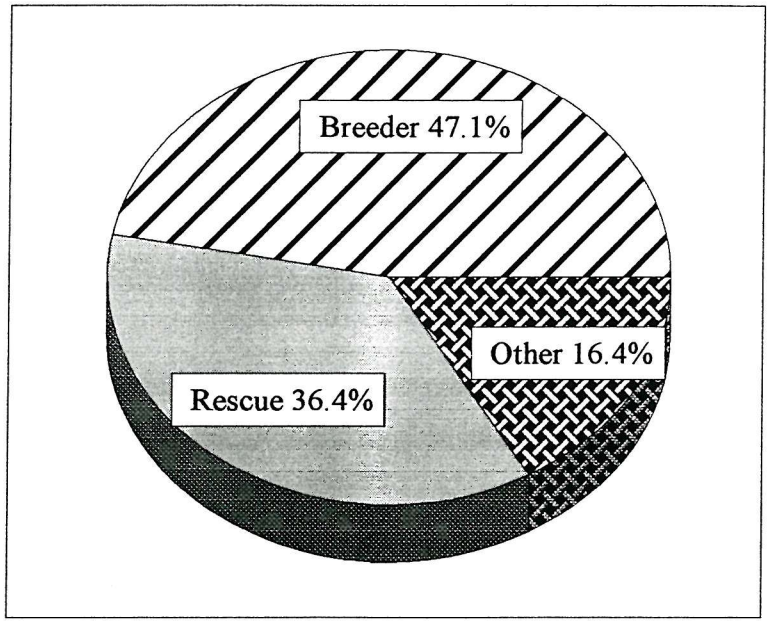
A one-way ANOVA was used to examine the age category of the dog (young adult / adult / elderly) in relation to the six factors. No significant results were obtained, although there was a loose relationship with Factor D (F=2.204, df=140, p=0.058) (eliminatory, highly stressed), the older dogs (those obtained at > 12 months) generally scoring higher.

2.3.6.2.2 *Where the dog was obtained from*

The origin of the dog was split into three categories - breeder, rescue centre, or other. The latter category encompassed a multitude of options, the majority being covered under the following: pet shop, puppy farm, found straying, from family/friends. The distribution of the population is illustrated in *Figure 2.14*.

Again a one-way ANOVA was performed on each of the six factors. The origin of the dog was found to significantly influence Factors D (F=3.453, df=139, p=0.03) (eliminatory, highly stressed) and F (F=3.857, df=139, p=0.02) (destructive, not vocal). Examination of the resulting table of means indicated that in each case it was the rescue dogs which tended to have the highest scores.

Figure 2.14 Distribution of dog origin



2.3.6.2.3 *Number of previous homes*

A linear regression analysis was to used to investigate whether the number of homes significantly affected any of the six factors. Only one result proved to be significant at the 5% level, revealing a positive association with Factor D, (t=2.551, df=104, p=0.012, (eliminatory, highly stressed).

2.3.6.2.4 *Rescue kennels*

Linear regression was once again used to examine any relationship between the number of periods of residence in rescue kennels against the symptoms displayed in the six factors. Two significant positive associations were found - with Factor D (eliminatory, highly stressed) (t=2.675, p=0.008 and Factor F (destructive) (t=2.422, df=134, p=0.017).

2.3.6.2.5 *Boarding kennels*

An identical process was applied to the experience of and number of (e.g., frequent, occasional, rare, never) visits to boarding kennels. No significant results were obtained although a loose positive association was noted with Factor F (destructive) (t=1.737, df=108, p=0.085).

2.3.6.3 *Current behaviour/routines*

The remaining associations investigated were those relating to current circumstances and were largely with respect to ongoing owner routines.

2.3.6.3.1 *Duration of routine separation*

Two significant results were generated using linear regression analysis. Factors C (vocal, non-fearful) (t=-2.898, df=140, p=0.004) and E (miscellaneous symptoms, immediate reaction to separation) (t=-3.358, df=140, p=0.001) were both *negatively* associated with the length of time the dog was routinely left alone. In other words, animals scoring highly on these factors tended to be left for very short periods of time only.

2.3.6.3.2 *Where the animal is left*

A one-way ANOVA was used to assess differences between where the animal was left and each of the factors. The only notable difference occurred with Factor D (eliminatory, highly stressed) (F=2.907, df=138, p=0.024); the dogs scoring high on this Factor were more likely to be restricted to one area of the house when left and were least likely to be given free run of the house. Given the nature of the symptoms displayed, it is probable that access was restricted as a result of the

inappropriate behaviour.

2.3.6.3.3 *Owner behaviour on departure*

The owner's behaviour towards the dog on departure was categorised as: an intense goodbye, a brief interaction, completely ignoring the dog, or inconsistent. Again one-way ANOVA was used as a statistical measure of difference / variation, Factor A (immediate reaction to denial of access) ($F=0.049$, $df=140$, $p=0.049$), showing the only significant relationship. Dogs whose owners behaved inconsistently on departure scored highest on this factor; dogs whose owners behaved intensely towards their pet on departure scored lowest.

2.3.6.3.4 *Where the dog sleeps*

No significant results were generated using a one-way ANOVA.

2.3.6.3.5 *Measures relating to affection*

One-way ANOVAs were performed on each of the following variables for each of the six factors:

1. The dog's level of affection (extremely affectionate, affectionate in general, affectionate only towards specific people, not particularly affectionate, or not at all affectionate)
2. Whether or not the dog was given affection freely
3. Whether the dog demanded affection (frequently, sometimes or never)

Two significant results were obtained: Factor B (independent, not overly-attached dogs), showed a relative *lack* of affection ($F=3.924$, $df=140$, $p=0.01$). Dogs scoring highly on Factor B were *not* likely to demand affection ($F=9.089$, $df=141$, $p<0.001$; they were least likely to score a maximum 4 for affection and most likely to score 2 (not particularly affectionate), 3 (affectionate only with specific people) or 1 (not at all affectionate).

2.3.6.4 *Variables associated with the six factors*

Independent variables significantly associated with high scores on each of the six factors are displayed in *Table 2.10*.

In cases where more than one measure was found to be associated with a particular factor, an analysis was performed on these measures to see whether they themselves were related. Pair-wise cross-tabulations were employed to examine the existence of any relationships between the independent variables. Those relationships which proved to be significant are outlined in *Table 2.11*.

Table 2.10 Summary of independent variables significantly associated with high scores on each of the six factors (at $p<0.05$).

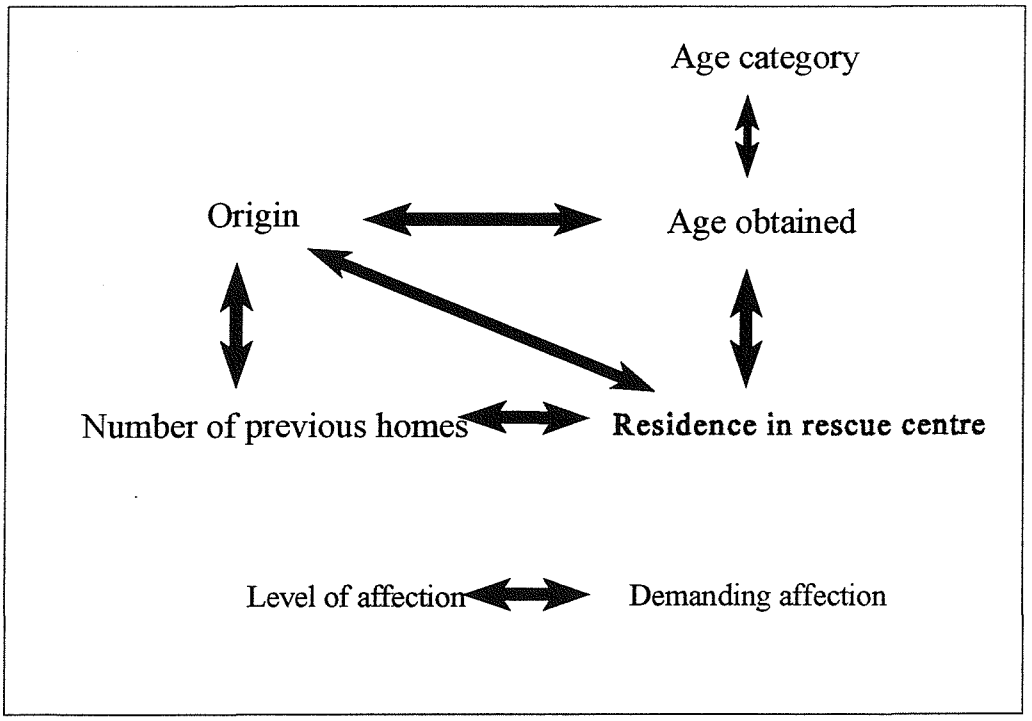
Factor	Name	Independent variables
A	Immediate reaction to denial of access	Number of children in the household (one or more) Inconsistent behaviour of owner on departure
B	Independent	Low level of affection Absence of demanding affection
C	Vocal, non-fearful	Number of children in the household (one or more) Left for brief periods during the day
D	Eliminatory, highly stressed	Age category (adult) Number of previous homes Dogs originating from rescue centres Number of stays in rescue centres
E	Miscellaneous symptoms, immediate reaction to separation	Left for brief periods during the day
F	Destructive, non-vocal	Dogs originating from rescue centres

Table 2.11 Significant (5% level) associations between measures

Measure 1	Measure 2	Chi^2 (df)	Probability
Age category	Age obtained	36.08 (10)	<0.0001
Age obtained	Residence in rescue centres	85.34 (15)	<0.0001
Age obtained	Dog's origin	80.41 (10)	<0.0001
Dog's origin	Number of homes	67.81 (8)	<0.0001
Number of homes	Residence in rescue centres	108.30 (8)	<0.0001
Residence in rescue centres	Dog's origin	159.60 (6)	<0.0001
Level of affection	Demanding affection	70.99 (6)	<0.0001

Several of the measures can therefore be said to be intrinsically linked, most of these pertaining to a rehoming via a rescue centre (*Figure 2.15*).

*Figure 2.*15 Association of independent variables.

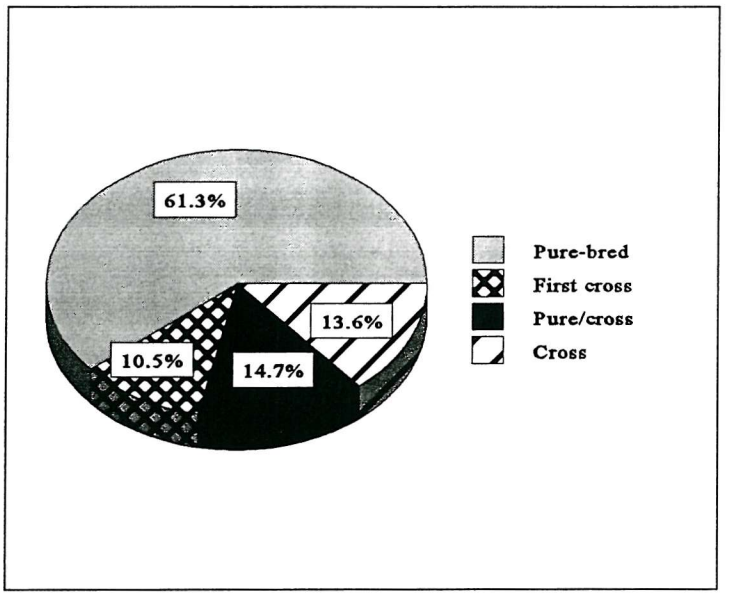


The measures associated with Factors B and D require some modification to account for the inherent relationships occurring between independent variables. Factor B (independent, not overly-attached) may be said to be associated with an absence of overtly affectionate displays of behaviour. Factor D (eliminatory, highly stressed) is apparently strongly associated with the process of rescuing and the age of the dog, the latter also being indirectly linked to the rescue process.

2.3.7 *Breed incidence*

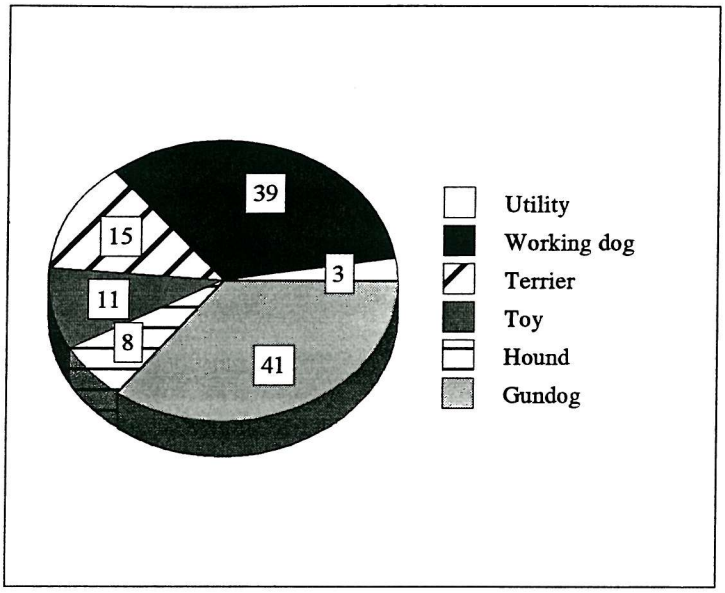
Of the 192 dogs in the original data set, 117 were pure-bred, 20 were first crosses (pure-bred/pure-bred cross), 28 were pure-bred/mixed breed crosses and 26 were of indistinct breed (crosses) (*Figure 2.16*).

Figure 2.16 Distribution of pure-breed/mixed breed dogs



Within the pure-bred category, the dogs were split into groups according to the British Kennel Club divisions (*Figure 2.17*). Gundogs and working dogs were heavily represented in the sample of dogs referred for separation problems. This was also true for those categories of crosses which included one or more pure-bred dogs (38 dogs were either German shepherd cross, Labrador cross or Border collie cross).

Figure 2.17 Numbers of pure-bred dogs in each of the Kennel Club breed groupings



Although the variation in dog breeds was considerable, a total of 46 breeds being represented by one or more individuals, several breeds appeared to be over-represented. *Figures 2.18* and *2.19* display the specific breeds comprising the gundog and working dog categories. The *other* section in each of the charts includes breeds for which there was only one member. For gundogs these breeds were: Irish setter, German wire-haired pointer, flat-coat retriever and Hungarian vizla, and for the working breeds: Alaskan malamute, Doberman, samoyed and Rhodesian ridgeback. *Table 2.12* lists the ten most popular breeds in the UK pet dog population 1990 according to a nationally conducted market research survey. From this, it may be surmised that the smaller dogs, particularly the terriers, were particularly under-represented in the sample of separation cases; however, the Weimeraner, Boxer and Bearded collie seem to be over-represented.

Unfortunately, the large spread of breeds did not permit the use of any specific statistical method. In light of this, a cluster analysis (see page 2.35) was performed on the factor scores obtained for each dog in attempt to identify any possible breed effects.

Table 2.12 Ten most popular dog breeds (UK 1990) with percentage incidence in the pet dog population

Popularity	Breed	% incidence
1.	German shepherd	10.2
2.	Labrador retriever	9.4
3.	Yorkshire terrier	8.1
4.	Jack Russell terrier	4.8
5.	Springer spaniel	4.3
6.	Cocker spaniel	3.1
7.	Cavalier King Charles spaniel	3.0
8.	West Highland white terrier	2.7
9.	Border collie	2.6
10.	Golden retriever	2.4

Figure 2.18 Breed distribution of pure-bred *gundogs*. Absolute numbers of each breed are indicated within the relevant sector.

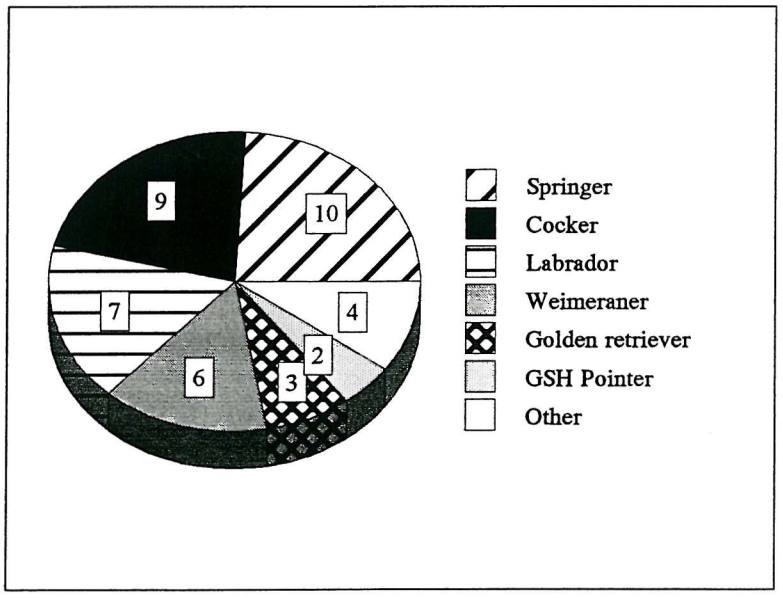
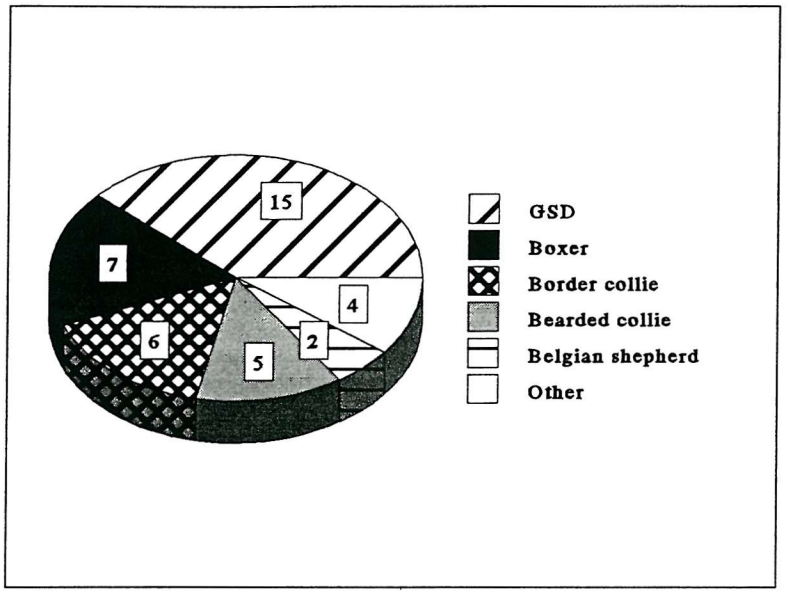


Figure 2.19 Breed distribution of pure-bred *working dogs*. Absolute numbers of each breed are indicated within the relevant sector



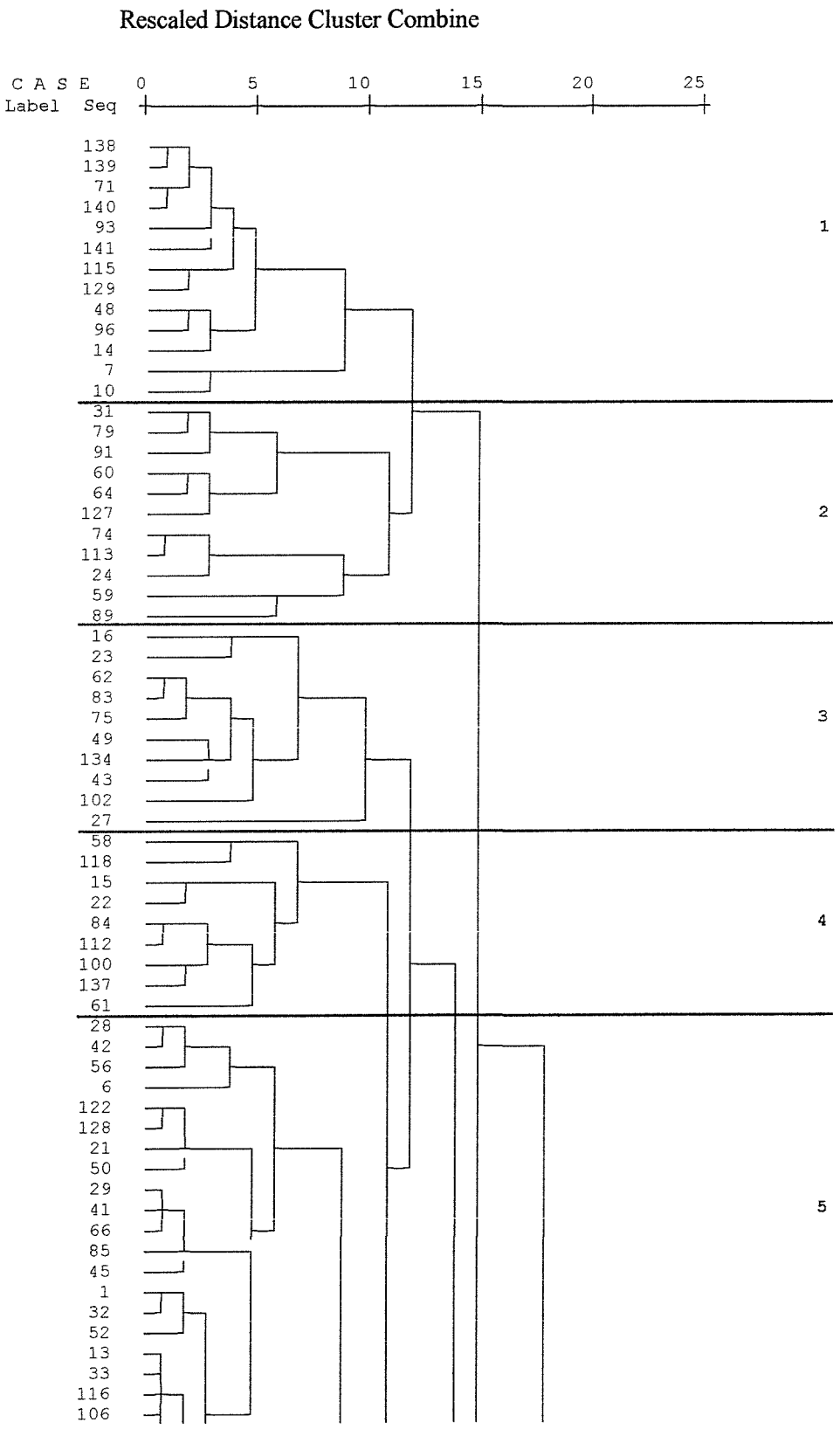
2.3.8 *Cluster analysis*

Cluster analysis is a classification system used to generate subgroups within a population based on multiple measures on each member of that population. This analysis was used not only to determine whether any specific breeds or breed types were displaying certain symptoms, but also to investigate the possible existence of distinct subgroups of symptoms within the separation cases. Since the symptoms displayed were the target of investigation, the six rotated factor scores obtained for each dog were selected as the variables serving as the basis for the cluster analysis. As only 142 of the original 192 cases had a complete set of factor values, only these dogs could be used in the analysis. Although the individual breeds making up this restricted sample differed slightly from the original 192, the breed composition remained remarkably similar.

The cluster analysis was performed on *SPSS/PC version 5.0, 1992.* It was not necessary to convert variable values to z scores since the variables used were already in a standardised format (factor scores). The distance measure (measures how far apart two individuals are) used was *squared Euclidean*, which is the sum of the squared differences over all of the variables (Norusis, 1994). The clusters were formed using *agglomerative hierarchical cluster analysis*. In agglomerative hierarchical clustering, clusters are formed by grouping cases into larger and larger clusters until all cases are members of a single cluster. The resulting dendrogram is shown in *Figure 2.20*.

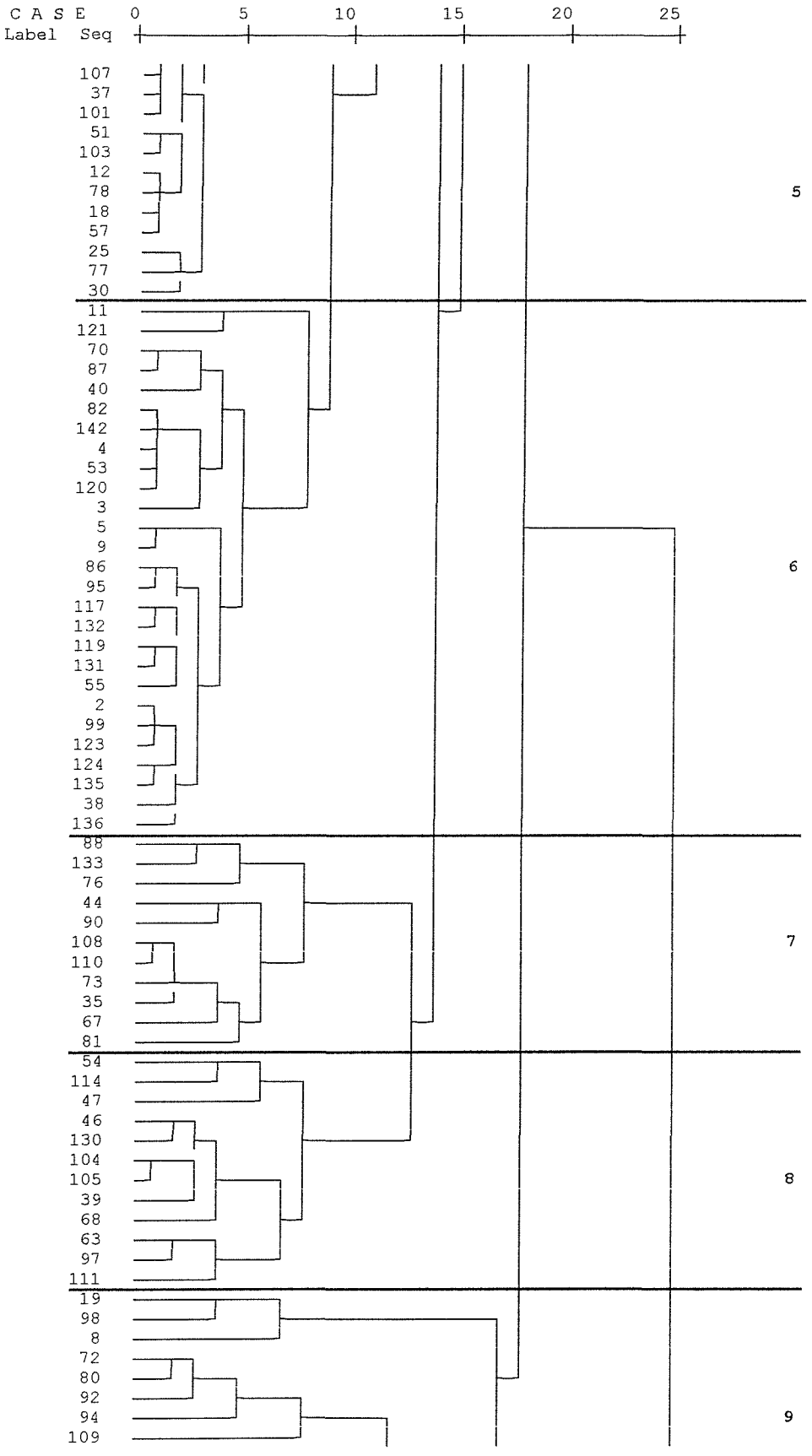
Figure 2.20 Dendrogram generated via agglomerative hierarchical cluster analysis. Red lines indicate individual cluster divisions and figures in red the allocated cluster number.

Dendrogram using Average Linkage (Between Groups)

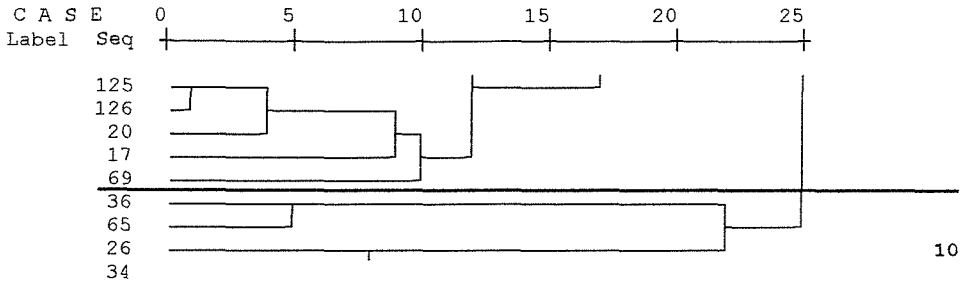


Dendrogram using Average Linkage (Between Groups)

Rescaled Distance Cluster Combine



Dendrogram using Average Linkage (Between Groups)
Rescaled Distance Cluster Combine



Visual inspection of the dendrogram suggested that there were ten more or less homogeneous clusters, containing a range of 4 to 32 individual dogs. Each cluster was examined for similarities existing between individuals with respect to independent variables, symptoms, potential causative measures and current household routines. Descriptions of each cluster may be found in *Table 2.13*.

Although ***Section 3*** of the questionnaire has already been shown to be highly subjective, hence its exclusion from the factor analysis, some clusters revealed similarities in the response of the APBC members to the items from ***Section 3***. It was therefore felt that this apparent agreement between members regarding certain aspects of the separation cases warranted further attention. These variables have been retained within the appropriate cluster and marked with an asterisk.

The characteristics of each cluster were examined by calculating the means of the six factor scores for all dogs in each cluster (*Table 2.13*), and these were used to generate general descriptions for each cluster (*Table 2.14*).

Table 2.13 Mean factor scores for each cluster

	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**
Cluster 1	-1.67	-0.77	-0.81	0.13	-0.07	0.54
Cluster 2	-1.43	-0.09	1.43	0.41	0.24	0.44
Cluster 3	0.57	-0.07	-0.10	1.73	-0.76	0.23
Cluster 4	0.46	-0.44	0.11	-0.70	0.12	-1.79
Cluster 5	0.55	-0.38	1.14	-0.52	0.01	0.39
Cluster 6	0.60	-0.66	-0.92	-0.28	0.01	0.49
Cluster 7	-0.05	1.54	-0.26	0.62	0.93	0.58
Cluster 8	-0.17	1.49	-0.39	-0.98	-1.13	0.26
Cluster 9	-0.25	0.50	-0.44	0.56	-0.43	-1.98
Cluster 10	-0.66	0.52	0.16	0.63	3.11	-0.45

Table 2.14 Predominant features of clusters 1-10. Measures preceded by * are derived from ***Section 3*** of the questionnaire. The "other features" within this table have been derived from the six factors, the cluster analysis and the original questions. Abbreviations used: *f*, female; *m*, male; *n*, neutered; *e*, entire; *ya*, young adult; *a*, adult.

Cluster	Subjects	Age	Sex	Breed	Symptoms	Other features
1	13		f(n) 46%	Working/gundog	Destruction	Fearful, *overattached (esp. to females), do not react overtly to a denial of access. Tend to occur in households with few members and no children. 77% sleep in the owners bedroom. *Severe cases.
2	11	ya 64%	m(e) 45%	Working /gundog/toy	Destruction	Not fearful, display symptoms when left unexpectedly, do not react overtly to a denial of access. Highly affectionate
3	10	ya 60%	f 90%	Working/gundog/hound	Destruction Elimination	Fearful, display symptoms when left unexpectedly, react to a denial of access. Symptoms commenced very soon after acquirement. 50% rescue dogs.
4	9	e 33%	m(e) 67%	Working/terrier/gundog	Vocalisation Not destruction Not elimination	All react to a denial of access. Symptoms commenced more than 6 months after acquirement. *Overattached.
5	32		m 73% m(e) 40%	Gundog/working/cross	Destruction Vocalisation	Not fearful, destructive targeting of entrances/exits, display symptoms when left unexpectedly, react to a denial of access. Follow persistently.
6	27	ya 63%		Working/gundog/cross/ toy	Destruction	Fearful, immediate reaction to separation, react to a denial of access. Do not stay in a room voluntarily follow persistently (usually one person). 52% rescue dogs

Cluster	Subjects	Age	Sex	Breed	Symptoms	Other features
7	11		m 73%	Working/gundog/hound	Destruction	Fearful, symptoms displayed when left unexpectedly, stay in a room voluntarily, follow occasionally, relatively less affectionate. 64% rescue dogs.
8	12	ya 67%	m 83%	Working/gundog/terrier	Destruction Not elimination Little vocalisation	Symptoms commenced several months after acquirement, high latency of separation behaviour, stay in a room voluntarily, low level of following, tend to be attached to females. *Relatively mild cases.
9	13		m 69%	Terrier	Elimination Not destruction	Fearful, stay in a room voluntarily, tend to be attached to females. Bought from breeders.
10	4		f 75%	Working/gundog/hound	Other	Very rarely left alone, symptoms displayed when left unexpectedly, highly affectionate.

Dogs in clusters 1 and 4 scored highly on the counsellors' perceived level of attachment to owner(s), which has previously been shown to be unreliable. However, the dogs concerned also presented *negative* scores for Factor B, i.e., they tended to be rated as dependent and overly-attached. The latter may therefore be interpreted as behaviour indicative of attachment. This suggests that although subjectivity was high amongst the counsellors overall, agreement existed at least for measures of attachment and that this agreement bore some resemblance to other related but less subjective measures.

2.4 *Discussion*

2.4.1 *General characteristics of the sample*

Using the information extracted from 192 individual separation cases, several trends were identified with regard to the general characteristics of the problem animals.

2.4.1.1 *Household composition*

Thirty-four dogs lived in households with only one person, the median value for household members being two. The vast majority of households contained no children, only 23% of families having any children at all. Although not proven, this suggests an association between a low number of family members and a tendency for dogs in such an environment to exhibit separation problems. The potential for developing strong attachments to specific individuals is greater if there are fewer potential target attachment figures. In an ethological study of the interactions between people and their dogs, Smith (1983) found that childless households interacted with their dogs more often and with greater complexity than households with children. Consequently, the dogs within childless households spent more time in close proximity to one or more adult persons, presumably providing the foundation for strong reciprocal attachments. Psychological effects from the human perspective may also play a role in the development of intense attachments; it is plausible that childless couples view the pet as a "child substitute" thereby encouraging very strong attachments to develop.

It is also likely that the population of owners of dogs referred to APBC members are a biased sample of owners in general. Owners seeking behavioural advice from professional counsellors are,

by definition, willing to make a financial investment in their animal's future. Furthermore, behaviour therapy relies upon a high degree of behaviour modification, not only on the part of the canine subject but also for the human owner, even to the extent of demanding complete modifications in lifestyle; dedication towards the animal is therefore by and large a necessary prerequisite to successful treatment. It seems likely that attachment to the animal tends to be stronger than usual in owners presenting their dogs to counsellors - possibly, though not necessarily, contributing to the actual onset of the problem behaviour (Mugford, 1983). It may be that single owners of dogs, or couples without children, are more likely to, and are in a better financial situation, to seek behavioural advice from counsellors than other owners. In all probability both the number of household members and the motivation of the owner contribute to some extent; a complex network of social, financial and psychological aspects influencing the behaviour of the dog and as a consequence, the decision to seek behavioural advice.

According to Overall (1997), referring to Tuber *et al.* (1982):

"the standard dogma about separation anxiety includes the admonition that obtaining another pet will not greatly aid the distressed patient because the separation anxiety is focussed on a human or humans, not animals"

There are no studies examining whether separation behaviour develops as readily in multi-dog households; however Overall (1997) postulates that if an individual were *predisposed* to underlying "anxious" behaviour, the potential conspecific social interaction may modulate this behaviour. She remarks that this is *not* the same as treating a dog with a separation problem by providing another dog for company since this may raise the dog's level of anxiety. Some enlightenment regarding the effect of the presence of conspecifics is provided via an examination of the behaviour of dogs living with other dogs in this study. Although most of the 192 dogs in the sample existed as lone canines within a household, 58 (31%) did have conspecifics as companions. Thirty of these 58 were obtained following, and in addition to, a "normal" dog. Six of the dogs displaying symptoms currently had a canine companion but used to have a different companion. Interestingly, only seven households acquired another dog *after* the dog with separation problems had been obtained. This is likely to result from the behaviour displayed by the original pet and a reluctance on the part of the owners to risk compounding or even doubling the problems experienced. Nevertheless, it used to be a commonly believed concept (and according to Bailey (1997 *pers. comm.),* still is) that the acquisition of an additional conspecific, albeit strongly discouraged by behaviour counsellors,

would act to alleviate the distress experienced by an individual animal. Indeed in this study, of the fourteen separation cases obtained at *the same time* as another dog, ten of the canine companions also exhibited separation symptoms. These ten individuals comprised five littermate pairs of diverse sex combination and breed, all obtained from breeding establishments. This may reflect a genetic predisposition to separation behaviour, although little evidence exists to substantiate this, or possibly and perhaps more likely, the distressed state of one individual acts to stimulate inappropriate behaviour in the other. This is the major reason for the discouragement of conspecific contact during human isolation, i.e. the "infectious" state of distress. Some evidence for this is provided by the case history of one household. Excluding the five littermate pairs presented, there was only one multiple separation case household consisting of an older female boxer and an unrelated young male boxer. The female had been displaying separation symptoms before the male was acquired; however following acquisition of the unrelated male puppy, he began to display severe symptoms during human isolation (barking, eliminating, vomiting, excessive salivation and chewing of doorways, walls and carpets), indeed the referring behaviour counsellor described him as one of the most severe cases she had ever come across. In addition, as a result of the male's behaviour, the behaviour of the original female worsened.

In each of the situations outlined above, the presence of another dog in the household did not reduce the inappropriate behaviour displayed. The 58 dogs cannot therefore be said to be reacting to a denial of social contact *per se*, rather they are reacting to the absence of *human* contact.

2.4.1.2 *Age of subjects*

The age of dogs referred to behaviour counsellors for separation related problems averaged four years, with a range of 3 months to 14 years. Approximately forty-eight percent of these dogs were less than two years old. This suggests that the inappropriate behaviour is more common in young adult dogs, although it is difficult to come to any firm conclusions regarding age and behaviour for the following reasons: dogs displaying problem behaviour at a young age are likely to be referred to a behaviour counsellor whilst they are still young (hence the over-representation in the APBC sample), to be given up for adoption, to stray, or to be euthanased (Mugford, 1983). Furthermore, there may a natural decline in the intensity of behaviour displayed once dogs reach a certain age, although no evidence exists to substantiate this hypothesis. Older dogs displaying separation behaviour may have already been through an unsuccessful course of treatment, or through a rescue

process/repeated cycle of rehoming. Alternatively, separation symptoms may have developed in the recent history of the dog. A full and detailed history of each dog is necessary to evaluate the effect of the age of the dog on the development of symptoms. Nevertheless, the fact remains that in this study almost half the dogs referred to behaviour counsellors were less than 2 years old. Even taking into consideration the aforementioned complexities regarding age, this seems to indicate that some relationship exists between the age of the dog and the exhibition of symptoms. This is in agreement with McBride *et al.* (1995) who revealed that 47% of those dogs exhibiting separation behaviour following rehoming by rescue centres were less than two years of age.

2.4.1.3 *Sex of subjects*

More males than females were present in the sample (3 male : 2 female). This finding is in contrast to many previous observations (e.g., McCrave, 1991), which generally state the sex ratio of inappropriate separation behaviour to be 1:1; although Wright and Nesslerote (1987) found that separation related problems were slightly more prevalent in males. Furthermore, Mugford (1983), reports that attachment problems in general are marginally more common in males than in females. No significant differences in symptoms (factor scores) were found to exist between the sexes.

2.4.1.4 *Breed/breed type*

The majority of purebred dogs were of the working dog and gundog types. Within these breed groupings, German shepherds, springer spaniels, cocker spaniels, Labrador retrievers and boxers were the most common breeds, followed by Weimeraners, Border collies, bearded collies, golden retrievers, German short-haired pointers and Belgian shepherds. The purebred/purebred crosses were also dominated by the working and gundog types, particularly German shepherd and collie crosses.

To some extent the breed representation within this sample reflects the popularity of breeds within the general population. Nevertheless, the prevalence of working and gundogs (42% of the entire sample) suggests that dogs of this type may be particularly prone to separation problem behaviour. Mugford (1983) makes reference to an unusually high incidence of separation behaviour in

Labrador retrievers (particularly destructive behaviour), German shepherds and English cocker spaniels, which is in agreement with the findings of this study.

2.4.2 *Symptoms displayed*

The most common symptom was that of destruction during separation followed by vocalisation (barking and howling), elimination and miscellaneous other behaviours. All possible combinations of symptoms were encountered with the exception of vocalisation, elimination and other behaviours. Seven individuals were aggressive towards their owners on departure. Although this is a recognised (but rare) symptom in some dogs displaying other symptoms of separation behaviour (Borchelt, 1983; Voith & Borchelt, 1985; McCrave, 1991), so far no plausible hypothesis has been suggested for the exhibition of this behaviour. It has been proposed that the behaviour may be to some extent breed-specific (McBride, *pers. comm.*), i.e., it is a form of "herding" and as such is more prevalent in the shepherd breeds. Although several of the dogs in this sample which displayed aggression towards owners were of the shepherd/collie type (i.e., the "herding" breeds), three of the nine were not. It is therefore not possible to come to any firm conclusions regarding the motivation for this behaviour.

Initial principal factor analysis segregated the measures relating to the behaviour of the dogs during separation into six distinct Factors, four of these relating directly to behaviour displayed whilst the animal was alone, one relating to behaviour during a denial of access, and finally, one relating to an apparent absence of attachment behaviour. Of the factors associated with symptoms during separation, Factor C (vocal, non-fearful) is particularly interesting. Generally, vocal dogs were *not* destructive, and *not* fearful. In contrast, Factors D and E seem to reflect the generally accepted version of separation problem characteristics - displaying separation symptoms soon after acquirement (Factor D), responding rapidly to separation (Factor E), and displaying separation behaviour when left unexpectedly (Factor D). The existence of Factor B (independent, not overly-attached) appears to confirm the hypothesis that not all separation cases are by default over-attached.

Factor A (reaction to a denial of access) was found to be positively associated with the number of children in the household and inconsistent departure routines on the part of the owner. The presence of a larger number of persons in a household, particularly children, suggests a "busier", more active

environment. Dogs may become conditioned into having social contact as the norm and react inappropriately to being denied this contact. In accordance with behavioural therapy techniques, the departure routine of the owner is advised to be low key, either by ignoring the dog completely (Mugford, 1983; Machum, 1991), or by presenting distinct departure cues (Voith & Borchelt, 1985). Inconsistent departure routines are thought to provoke elevated levels of stress in the animal. It is interesting therefore that dogs scoring highly on Factor A also receive inconsistent departure routines. This suggests that the animal may be confused as to whether it is being left completely or merely being denied access. It is possible that the presence of children influences the nature of a departure routine; preparing one or more children to leave a residence for any period of time is frequently a stressful period for all concerned, often the family pet being the last to be considered.

Factor B (independent, not overly-attached), was found to be negatively associated with affection and demanding affection, reinforcing the prior indication of low levels of inter-species attachment in animals scoring highly on Factor B. In addition, this proposed lack of attachment is confirmed by the APBC member's subjective interpretation of the dogs' personality. Dogs scoring highly on Factor B were thought to be *not* overattached to anyone in particular, to display low levels of attachment to family members, and were probably not particularly severe cases. Such individuals can therefore be said to possess the following characteristics: a lack of persistent following behaviour, a willingness to remain in a room without human company, exhibition of relatively low levels of affection towards the human counterpart, an absence of demanding affection, low levels of attachment to family members, and relatively mild symptoms. These individuals appear to be quite distinct from many of the other, more typical separation cases.

Systematic examination of the independent variables with respect to Factor C (vocal, non-fearful), revealed a significant association with the number of children in the household. Dogs scoring highly on Factor C were also likely to be left for relatively short periods during the day. It is feasible that the presence of one or more children is itself directly linked to the amount of time the dog is likely to be left for. In particular, families with pre-school children are liable to spend more time at home, presumably in the company of the family pet. It is also notable that the subjective measures of temperament (***Section 3***) revealed significant, though tentative, relationships with Factor C. In general, dogs scoring highly on Factor C were inclined to show *low* levels of submission, fearfulness, and susceptibility to stressful family circumstances. These are apparently relatively well-balanced well-adjusted pets, not typical of many separation cases, so why are distress symptoms displayed during separation? In a further analysis of the measures affecting Factor C, it

was revealed that the inappropriate behaviour displayed by these animals was likely to have been triggered by a specific event. The onset of behaviour problems as a result of a traumatic experience is well-documented (Borchelt & Voith, 1982, Voith & Borchelt, 1985). Although the existence and effect of a behavioural trigger is largely a subjective measure, it would seem to explain the presence of separation symptoms in cases of otherwise stable individuals.

Factor D (eliminatory, highly stressed) was found to be positively linked to several variables, most of these pertaining to one or more periods of residence in a rescue centre. Adult dogs scored higher on Factor D than any other age group thereby excluding the possibility of elimination due to inferior house-training in puppies. Although dogs previously resident in rescue centres scored highly, there appears to be an additive effect, linked also to the *number* of periods in rescue centres and the total number of previous homes. These dogs were highly submissive in nature and the behavioural symptoms were *not* thought to have developed as a result of a specific trigger. It is of course possible that the rescue/rehoming process itself, in particular repeated cycles of rescuing and rehoming, manifested as a behavioural "trigger".

More than a third of the total sample of 192 dogs originated from rescue centres. This over-representation is in agreement with the findings and observations of many authors, e.g., Bailey (1993), Borchelt (1983), Borchelt & Voith (1982), McBride *et al.* (1995), Fisher (1991), Houpt (1985).Residence in rescue centres was found to affect Factor F (destructive, non-vocal). Two of the six factors were highly influenced by dogs which had been in rescue centres on one or more occasion.

Dogs displaying miscellaneous other symptoms tended to display the inappropriate behaviour very soon after the owner's departure (Factor E). These dogs were likely to be left for brief periods during the day, hence although it is not possible to identify cause and effect, such interim absences potentially act to encourage the immediate response to isolation. With respect to the subjective measures of temperament, dogs scoring highly on Factor E were highly submissive, probably susceptible to stressful family circumstances, and displayed relatively severe symptoms. Since many of the symptoms displayed were indicative of severe physiological distress, e.g. self-mutilation, vomiting, excessive salivation, pacing, panting, whirling and hyperventilation, it is reasonable to suggest that these individuals were exceptionally stressed, or in a presumed "anxiety-like" state.

2.4.3 *Grouping of "types" within the sample*

Agglomerative hierarchical cluster analysis of the six factors revealed several subgroups within the sample which reflected different symptomatologies and potentially, different motivational states. Although many clusters contained dogs which displayed similar symptoms during separation (seven of the ten clusters related to destructive dogs), by examining similarities in the behaviour of the dogs when *not* separated from their owners, almost all could be categorised into at least two "types". There appeared to be: dogs which were presumably attached (or over-attached) to their owners, those which were not particularly attached but generally fearful ("anxious"), or dogs which were both highly attached and fearful. In a correlation analysis of the subjective measures section of the questionnaire, the level of attachment to the owners apparently showed no relationship with the animal's level of fearfulness. Furthermore, it was found that these individuals were likely to be susceptible to stressful family circumstances. Taken together, these observations seem to support the generalised state of "anxiety" described in ***Chapter 1*** and suggest that at least some of the subjects *not* overly attached may be reacting to the absence of a figure of security rather than a figure of attachment.

The largest cluster (number 5) consisted of animals which were not fearful, displayed symptoms when they were left unexpectedly, followed their owners persistently, and reacted to a denial of access to the owners. From these measures, it may be assumed that these dogs were attached to their owners. The symptoms displayed during separation were destruction in all 32 cases (mainly towards entrances and exits), together with vocalisation in 25 cases. The vast majority of dogs were male (73%), 40% of them entire. No bias was found towards any of the age categories.

The second largest cluster, number 6, also contained dogs which were destructive, but much fewer were also vocal (8 out of 27). The major difference between this cluster and cluster 5 was the high prevalence of fearfulness in these dogs. Once again the dogs in this cluster appeared to be attached to their owners (persistent following of one owner, not staying in a room voluntarily, and reacting to a denial of access). Cluster 6 was over-represented by dogs of less than two years of age (63%) and dogs from rescue centres (52%), although given the biased age distribution in rescue centres (Bailey, 1991) the two are likely to be linked.

Four other clusters (numbers 1, 3, 7, and 9) contained dogs which were viewed to be fearful, and these will be discussed first. Cluster 1 contained 13 dogs which were generally described by APBC

members as being "over-attached", although they did not react overtly to a denial of access. Many of the dogs lived in houses with few adult members and no children; many were also permitted to sleep in the owners bedroom. Although causative factors may only be speculated on, it is plausible that the household circumstances may have acted to encourage the development of the intense attachment between dog and owner. Interestingly, almost half of the dogs in this cluster were neutered females. All cases displayed destruction during separation and were generally considered by behavioural counsellors to be "severe".

Cluster 3 contained ten dogs who had commenced displaying symptoms very soon after acquirement (often from rescue centres), displayed symptoms when left unexpectedly and reacted to a denial of access. Once again many were female (90%), and more than half were less than two years old (this may be an artefact of their being derived from rescue centres). Other than the reaction to a denial of access, there were no measures which suggested any elevation of attachment to owners in these dogs. Several of the dogs in this cluster eliminated during separation as well as exhibiting destructive behaviour.

The eleven dogs in cluster 7 were also largely derived from rescue centres (64%), although in this instance there was no bias towards young adults. The majority were male (73%) and destructive. These dogs were not particularly attached, only following occasionally, staying in a room voluntarily, and displaying less affection towards their owners than many other dogs in the sample.

So far all of the clusters discussed have been largely represented by dogs of the working type, gundog type or general cross breed. Cluster 9 was the only one to reveal any breed predilection, being largely accounted for by dogs of the terrier group. These dogs were *not* destructive but eliminated during separation; eight of the twelve were male. No specific indicators of attachment were revealed.

Of the remaining clusters, at least one (cluster 4) encompassed dogs having an overattachment with one or more owners. These nine dogs were *not* destructive and did *not* eliminate, but vocalised during separation. More than half were entire males; three of the dogs were more than eight years old. In many instances the symptoms of separation behaviour commenced more than six months after the dog had been obtained, presumably a time during which this intense relationship developed.

In clusters 2 and 10, neither fearfulness nor attachment were prevalent, although both encompassed "highly affectionate" animals. Those in cluster 2 are were notably *not* fearful, and did not react to a denial of access. Almost half of the 11 dogs were entire males and six of the dogs were young adults.

The four dogs in cluster 10 all displayed "other" behaviours when alone, including mainly physiological responses to separation (e.g., vomiting, excessive salivation). The reaction to isolation was extremely rapid, three dogs showing symptoms prior to owner departure. These dogs were very rarely left alone but when they were, the behaviour was always exhibited. It is not clear whether the infrequent owner absences were a result of the inappropriate behaviour displayed or whether they might be causal. Given that these dogs were apparently not particularly nervous under other circumstances and were not necessarily over-attached, it is possible they may be phobic[4].

In conclusion, it appears that the characteristics of the animals within each cluster differ greatly. Two clusters contained dogs which were said to be over-attached (clusters 1 and 4). One other cluster suggested an attachment to one owner (cluster 6). Two clusters contained individuals which were not particularly attached (clusters 7 and 8), and a further cluster suggested an absence of overattachment (clusters 9). Clusters 2 and 10 contained individuals which were apparently neither over-attached nor not attached. Several clusters contained individuals which were regarded to be highly fearful in nature. These were: clusters 1, 3, 6, 7, and 9.

If the clusters are categorised as encompassing fearful and / or highly attached dogs, then three appear to relate to fearfulness, two to attachment and two to both fearfulness and attachment. Two clusters appear to have no underlying state of fearfulness or attachment, although both contain "highly affectionate" dogs (which could be used as an indicator of attachment if it is specific in direction). One cluster (cluster 8) encompassed twelve dogs displaying a largely atypical set of characteristics, e.g., symptoms commencing several months after initially obtaining the dog and a high degree of latency of separation behaviour. In addition, the fact that these dogs were viewed by counsellors to be "mild" cases tends to suggest that these dogs are outliers and may not be true separation cases.

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[4] Although little evidence exists to support the hypothesis, "phobias", of known or unknown origin, have been attributed to instigating the excessive separation reaction in some dogs. Commonly, symptoms are initiated by a particular "traumatic" event (often fireworks or a thunderstorm), which if occurring during owner absence, results (via associative learning) in the perpetuation of the inappropriate behavioural response even in the absence of the specific environmental stimulus (e.g. Voith & Borchelt, 1985).

2.4.4 *General conclusions*

The overall sample of separation cases referred by APBC members differed from those of previous studies in several aspects. Firstly there was a bias towards dogs of less than two years of age. Secondly, the male to female ratio was 3:2 as opposed to 1:1. Furthermore, the vast majority of subjects were of gundog/working dog type. With respect to the symptoms exhibited during separation, interesting sub-groups of behaviour and characteristics emerged, particularly regarding destructive dogs. Of the destructive dogs, five of the seven clusters were over-represented by young adults. Within the two vocal categories, both were over-represented by male dogs, particularly entire males.

In aggreement with the hypothesis for this study, a number of dogs were found to be over-attached to their owners, but many dogs were apparently not over-attached. In addition, many dogs which were not over-attached were regarded as being generally fearful. This suggests that there are at least two underlying motivational causes for the exhibition of excessive separation behaviour, which are not necessarily mutually exclusive: over-attachment to one or more persons, and a general fearfulness or "anxiety". Interestingly, the dogs displaying mainly physiological symptoms (e.g., urination, defecation, vomiting, excessive salivation) were generally fearful, providing supporting evidence for the existence of an "anxiety-like" state.

With respect to independent variables, the household composition, (in particular the presence of and number of children), the departure routine of the owner (inconsistent), the length of time the dog was routinely left for (short periods), and the origin of the dog (rescue centre) all significantly influenced the symptoms displayed. Dogs originating from rescue centres were significantly associated with two of the principal factors generated: destructive, non-vocal dogs and eliminatory, highly stressed dogs.

None of the other circumstantial factors postulated by previous authors, e.g. the experience of boarding kennels (McCrave, 1991), the type of owner greeting, the owner's reaction to destruction, soiling, vocalisations (Borchelt & Voith, 1982) *etc.*, or where the dog sleeps, were found to be significantly associated with any of the symptoms displayed within this population. That is not to say that these factors do not exacerbate or even initiate the inappropriate behaviour, merely that the absence of comparative data from similar dogs not displaying symptoms problems inhibits the confirmation or otherwise of such observations.

Part II

BEHAVIOURAL ASSESSMENT OF DOGS IN RESCUE CENTRES (I)

POTENTIAL INDICATORS OF GENERAL BEHAVIOURAL PROBLEMS

3.1 *Introduction*

To guard against the risk that rescued animals are homed into unsuitable environments many rescue organisations now interview prospective owners before allowing them to adopt an animal; furthermore some carry out a home visit to establish where and how the animal will be housed. In spite of these precautions, return rates remain higher than is deemed acceptable (approximately 9% in Blue Cross centres (Bailey, 1991) and 19% in RSPCA shelters (Ledger *et al.* (1995)). Unfortunately it is still extremely common for people to select animals, in particular dogs, on their appearance alone. In many cases the outcome is an owner burdened with a pet which has habits they neither like nor wish to tolerate. The need for an additional process whereby owners can be matched with dogs of suitable temperaments prior to adoption has therefore been recognised for some time.

A substantial proportion of the animals which pass through animal shelters are given up or returned because they display behavioural disorders[1]. Diagnosis of incipient behaviour problems whilst in a shelter would facilitate the dog-owner matching process and permit the provision of precisely targeted advice. Several attempts have been made to produce such a method of assessment yet so far all have proved to be unworkable for one reason or another. Van der Borg *et al.* (1991) published a comprehensive assessment procedure covering a range of strategies for diagnosing potential problems and although this revealed a high predictive value in those developing subsequent inappropriate behaviour, each dog took an average 90 minutes to test, making it unsuitable as a routine instrument. Other less widely disseminated procedures have not been formally validated and may rely on a high degree of skill in the interpretation of behaviour on

[1] Bailey (1991) states that 33% of dogs in Blue Cross rescue centres over the period 1990/1991 were given up for adoption as a result of a known behaviour problem.

the part of the tester. Furthermore, preliminary results from the evaluation of a temperament test in RSPCA shelters (Ledger *et al.*, 1995) have revealed that where the same dog has been returned to the RSPCA on two occasions by successive owners, only 18% of owners cited the same behavioural problem as the reason for returning the dog. This suggests it is not only the underlying temperament of the animal which dictates its behaviour in a new home, but that the perception of a behavioural problem differs between households and/or that these households may vary in the presence of specific stimuli which elicit particular types of problematic behaviour.

The aim of this study was to devise and implement a general test of potential problem behaviour in kennelled rescue dogs as a preliminary to developing a specific test of separation behaviour. The constraints of a reliable and practical test demand that it should be both brief and standardised, yet easily interpretable by the (relatively) untrained eye. To be reliable, the procedure would require any dog to react in an identical manner to the person carrying out the assessment. Anecdotal evidence and two single published accounts (Lore & Eisenberg, 1986; Hennessy *et al.*, 1997) suggest that dogs react differently to male and female testers. The two testers selected to carry out the assessments for this study were therefore of different sex to generate a maximum variation in response from each animal: test elements in which a given dog responded similarly towards both testers would therefore be likely to be robust.

3.2 *Method*

A test was constructed taking into consideration various elements of existing temperament tests, both published and unpublished, in collaboration with a Universities Federation for Animal Welfare (UFAW[2]) working party (see ***Appendix B)***. Over a period of three months during the summer of 1994, this test was put into practice on a random sample of dogs housed at the Southampton Blue Cross Adoption Centre, Hedge End, Southampton.

2

UFAW is an internationally recognised scientific charity which aims to improve the welfare of animals kept on farms, in laboratories, in zoos, in the wild and as pets. Their aims are to promote and support research into the physical and psychological needs of animals, to publish and distribute this information to educate and advise those who are responsible for animals.

3.2.1 *Blue Cross policies and routines*

3.2.1.1 *Admission procedures*

The majority of dogs taken into the Blue Cross have been given up for adoption by their owners. In such circumstances, background details of the animal are taken including: the age, sex and breed of the dog; why the current owners wish to have it adopted; brief details of the animal's behaviour towards dogs, cats, children, livestock and strangers; whether the dog travels well; whether or not it can be groomed; can it be let off the lead safely; can food be taken away from it; whether or not it is house-trained; how long it is used to being left for and its behaviour on being left; details of reproductive seasons (if applicable), worming and vaccination; any medical history; the type of housing the animal has been used to living in and how many people it has lived with. The length of time the dog has been with the present owner, the number of previous homes the dog has had and whether or not it is a returned adoption are also noted as a matter of routine.

In addition, the Blue Cross admit stray dogs for homing from various sources. At the Hedge End shelter, Southampton these are: Warren Avenue kennels (Southampton), Winchester County Council, Eastleigh dog warden, New Forest dog warden, local police stations, and occasionally other rescue centres. In most cases the strays have already been held for the mandatory seven day period and are accepted for immediate adoption; however, if they arrive prior to the holding period, they are retained for owner reclamation for the seven day period.

Following admission, all animals are examined by a veterinary surgeon for their general health condition and if necessary prescribed treatment/ surgery. It is Blue Cross policy for all animals to be neutered prior to adoption and arrangements are made for the required surgery to be performed.

3.2.1.2 *Daily kennel routine*

The rescue centre daily practice consists of cleaning from 8.00am - 10.00am which is followed by feeding (special diets given where necessary) for those dogs which require meals twice daily.

The shelter opens to the public from 10.00am to 3.00pm on weekdays and from 10.00am - 1.00pm

on Saturdays and Bank holidays. The shelter is closed to the public on Sundays. During these hours, and until staff depart, the animals are exercised (by both staff and volunteers), groomed and trained if necessary. Particular attention is paid to any difficult or aggressive animals.

At 3.00pm, the animals are once again fed. At 4.30pm, the kennels are cleaned and the guillotine hatch lowered to restrict the dogs to the indoor kennel area overnight. If any dogs require medication, this is also administered at the time of feeding.

On completion of cleaning and feeding, the kennel blocks are locked and the staff depart (at approximately 5.00pm).

3.2.1.3 *Adoption policies*

On arrival at an adoption centre, all visitors are asked to complete a questionnaire pertaining to their home situation (other pets, number and ages of children, previous experience of dog ownership, accommodation details, how long the animal is likely to be left alone for, whether everyone in the house is happy to home a dog) and the type of dog/puppy they are looking for.

If this is completed satisfactorily, visitors are then invited to enter the kennel area and view the occupants. Basic details of the dog's behaviour in social situations (if known) are displayed on each kennel, together with reservation cards if appropriate. If visitors express an interest in one or more animals, staff are able to provide them with additional information from the admission forms and from experience gathered during the animal's stay at the shelter. At the staff member's discretion, a reservation may then be made on a particular dog. Arrangements can then be made for the potential adopters to take the animal home for a day/overnight stay before any commitment is made. In some cases, particularly with known problem or difficult animals, a trial period of up to six weeks is advised before the adoption is completed. Before any adoption is confirmed, a home visit is made by one or members of the Blue Cross staff to assess the suitability of the potential home for a particular dog. Once the home as been passed as suitable, only then may the adoption *per se* go ahead.

At the time of adoption, all new owners are asked to sign an agreement with the Blue Cross and are supplied with an adoption package (contains details of food, insurance, veterinary care *etc.*). They

are also given advice regarding the behaviour of dogs in general, the individual animal if deemed necessary, how to prevent problems and what to do if problems arise. A video detailing both normal and inappropriate behaviour is loaned for a fixed period and a leaflet specifically targeting separation problems supplied.

Once the dog has been adopted, a prospective home visit is arranged for approximately four weeks hence. This provides both the adoption centre and the new owners with the opportunity to evaluate the success of the adoption and to discuss any difficulties that have arisen. In collaboration with an APBC member, the Blue Cross offers a free behavioural consultation service for any animals which are displaying behaviour approaching "problem" level. In some instances, attendance at the behaviour clinic may have been stipulated at the time of the adoption for known problem individuals. Unfortunately despite the efforts made to ensure the success of each adoption, approximately 9% of animals are returned to the rescue centre.

3.2.2 *Components of the assessment test*

The test performed and scoring system can be found in ***Appendix B.***

Stage 1 - **Kennel Test**

The tester first approached the kennel where the dog was housed, and squatted down at the front of the kennel, initially making no verbal, visual or tactile communication with the dog but noting its reaction to the presence of the tester. Casual intermittent eye contact (*not* sustained eye contact) was then made with the dog before the tester put his/her fingers through the bars of the kennel and moved them around, in attempt to stimulate/maintain the dog's interest. At all stages the position of the dog in the kennel was noted along with any tail and ear movements, vocalisations, and specific reactions to the tester's hand.

Stage 2 - **Walk Test**

The tester entered the kennel, leashed the dog and walked it out of doors on a standardised route to another room away from the kennel block. The dog's reaction to being leashed was taken into account as well as the manner in which it walked through the kennel and on to the main site; any

eliminatory behaviour was also recorded. *Figure 3.1* depicts a plan of the Blue Cross site together with the route taken to the test room.

Stage 3 - **Room Test**

The room selected for behavioural assessment was located several metres away from the kennel block in one of the catteries (*Figure 3.2*). The animals being tested had no audio or visual contact with conspecifics either on the way to the room or whilst in it. The room itself contained a table, chair, a blanket placed on the floor, and a toy. The test room measured: approximately 3.0m x 4.0m, contained two doorways and no windows.

i) On arrival at the test room, the dog was released from the lead and allowed to explore the room at will for 5 minutes. In the meantime, the tester sat quietly and observed the dog without encouraging any interactive behaviour.

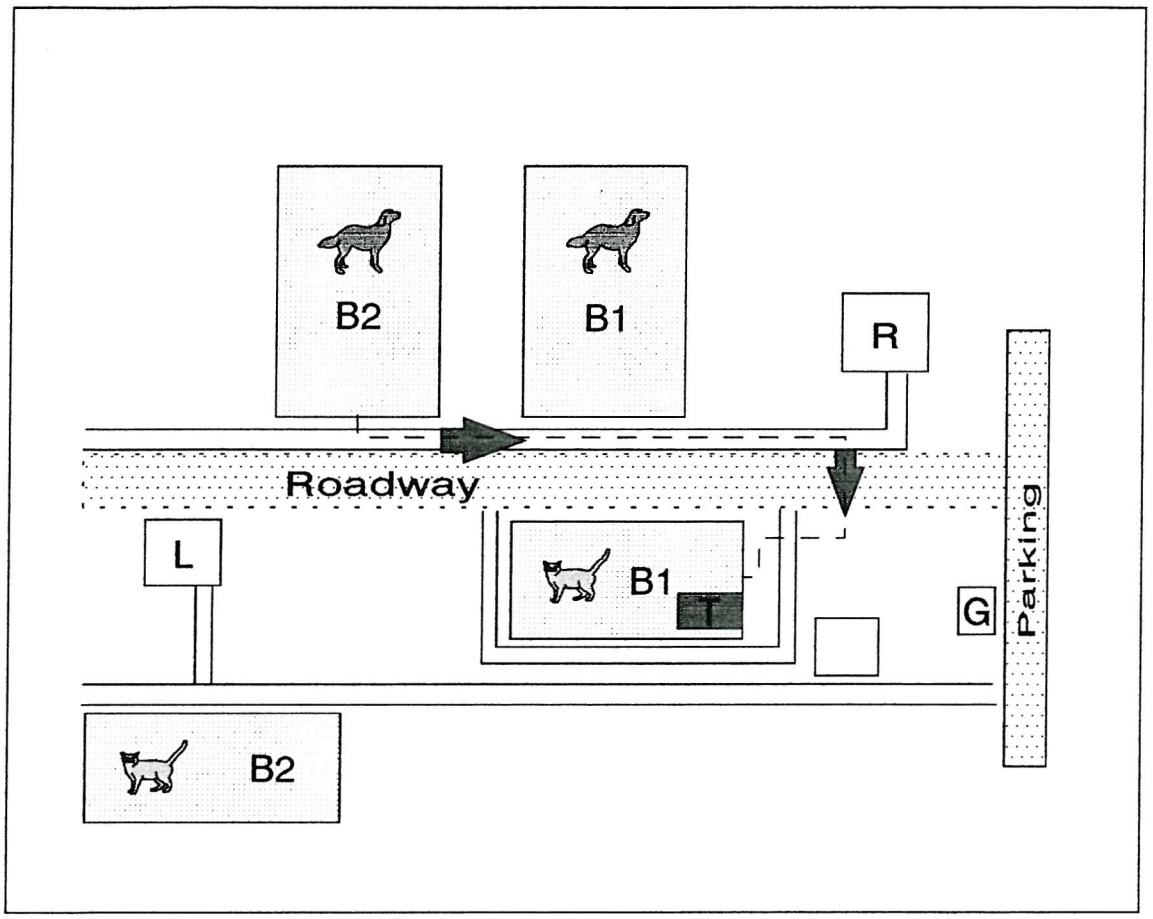
ii) After 5 minutes, the tester called the dog by name, commanded it to sit, and gave the dog a food treat. The dog was then briefly petted before being groomed with a soft brush in a methodical manner.

ii) The dog was offered a further item of food and subsequently left alone in the room for five minutes. Before departing the area, the tester switched on a strategically placed video camera (*PHILLIPS EXPLORER VHS CAMCORDER, VKR6855*) to record the dog's reaction to the impending period of separation. The tester remained within audio contact of the room to obtain gross measurements of vocalisations[3].

3

Although it may have been useful to incorporate an open field test (as in Von Borrell, 1991) as a measure of reactivity at this stage, in practice the use of such tests is limited for companion animal behaviour studies, particularly in the absence of physiological measures. The aim of this part of the test was to leave the dog in an environment similar to that provided in the *home* situation, therefore the complete absence of sensory stimuli as in an open field test would have been wholly inappropriate. In addition, given the restricted facilities available at the rescue centre and the powerful olfactory stimuli provided by test subjects, it would have ben impractical to perform such a test.

Figure 3.1 Plan of the Blue Cross site illustrating the test room location and standardised route taken.



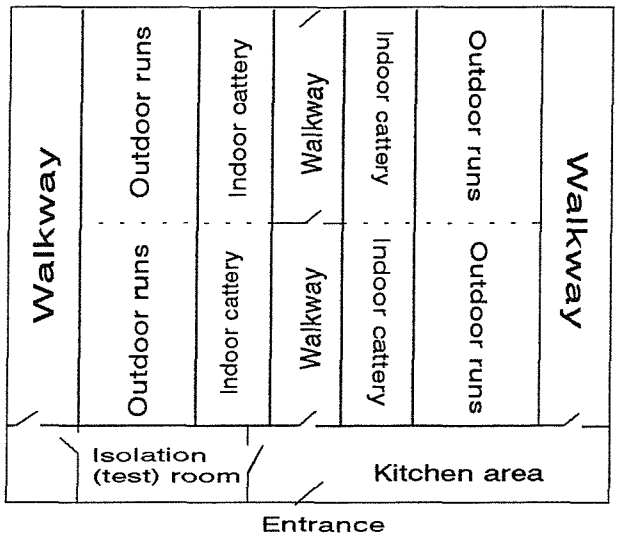
T Test room
B1 Block 1
R Reception
G Garage
B2 Block 2
L Laundry

Standard route

Kennels

Cattery

Figure 3.2 Plan of cattery 1



Stage 4 - **Reaction to conspecifics**

Once the tester had returned to the room, the dog was once again leashed and walked back to the kennel block. On entering the shelter, the handler paused for a few seconds in an area where all kennels were occupied to test the dog's reaction to unfamiliar conspecifics.

Stage 5 - **Reaction to (now familiar) handler when threatened**

The dog was returned to its kennel and the lead removed. The handler then left the kennel and spoke quietly to the dog for 10 seconds before making direct eye contact, standing up abruptly and shouting at the dog.

No attempt was made to standardise the handlers' clothes or appearance throughout testing.

3.2.2.1 *Measurements scored and method of recording*

Full details of behaviours recorded may be found in ***Appendix B*** along with the scoring system used for each measurement. *Table 3.1* displays an ethogram of some of the behaviours used in the scoring of individual responses to test situations.

Table 3.1 Ethogram of behaviours scored

Behaviour	**Description**
Approach	Movement of the animal towards the front of the kennel / person / dog
Unreactive	Absence of any visible response to presenting stimuli
Retreat	Movement away from presenting stimuli (person / dog)
Pawing	Raising of one foreleg towards the bars of the kennel / person, not necessarily making physical contact
Jumping up	Complete or incomplete elevation of dog from kennel floor in attempt to make contact with person
Standing over	Raising of both forelegs onto the bars of the kennel, where the dog maintains this elevated position over the tester. Position associated with dominance posture
Cringe	Adoption of a lowered body posture, usually accompanied by tucked tail, avoidance of eye contact, lip licking and ears back. Position associated with submission / fear
Shivering	Rapid, involuntary muscle spasm
Follow fingers	Maintenance of interest in tester's fingers (visual contact / tactile contact)
Ear position	Position of the animal's ears in relation to horizontal plane, i.e., forward, back,
Tail position	Position of tail in relation to vertical plane, i.e., up, neutral (relaxed), tucked
Tail movement	Presence or absence of tail movement
Avoid eye contact	Reluctance of animal to reciprocate eye contact with tester, often accompanied by movement of head away from human eye contact
Leans into hands	Presentation of torso towards kennel bars in an attempt to make physical contact with person
Presents rear end	Presentation of rear end only towards tester

Behaviour	Description
Settled (in room)	Sitting or lying down in a particular area of the room
Shake (groom)	Shaking of entire body in response to grooming
Mouth brush	Clasping and closing of mouth around the brush
Mouth person	Clasping and closing of mouth around person's hand during grooming
Greeting	Approach / tail movement / vocalisation / attempt contact with tester following period of separation
Stand alert	Adoption of an erect posture (usually with raised tail) in response to conspecific interaction

All behaviour in the kennel and throughout the standard walk was recorded at the time of testing on a specifically designed check sheet. Measurements made within the room were also recorded on this sheet although obviously only qualitative measurements of separation behaviour could be obtained by this method. A full analysis of the video recordings made during the separation phase was carried out at a later date.

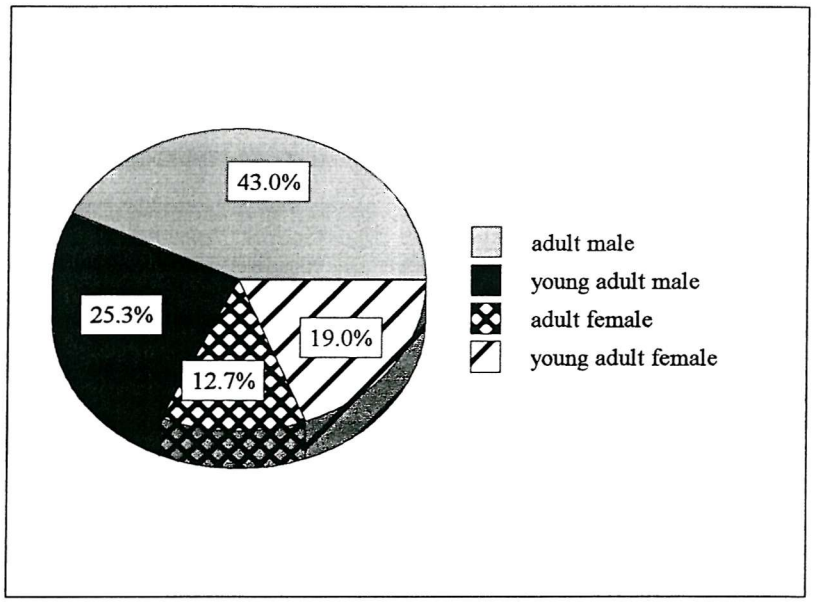
3.2.3 Test subjects

A total of 79 dogs aged at least 6 months were tested over an eight week period. All dogs were housed singly and had been at the shelter for at least 48 hours prior to testing. All testing took place following closure of the centre to the public and after the departure of centre staff; this permitted minimum distraction to the dogs and allowed a certain level of environmental standardisation. Prior to testing, all animals had been fed and restricted to the indoor kennel area only. Each dog was tested twice, once by the female tester (aged 38) and once by the male (aged 27), on different (preferably consecutive) days in the same week, the order of testing being varied between the two observers. Each assessment took no longer than 20 minutes to complete.

3.2.3.1 *Age/sex distribution of animals tested*

54 of the dogs tested were male and 25 female. The age category of the subjects was split into young adult (less than 25 months) and adult (25 months or older). The most common age/ sex category was adult male (34) followed by young male (20), young female (15), and finally adult female (10) (see *Figure 4.3)*. The sexual status of the animals was not included for investigation due to the neutering policies of the centre.

Figure 3.3 Age/sex distribution of subjects



44% of the sample were two years of age or less.

3.2.3.2 *Breed/breed type*

Unless the breed/breed-type of the animal was specifically stated on charts within the kennel block, breed description was largely left to the discretion of the testers. Inevitably, a high level of subjectivity ensued, particularly since the majority of subjects were cross-bred. It was therefore inappropriate to perform any statistical analysis relating specifically to breed, although some general observations of breed/breed-type are discussed later.

3.3 *Results*

3.3.0 *Summary of statistical analysis*

Initial analysis focussed on evaluating the level of inter-observer reliability. Spearman's rank correlation coefficient and Kappa coefficient tests were used to find the level of agreement between behaviours observed by the two testers. Those variables found to be sufficiently reliable, were then subject to Principal Factor Analysis (with varimax-rotation) to identify underlying linear combinations of variables accounting for most of the variance. The eight factors generated were subsequently modified to *composite measures* which could be used to examine the effects of various independent variables in both this and subsequent studies.

The reliability of the composite measures between tests was examined using Spearman's rank correlation coefficient (as a means of re-assessing the reliability of the tests) and Wilcoxon signed rank test to compare median scores.

Finally, the effect of various independent variables on each of the ten composite measures was investigated using multifactor ANOVAs (MANOVAs).

3.3.1 *Variable scoring and inter-observer reliability testing*

A total of 121 measurements was recorded for each dog. The majority of behaviours were scored for their presence/absence (on a 1/0 scale) with a small number being scaled according to the

intensity of behaviour being displayed. The full scoring system used is illustrated in ***Appendix B***. All score sheets were transcribed into spreadsheet format (*LOTUS 1-2-3 VERSION 2.4*) before proceeding with statistical analysis (using *STATGRAPHICS STSC VERSION 5.0, INC. 1988*).

Twenty-three measures were discarded either because they did not occur at all, or because they were too infrequent to be tested statistically, i.e. they occurred less than 5% of the time. These were:

Occurring during *Stage 1*: raise hackles (tester squatting), raise hackles (with eye contact), raise hackles (with fingers present), jump up (tester squatting), jump up (fingers), cringe (tester squatting), cringe (eye contact), cringe (fingers), retreat (eye contact), yawn (tester squatting), yawn (eye contact), yawn (fingers)

Stage 2: defecation during walk

Stage 3: growling during grooming, growling during separation, movement of blanket, movement of chair, movement of toy, urination during separation, defecation during separation, vomiting during separation

Stage 4: whining in response to conspecifics, cringing

Two infrequent measures, bite (tester) and growl (towards conspecifics) were retained for further analysis because of their potential value in predicting problems of aggression. In addition, growling at the handler was maintained as an indicator of aggression but with all three individual variables summed across all stages of the test to generate one combined measure.

For the remaining variables, inter-observer reliability was tested using kappa (κ) coefficients for the presence/absence measures and Spearman rank correlations for scaled measures with three or more points (Martin & Bateson, 1993). The kappa coefficient is a specifically designed measure for assessing observer reliability. Kappa takes into account both categorical agreements regarding the occurrence of each behaviour as well as allowing for chance agreements between observers.

$$\kappa = (O-C)/(1-C)$$

where, O = the observed proportion of agreements; and C = the proportion of agreements that can be accounted for by chance.

Since none of the measures exceeded the preferred 0.7 level of reliability (Martin & Bateson, 1993), frequency distribution histograms of correlation values and kappa values were constructed to assist with the determination of arbitrary significance levels (see *Figures 3.4* and *3.5*). On examination of these histograms, $\kappa > 0.3$ and Spearman $\rho > 0.4$ were selected as arbitrary threshold levels of significance.

Figure 3.4 Frequency distribution histogram of kappa coefficient values

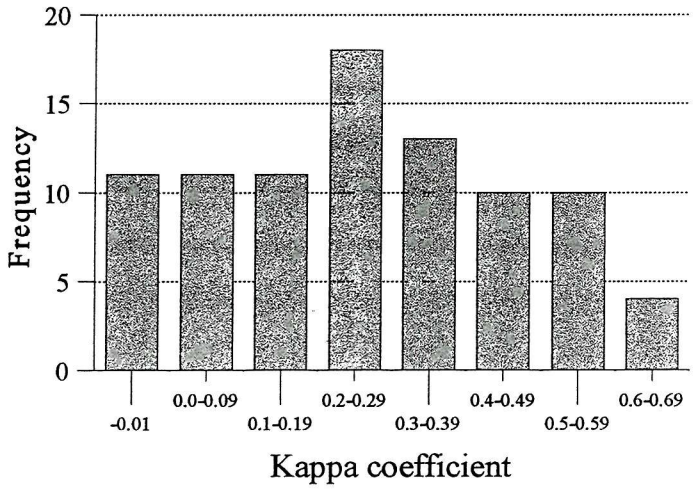
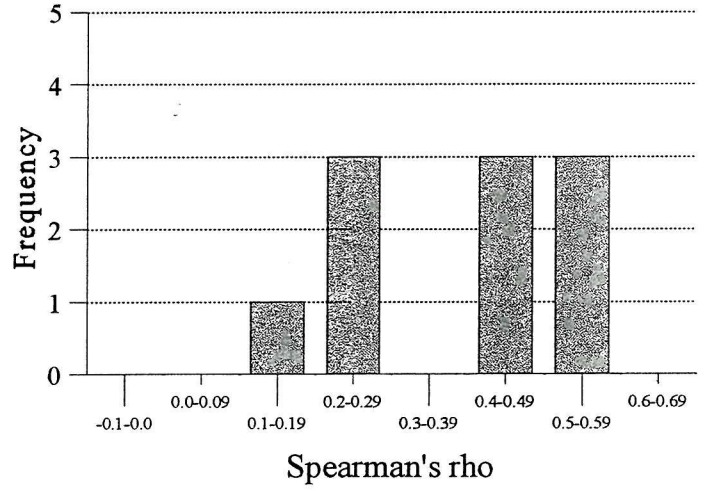


Figure 3.5 Frequency distribution histogram of Spearman's correlation coefficient values



54 measures were eliminated due to low reliability between observers (κ <0.3; Spearman ρ<0.4).

3.3.2 *Multivariate statistics*

The scores for the remaining 44 measures were averaged for the two testers and subject to Principal Components Analysis and Factor Analysis. The latter technique is used to reduce the complex relationships that can exist between a large number of variables in a data set by finding linear combinations of those variables that account for most of the variance in the original measures. A considerably smaller number of underlying *factors* are thus generated. Using this procedure, nine components with eigenvalues greater than 1.0 were isolated and retained for additional investigation. Varimax-rotated Factor Analysis was then used to correlate the groups of measurements further and align each variable with one factor only. The maximum weighting (irrespective of sign) for each factor was halved; all variables with weights exceeding this 50% threshold, again irrespective of sign, were used for interpretation of each factor (*Table 3.2*).

A number of the measures were weighted on more than one factor despite using varimax rotation which should eliminate this as far as possible. In each case the numerical value of each disputed measure in relation to the other values constituting a specific factor was considered. The nature of the variables comprising a particular factor were also taken into account before allocating the measure to the most appropriate factor. The values highlighted in bold are those which are considered most appropriate to each factor. The allocation of measures to factors can be found in *Table 3.3.*

Table 3.2 Varimax rotated factor matrix. Only weightings representing more than 50% of each factor's maximum value are shown. Figures highlighted in bold indicate variables retained in the generation in the of composite factors

Variable	1	2	3	4	5	6	7	8	9
abark1					**0.550**				
awhine1				**0.549**	0.326				
apaw1				**0.555**	0.456				
ashiv1						**0.900**			
atail_p1	**0.764**								
atail_m1		**0.662**							
aapp2		**0.791**							
abark2		0.459			**0.551**				
apaw2		0.489			**0.500**				
ast_ov2		**0.610**							
ashiv2						**0.882**			
aear_p2		**-0.569**							
atail_p2	**0.827**								
atail_m2		**0.746**							
atail_p3	**0.897**								
atail_m3	**-0.661**								
ab_fing								**0.774**	
al_fing		**0.419**							
af_fing		**0.501**							
bscent							**0.869**		
bfreq_sm							**0.834**		
bleave_k									**0.716**
bbark					**0.563**				
bjump					**0.586**				
cfreq_sm							**0.596**		
csit									**0.640**

Variable	1	2	3	4	5	6	7	8	9
cm_brush								0.395	
cno_mins				0.860					
cbark					0.370				
cwhine				0.765					
cjump				0.599	0.366				
cgreet		0.456		0.413					
dbark			0.809						
dgrowl_d			0.693						
dlunge			0.854						
dunreact			-0.712						
dtail_p	0.523		-0.409						
dtail_m			0.397						
ebark					0.421				
etail_p	0.767								
growl_tp								0.756	

Table 3.3 Behavioural measures and their associated abbreviations
In all cases a letter used as prefix represents a particular part of the assessment test, i.e., a = stage 1; b = stage 2; c = stage 3; d = stage 4; e = stage 5

Abbreviation	Measure
abark1	barking whilst tester squatting by kennel
awhine1	whining whilst tester squatting by kennel
apaw1	pawing whilst tester squatting by kennel
ashiv1	shivering whilst tester squatting by kennel
atail_p1	tail position whilst tester squatting by kennel
atail_m1	tail movement whilst tester squatting by kennel
aapp2	approach during eye contact
abark2	barking during eye contact
apaw2	pawing during eye contact
ast_ov2	standing over on hind legs during eye contact
ashiv2	shivering during eye contact
aear_p2	ear position during eye contact
atail_p2	tail position during eye contact
atail_m2	tail movement during eye contact
atail_p3	tail position whilst fingers present
atail_m3	tail movement whilst fingers present
ab_fing	biting tester's fingers
al_fing	licking tester's fingers
af_fing	following tester's fingers
bscent	scent marking
bfreq_sm	frequency of scent marking
bleave_k	behaviour on leaving the kennel
bbark	barking when walked
bjump	jumping at the handler when walked
cfreq_sm	frequency of scent marking
csit	sitting on command

Abbreviation	Measure
cm_brush	mouthing the brush during grooming
cno_mins	number of minutes during which noises occur
cbark	barking during separation
cwhine	whining during separation
cjump	jumping up at the door
cgreet	greeting on reunion
dbark	barking at conspecifics
dgrowl_d	growling at conspecifics
dlunge	lunging at conspecifics
dunreact	unreactive towards conspecifics
dtail_p	tail position
dtail_m	tail movement
ebark	barking in response to threat by handler
etail_p	tail position
growl_tp	growling towards handler at any stage

Table 3.4 Behavioural measures loaded positively on each of eight varimax-rotated principal factors. Descriptors of measures loaded negatively have been reversed.

Factor	Measures
1.	Tail position (up) towards observer at stage 1 (during squatting, casual eye contact and finger test) Absence of tail movement during fingers test (stage 1) Tail position (up) in response to conspecific Tail position (up) in response to threat by handler
2.	Approach tester (stage 1, casual eye contact) Tail movement (stage 1, squatting & casual eye contact) Standing over tester (stage 1, casual eye contact) Ear position (back) (stage 1, casual eye contact) Following fingers (stage 1) Licking fingers (stage 1)
3.	Lunge Bark Growl Tail movement (All occurring during stage 4)
4.	Timing of noises during separation Whining during separation Jumping at the door during separation Greeting following separation Pawing (stage 1, observer squatting) Whining (stage 1, observer squatting)
5.	Jumping up at the handler (stage 2) Barking (at stage 1, both during squatting & eye contact; stages 2, 3, & 5) Pawing (stage 1, eye contact)
6.	Shivering (stage 1, squatting & eye contact)
7.	Frequency of scent-marking (stages 2 & 3)
8.	Biting fingers (stage 1) Growling towards observer at any stage Mouthing the brush during grooming

Factor analysis generates factors unique to each data set that is analysed. In order to facilitate behaviour scoring in any repetitions of this assessment test, and for an evaluation of its predictability, composite factors were generated. These eight composite factors were calculated from the combinations of variables comprising individual varimax rotated factors, with each variable rescaled to give each equal weight within the composite factor.

3.3.2.1 *Composite factor generation*

Factor 1 *Tail position (up)*

Average of four tail positions (each scaled 1-3), three whilst in the kennel, one in response to threat by the handler:

avg(atail-p1 + atail-p2 + atail-p3 + etail-p)

Factor 2 *Affiliative, interactive during eye contact*

Approach during eye contact (1/0)
Tail movement during eye contact (1/0) **(aapp2 + atail-m2 + ast-ov2) - ear-p2**
Standing over during eye contact (1/0)
Ear position (back) during eye contact (1/0)

Factor 3 *Aggressive to conspecifics*

Behaviour towards conspecifics:
Growling (1/0), barking (1/0), lunging (1/0) and tail movement (1/0) towards other dogs:

avg(dgrowl-d + dbark + dlunge + dtail-m)

Factor 4 *Reacting to separation*

Number of minutes in which noises occurred during separation (0-5)
Whining during separation (1/0)
Jumping at the door during separation (1/0)
Greeting following separation (1/0) **avg[(no. mins/5) + cwhine + cjump + apaw1 + awhine1 + cgreet1]**
Pawing during squatting (1/0)
Whining during squatting (1/0)

Factor 5 *Contact-seeking*

Barking in kennel during squatting (1/0)
Barking in kennel during eye contact (1/0)
Barking when walked (1/0)
Barking during separation (1/0) **avg(abark1 + abark2 + bbark + cbark + ebark + bjump + cjump + apaw1 + apaw2)**
Barking in response to threat by handler (1/0)
Jumping up when walked (1/0)
Jumping at the door during separation (1/0)
Pawing in kennel when ignored (1/0)
Pawing in the kennel during eye contact (1/0)

Factor 6 *Shivering*

Average of two measures of shivering in the kennel (each 1/0):

avg(ashiv1 + ashiv2)

Factor 7 *Scent-marking*

Average of two scent-marking variables: **avg [(bfreq-sm/5) + (efreq-sm/5)]**

Factor 8 *Aggression to handler*

Average of three variables relating to aggression (each 1/0):

avg(ab-fing + growl-tp + cm-brush)

All subsequent analyses were performed on these composite factors in preference to the original factor scores.

3.3.3 *Internal validity testing*

The measures loaded on each factor were combined together for each observer and an internal validity test for reliability applied. The correlations between the scores recorded by each observer were examined using Spearman's rank correlation coefficient. The inter-observer reliabilities for these eight composite factors were all greater than 0.55 (Spearman ρ), except

measure 8 ($\rho = 0.39$) which was only scored for 15 dogs by either observer (*Table 3.4*).

Table 3.5 Inter-observer reliabilities for each of the eight composite factors

Factor	Spearman's rank correlation
Tail position (up)	0.58
Affiliative, interactive during eye contact	0.60
Aggressive to conspecifics	0.57
Reacting to separation	0.73
Contact-seeking	0.67
Shivering	0.62
Scent-marking	0.60
Aggression to handler	0.39

Median values for each observer on each composite measure were then calculated (via Wilcoxon signed rank test for a comparison of two paired samples) and found to be very similar, except for Factor 2, in which the male tester scored slightly higher than the female. (*Table 3.5*).

3.3.4 *Effect of independent variables*

Once the level of inter-observer reliability had been evaluated, the effects of the sex of the dog; age of the dog; and the order of testing were assessed for each factor. A multi-factor analysis of variance (ANOVA)[4] was used to estimate the effect of each of these independent variables, as well as the interaction of age and sex (*Table 3.6*).

[4] Parametric ANOVA was used on this data, despite its non-normal distribution, because of its power in examining several independent variables simultaneously. Square root, log and rank transformations did not consistently improve the normality of the composite factors; hence ANOVA was performed on the raw data

Table 3.6 Median values for composite measures, male and female observers compared.

Factor	**Scale**	**Median value** (female observer)	**Median value** (male observer)
Tail position (up)	1-3	2.00	2.00
Affiliative, interactive during eye contact	0-3	0.33	0.67
Aggressive to conspecifics	0-1	0.25	0.25
Reacting to separation	0-1	0.47	0.50
Contact-seeking	0-1	0.11	0.11
Shivering	0-1	0.00	0.00
Scent-marking	0-1	0.00	0.00
Aggression to handler	0-1	0.00	0.00

Table 3.7 Significance levels for independent variables generated using multi-factor ANOVA (1 degree of freedom in each case). Those figures in bold are significant at the 5% level.

Factor	**Age**		**Sex**		**Age/sex interaction**		**Day**	
	F-ratio,	**p value**	**F-ratio,**	**p value**	**F-ratio,**	**p value**	**F-ratio,**	**p value**
1	0.773	0.390	0.197	0.663	1.077	0.301	0.464	0.504
2	**13.614**	**<0.001**	0.214	0.650	2.105	0.149	0.048	0.828
3	**5.651**	**0.019**	1.140	0.287	0.395	0.538	2.331	0.129
4	**11.463**	**<0.001**	1.593	0.209	0.001	0.982	0.002	0.923
5	**18.406**	**<0.001**	0.196	0.663	**5.053**	**0.026**	0.191	0.667
6	0.391	0.540	**6.178**	**0.011**	0.082	0.778	0.019	0.892
7	1.636	0.203	**9.928**	**0.002**	0.887	0.358	0.101	0.755
8	**6.653**	**0.011**	0.767	0.392	0.421	0.525	0.346	0.564

Factor 2 (affiliative, interactive behaviours) was found to be highest in young adults; similarly, Factors 3 (aggressive to conspecifics), 4 (reaction to separation), 5 (contact seeking behaviours), and 8 (aggression to handler) were also higher in the young adult population (*Table 3.7*). Factor 6 (shivering) proved to be sex-linked, females displaying the behaviour significantly more than males (*Table 3.8*). The only other factor significantly influenced by sex was Factor 7 (scent marking) which, not unexpectedly, was mainly accounted for by male dogs (*Table 3.8*). One significant result was produced by the effect of an interaction of age and sex - adult females generally scoring *lower* on Factor 5 (contact seeking behaviour) (mean 0.089) than any of the other three age/sex combinations.

The order of testing did not generate any notable differences in the behaviour of the dogs, i.e. they tended to behave in the same way during the second test as during the first.

Table 3.8 Composite factors affected by age group

Factor	**Young adult mean (± se)**	**Adult mean (± se)**
Affiliative, interactive during eye contact	0.51 (0.06)	0.31 (0.05)
Aggressive to conspecifics	0.29 (0.04)	0.21 (0.04)
Reacting to separation	0.53 (0.04)	0.39 (0.03)
Contact-seeking	0.26 (0.04)	0.14 (0.02)
Aggression to handler	0.10 (0.03)	0.04 (0.01)

Table 3.9 Composite factors affected by the sex of the dog

Factor	**Male mean (± se)**	**Female mean (± se)**
Shivering	0.08 (0.03)	0.21 (0.07)
Scent-marking	0.13 (0.02)	0.02 (0.01)

3.4 *Discussion*

3.4.1 *Inter-observer reliability*

This study has highlighted the difficulties intrinsic in a test of dog behaviour that relies on interaction with a human handler. Despite the two observers discussing the standardisation of each element of the test prior to assessing the animals, different results were obtained on many elements of the test. In all, only 41 of the original 121 measures proved sufficiently common or reliable to be retained for further analysis. It must be noted, however, that the testers were of different sex and it was not unexpected that this should have had a substantial influence on the behaviour of the dogs. Further studies on the effect of the characteristics of the tester on dog behaviour are required; no firm conclusions can yet be drawn on the effect of the gender of the tester, since in both this study and that of Lore & Eisenberg (1986) only one male and one female were used. Unfortunately using a larger number of testers to evaluate inter-observer reliability generates additional problems including one of an increased likelihood of a significant order effect. Complex incomplete-block designs would therefore be required.

3.4.2 *Factor generation*

The eight composite factors generated relate to quite different groups of behaviour, frequently occurring only during specific test parts. For example, Factor 2 (affiliative, interactive) is derived mainly from reactions to eye contact in the kennel, Factor 3 (reaction to conspecifics) is derived solely from one section, and Factor 4 (reaction to separation) is derived mainly from the separation phase of the room test. On initial examination, Factors 2 and 4 seem to reflect similar forms of behaviour although Factor 2 is directed at the test person, and 4 at the absence of the test person.

Factor 8 relates specifically to overtly aggressive behaviours towards people. Aggression towards the testers was in fact relatively rare, only 15 individuals displaying any aggressive behaviour (incidently 8 were male and 7 female), almost all of these (11) being young adults. Nine of these individuals displayed one aggressive behaviour to one tester only, 5 displayed 2 aggressive behaviours to either tester (four of them male dogs) and one obtained positive scores for aggression on all three measures to *both* testers. This individual, a young adult male German shepherd cross was largely responsible for the generation of Factor 8. One dog, a young adult male Staffordshire

bull terrier cross, appeared to be highly selective in its display of aggression, being scored as aggressive on three occasions towards the female tester but never to the male.

Factor 6 (shivering) proved to be more common in females than males and seemed to be one of the only factors to reveal any specific breed prevalence. Although scored rarely, five of the ten individuals exhibiting shivering were terriers, suggesting that this behaviour is to some extent breed orientated.

One Factor (Factor 4) was of particular relevance to this thesis since it revealed a collection of behaviours relating specifically to a reaction to separation. These involved vocalising and jumping at the door during separation and the exhibition of a greeting towards the tester on reunion, all classic separation behaviours in their own right. In addition, pawing and whining in the kennel following initial approach by the tester was found to be linked with separation behaviours.

3.4.3 *Effect of independent variables*

The age of the subject generated some significant differences in the behaviour being displayed; younger dogs were more likely to show affiliative behaviour (Factor 2), a reaction towards conspecifics (Factor 3), a reaction to separation (Factor 4), increased contact seeking behaviour (Factor 5), and aggression towards the handler (Factor 8). Many of these differences may simply reflect higher levels of general activity in young animals. Females showed a significantly greater incidence of shivering (Factor 6) which had not been predicted at the outset and is of unknown significance. Males displayed a higher level of scent marking (Factor 8) which is species typical (Bradshaw & Nott, 1995). Adult males were least likely to exhibit contact-seeking behaviour (Factor 5).

Young adults were found to score higher than adults in the display of separation behaviour. This is consistent with the higher prevalence of separation problems in young adults (McBride *et al.*, 1995) although, given the very brief time that the dogs had been given the opportunity to affiliate with the testers before being left alone, this link may not be reliable at the individual level (see below).

3.4.4 *Prospective tests*

The analysis of the temperament assessment test for inter-observer reliability indicates that the original version should be restructured. Several of the sections contain elements which appear to provide little reliable information for behavioural profiling. It is therefore tempting, if perhaps unwise, to remove these completely and retain only those parts of the test which include a number of reliable measures. However, it would be inadvisable to assume that because a measure is not reliable, it does not play some role in the expression of subsequent behaviours. The design of any future test should bear in mind both the nature and order of elements of the original test before eliminating them.

Following the assessment of the animals in the rescue shelter, an undergraduate student at Southampton University (Gibb, 1995) contacted the new owners of 50 of the original 79 dogs 4 to 8 weeks after adoption. They were interviewed by means of a telephone questionnaire designed to reveal any behaviours which could be construed as "problematical". It is notable that very few of the owners actually felt their dog's behaviour was a problem but for the purposes of the study the dogs were categorised into one or more possible problem behaviour types. The questionnaire generated seven potential problem areas, one of which included separation behaviour. The occurrence of the seven potential behaviour problems was compared to the eight factors isolated from the temperament assessment test. Unfortunately there appeared to be very little correlation between the behaviour displayed in the rescue centre and that displayed by the dogs in the new home. No significant correlation was found between dogs exhibiting a separation reaction during testing and those showing separation behaviour in the new home. Nevertheless, three measures derived from the temperament test which were found to be significantly associated with the display of separation behaviour in the new home. These were:

(1) a low tail position (related to a low score on Factor 1)
(2) a low level of scent-marking (related to a low score on Factor 7)
(3) a low level of aggression shown to the observer (related to a low score on Factor 8)

Although these are not the measures one would have perhaps predicted, they may indicate a susceptible "personality type" similarly described by Borchelt & Voith (1982) and through anecdotal evidence provided by behaviour counsellors.

Despite the low overall predictive value of the temperament test in this study, it was felt that the three measures described above ought to be retained for use in the development of a further, more specific assessment test. Tail position, scent marking, and indicators of aggression were therefore incorporated into the test specifically targeting animals predisposed to separation problems, which is described in full in ***Chapter 4***.

BEHAVIOURAL ASSESSMENT OF RESCUE DOGS (II)
PREDICTION OF SEPARATION PROBLEMS

4.1 *Introduction*

In a preliminary study of the occurrence of separation problems in dogs rehomed by the Blue Cross, undertaken by an undergraduate student from Southampton University (McBride *et al.*, 1995), the new owners of 197 rescue dogs were contacted 4 to 8 weeks after adoption. Information regarding the household environment and the dog's behaviour was analysed to identify which of the factors examined appeared to predispose dogs to display separation problems. The results provided positive evidence that many animals with separation problems have a strong attachment to a particular person. In addition, those dogs rehomed between the age of six and twelve months were two to three times more likely to exhibit separation problems (this figure included those dogs which were known to be destructive prior to rehoming in addition to those who showed the first signs of separation problems in their new homes). The rate of rehoming, calculated using an index of number of homes / age, showed a weak positive relationship with the development of separation problems.

In this and the following chapter I describe a second study of dogs at the Blue Cross adoption centre, Hedge End, Southampton. Whilst in the shelter, each dog was assessed by means of a test specifically targeted towards the disclosure of potential separation problems, the hypothesis being that the behaviour of the dog whilst in the kennel can predict the probability of its exhibiting separation behaviour following rehoming. The aim of the test was to establish a relationship with each dog over a limited period of time before leaving it alone in a room. Although there proved to be no significantly reliable measures when using the room test during the first temperament assessment test (***Chapter 3***), it was felt that by placing a slightly different emphasis on this part of the test, it might have an important role to play. As Van der Borg *et al.* (1991) noted, one of the major obstacles associated with the prediction of problem behaviour whilst in the shelter lies in the absence of a fundamental dog-owner relationship. Many inappropriate canine behaviours arise

from the type of relationship existing between dog and owner (Voith, 1981; Mugford, 1983); this type of close, perpetuating affinity would be impossible to recreate or even simulate under such circumstances, nor would it be desirable from a welfare point of view. Nevertheless, the development of a relatively superficial relationship may be enough to provide an insight into potentially maladaptive behaviours.

The test comprised the following elements: a modified version of the previously verified temperament assessment test including: i) elements which were suggested as possible predictors of separation problems by the follow-up study; ii) some other measures which were found to be reliable via inter-observer analysis; iii) an expanded period of time spent with each dog in an area away from the kennel environment where novel measurements were recorded. Particular attention was paid to any attention seeking behaviours, separation behaviour and the amount of time spent in contact with or attempting contact with the observer.

4.2 *Method*

All tests took place following closure of the rescue centre to the public and after the departure of centre staff. This permitted minimum distraction to the dogs and allowed a level of environmental standardisation. Prior to testing, all animals had been fed and restricted to the indoor kennel area only. Weekday testing took place from 5.00pm to 8.00pm, weekend testing from 1.00pm to 6.30pm. No more than five dogs were tested in any one day. Each dog was tested twice, preferably on consecutive days, to permit reliability testing. Occasionally it was not possible to duplicate-test within 48 hours; in such instances the repeat test was performed as soon as circumstances permitted. The maximum delay for any test-retest was 10 days, for one individual only.

4.2.1 *Subjects for assessment*

Before testing, a dog had to meet several criteria:

1. The animal must have been resident at the shelter for a minimum of 48 hours, preferably 72 hours

2. The animal must be in good health generally and not be in receipt of prescribed

medication likely to affect behaviour

3. A minimum of 48 hours was allowed following routine surgery

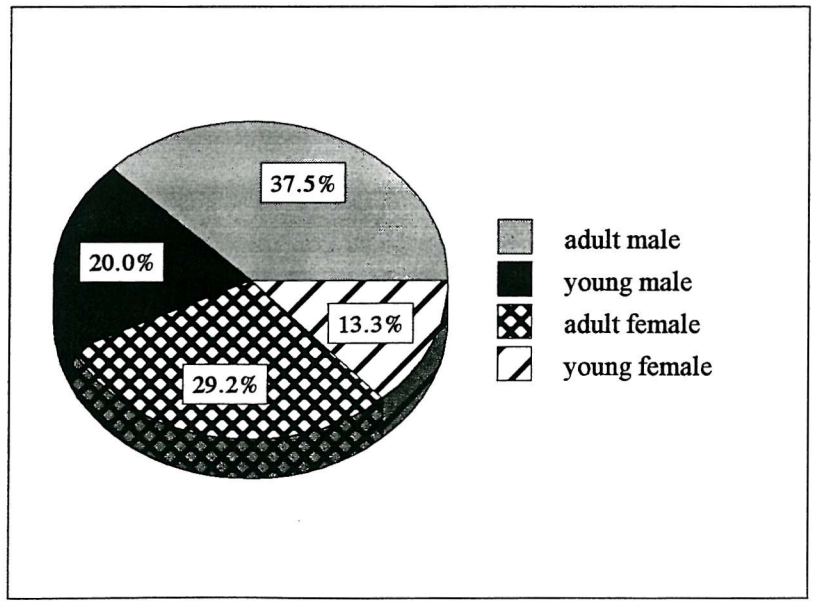
4. Each dog was assessed by a staff member to evaluate its level of aggression. Animals that were scored as highly aggressive, i.e. 4 or 5 on a scale of 1-5, were not tested for personal safety reasons

121 individual animals were tested over a period of six months. 115 of these subjects were retested. Of the six that were tested only once, four were homed before the second test could be performed; the remaining two were not retested due to unreasonable levels of aggression displayed towards the tester during initial testing.

4.2.1.1 *Age/sex distribution of animals tested*

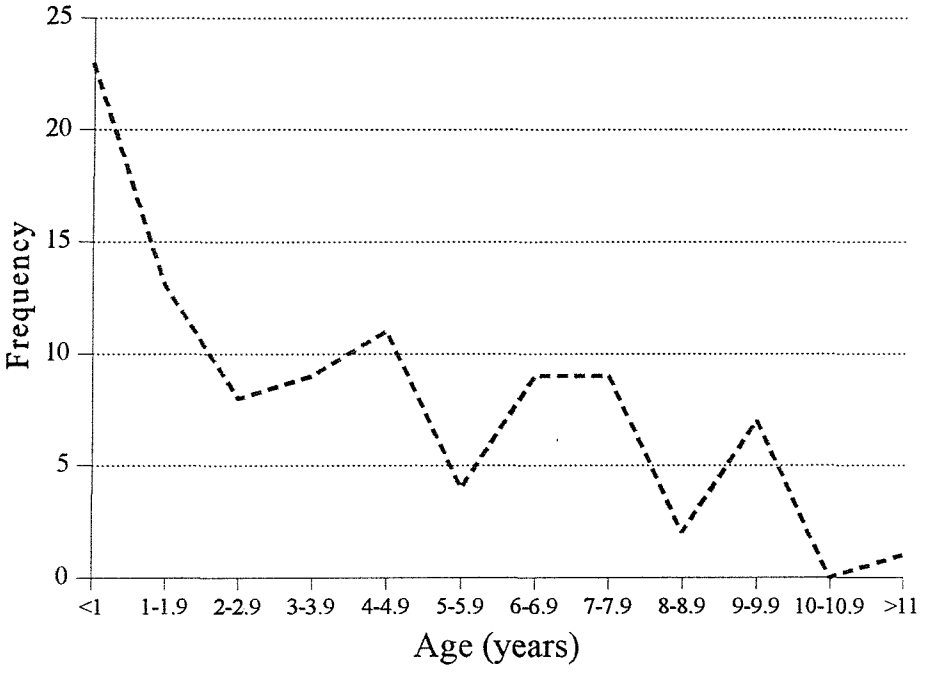
Seventy of the dogs tested were male and 51 female. Thirty-four of the subjects were strays and therefore of unknown age, although it was relatively easy to assess whether or not they were under two years. The age category of the subjects was split into young adult (less than 25 months) and adult (25 months or older). The most common age/sex category was adult male (46) followed by adult female (35), young male (24) and finally young female (16) (see *Figure 4.1)*

Figure 4.1 Age/sex distribution of subjects



A third of the sample were up to two years of age. The youngest dog tested was 20 weeks and the oldest 12 years; the average and median age of subjects was approximately four years. The full *known* age distribution is illustrated in *Figure 4.2*.

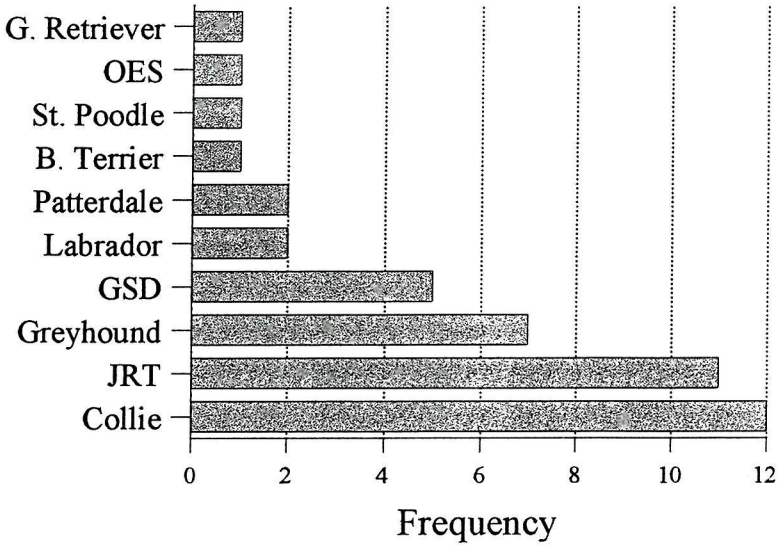
Figure 4.2 Age distribution of 107 subjects



4.2.1.2 *Breed/breed type*

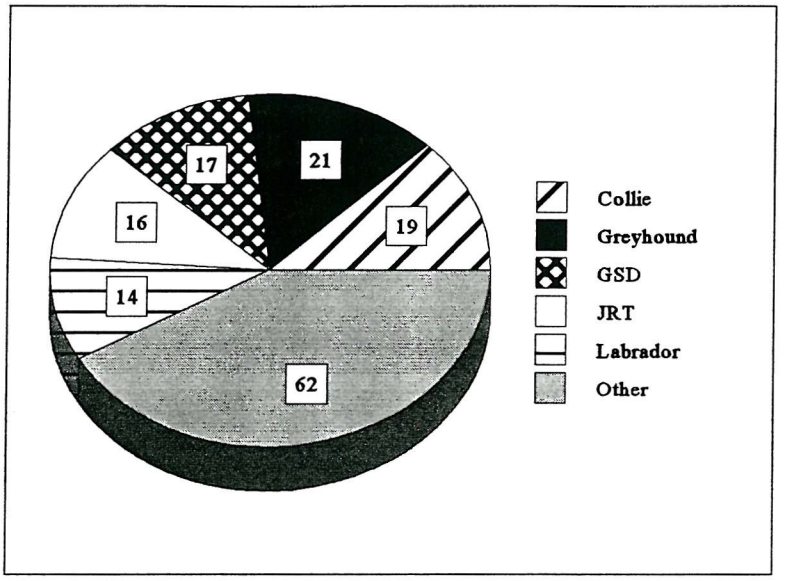
The majority of dogs were cross-bred although 43 were pure-bred representing ten different breeds (see *Figure 4.3*). Representative breeds were: golden retriever (G. Retriever), old English sheepdog (OES), standard poodle (St. Poodle), Border terrier (B. Terrier), Patterdale terrier (Patterdale), Labrador retriever (Labrador), German shepherd dog (GSD), greyhound, Jack Russell terrier, (JRT), Border collie (Collie)

Figure 4.3 Frequency distribution of pure-bred dogs.



Of the non-pure-bred dogs, many were first breed crosses (13), breed crosses or "types" (41). The remainder were described merely as indistinct crosses (14). The vast majority of subjects could be split into types according to their breeding or general morphology. Almost half of the sample fell into one of four types, either collie, greyhound, German shepherd, or Jack Russell terrier. Many dogs were described as being "Labrador cross", although this apparently encompassed a great variety of morphologies, the main criteria seemingly medium size and short hair. *Figure 4.4* illustrates the distribution of various breed types (including pure-bred dogs) within the sample. Unfortunately, due to the absence of accurate breed information for many individuals, it was not possible to perform any statistical operations on these data.

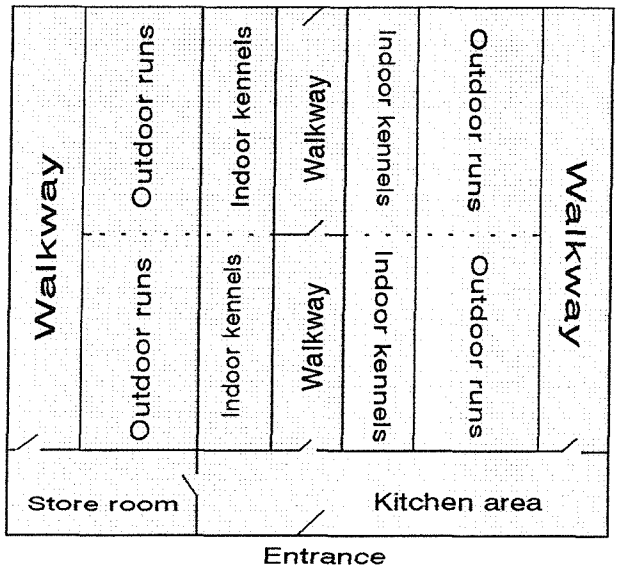
Figure 4.4 Distribution of breed "types" within the entire sample of 121 dogs



4.2.2 *Assessment test*

Each kennel block contained 20 kennels divided into two sections via a doorway across a central walkway (2.2m wide). The majority of dogs were housed individually in kennels consisting of a 1.5m x 2.0m internal kennel connected via a guillotine hatch to a 2.5m x 2.0m external kennel, access to the outside kennel being routinely restricted overnight. For all tests taking place within the occupied kennel block, canine access was limited to the indoor area only. This allowed the animal to be in full view of the tester at all times.

Figure 4.5 Plan of kennel block 2



The full assessment test and method of scoring may be found in ***Appendix C***.

Part a

1. The dog was approached in a non-confrontational manner whilst in the kennel. The tester (myself) squatted alongside the kennel and avoided eye contact with the dog for a 30 second period. Measurements recorded included:

(1) whether the dog approached and if so, the time taken to approach
(2) any vocalisations, including type and frequency
(3) pawing the front of the kennel
(4) the tail position of the dog
(5) the total amount of time spent directing behaviour towards the observer

2. Casual eye contact was then made with the dog for 30 seconds, the above measurements being recorded once again.

3. The dog was then gently spoken to before the tester entered the kennel and leashed the dog. The dog was taken out of the kennel on a standardised route (*Figure 4.6*) to a quiet area of the shelter; recording any scent-marking on the way.

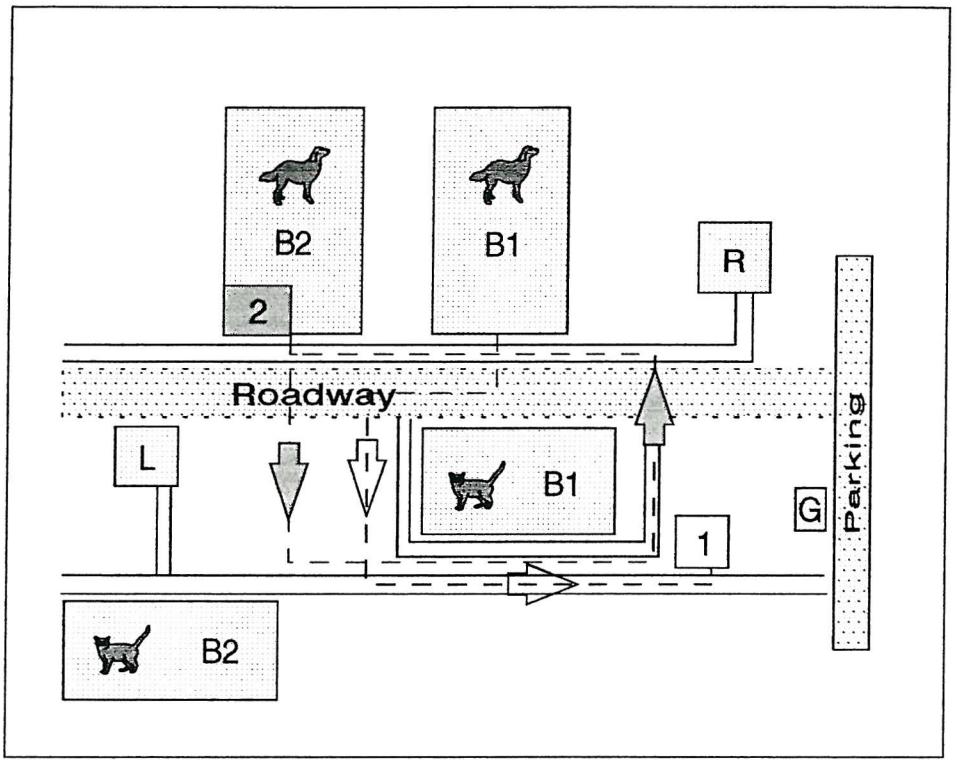
Unfortunately due to the damage caused by one of the individuals under test, the original test room could no longer be used after January 1997 and alternative accommodation was sought. The only other room of suitable size and availability was housed within the second kennel block building (*Figure 4.5*) and inevitably occasional noise distraction ensued.

The physical dimensions of each test room used are outlined in *Table 4.1*.

Table 4.1 Physical dimensions of test rooms 1 and 2

Measurements	**Switch room (1)**	**Store room (2)**
Testing commenced	22 October 1996	25 January 1997
Testing ceased	23 January 1997	15 April 1997
Subjects tested	59	63
Room width	3.0m	3.0m
Room length	5.0m	6.5m
Room height	2.0m	3.0m
No. doors	1	2
No. windows	0	1
Distance from block 1	22.0m (x2)	38.0m
Distance from block 2	19.0m (x2)	32.0m

Figure 4.6 Plan of the Blue Cross site illustrating test rooms and standardised routes taken.



1 Test room 1 2 Test room 2
B1 Block 1 B2 Block 2 Kennels
R Reception L Laundry
G Garage Cattery

Route 1 Route 2

Part b

4. (I) Person present

i) On arrival at the test room, the dog was unleashed and allowed to explore the new environment for approximately 5 minutes, again any scent-marking behaviour being recorded.

ii) An element of play was then introduced to the test. It was felt that to establish a relationship with a dog over a very brief period of time a level of relatively intense interaction was required which could be stimulated by providing the opportunity to play.

A selection of toys (a Ragger®[1], several sized balls, a soft toy, a Kong®[2], and squeaky toys), already present in the room, were offered to the dog and play encouraged. Specific components of play behaviour were not recorded, merely the total amount of time spent engaged in play activity. The period of play allowed was three minutes. Occasionally, individual animals became particularly distressed by the initiation of play behaviour, the increase in human activity and noise of the play objects seeming to induce high levels of nervous and submissive behaviour. In such cases, no further attempt to encourage play was made so as not to jeopardise the establishment of the relationship.

iii) A further five minutes was spent interacting, or encouraging interaction, with the dog by means of talking to and petting the animal. Once again, it was not felt necessary to record specific measurements during this element of the test but simply to establish a general, non-threatening relationship with the dog.

iv) Following this period of "bonding", the tester then moved around the room and noted whether the dog attempted to sustain the social contact. Before leaving the room, each dog was offered a titbit (commercial dog biscuit) and given several audio and visual indications that separation was about to occur. It was hoped that by doing so, the dog would be given the impression that it was about to be *left* as opposed to merely being denied access to the person concerned.

(II) Person absent

v) The tester left the area completely denying the animal either audio, visual, or olfactory communication for a period of five minutes.

(I) Person present

vi) Following this period of separation, the tester re-entered the room and greeted the dog, recording the dog's reaction to the reunion.

5. The dog was leashed and returned via the same route to the kennel block.

---

[1] Short length of multi-coloured entwined rope, knotted at each end

[2] A rubberised, hollow three tiered object

4.2.2.1 *Measurements scored and method of recording*

Full details of behaviours recorded may be found in ***Appendix C*** along with the scoring system used for each measurement. *Table 4.2* displays an ethogram of behaviours used for the scoring of behaviours.

A Dictaphone (*SONY, M-607V MICOCASSETTE RECORDER*) was used to verbally record frequencies of behaviour in the kennel along with a stopwatch (*LORUS, CAL. W941, R23 SERIES*). These measurements were then transcribed to score sheets later the same day. For measurements taken in the room away from the kennel block, a strategically placed video camera (*SONY, VIDEO 8, CCD-TR37OE*) with wide angle lens, powered by mains supply was used. This permitted accurate independent recording of all interactive behaviour and, perhaps more importantly, the behaviour of the dog during social separation. The video tapes were later transcribed to the same score sheets.

Table 4.2 Ethogram of behaviours scored with variable codings in brackets. Prefix *a* signifies testing whilst in the kennel environment (excluding **asm** during the walk), prefix *b* inside the room environment (either on the walk or in the room). Numbers *1/2/3/4/5* and letters *ii/iii* refer to different test parts, letters *I/II* to the presence/absence of the tester

Behaviour	Description
Approach	Movement of the animal towards the front of the kennel. Animals already positioned at the front of the kennel were said to have approached **(aapp1/2)**
Pawing	Raising of one foreleg towards the bars of the kennel, not necessarily making contact with them **(apaw1/2)**
Tail position	The level of the tail with respect to the morphology of the dog. Neutral referred to either horizontal or low tail position, i.e. completely relaxed. A tail held above the horizontal was scored as raised, a tail held low and close into the body was scored as tucked **(atail-p1/2)**
Interaction (in kennel)	The amount of time during which the animal was in close proximity to the tester (<0.5m), and/or making some attempt to communicate (by audio, visual, or olfactory means) **(aint1/2)**
Time taken for approach	The latency between the tester crouching outside the kennel and the dog being within 0.5m of the tester **(aapp3)**
Scent-marking	Any urination behaviour **(asm3, bsm4I, bsm4II, bsm5)**
Playing	Time spent engaged in *object play* with any of the available toys. If the dog interacted with the tester and the toy simultaneously, it was said to be playing **(bplay)**
Interaction (in room)	Time spent in physical contact with or in close proximity to the tester, displaying social behaviour towards the tester **(bint4ii, bint4iii)**
Behaving independently	Neither playing nor engaged in social interaction **(balone4ii, balone4iii)**
Maintaining social contact	Remaining within 1.0m of the tester during a period of locomotory activity **(bfoll)**
Acceptance of food	Taking food into the mouth but not necessarily ingesting **(bfood)**
Destruction	Chewing, biting or tearing at fixtures or fittings. Removal of objects from one location to another, except of toys and bedding **(bdestrI/II)**
Jumping on furniture	Standing or sitting on tables, chairs or shelves **(bfurn)**
Escape attempts	Scratching, pawing, digging or jumping up at the exit through which the tester had departed **(bescI/II)**
Aggressive behaviour	Growling, snarling, raising of hackles, attempted biting, actual biting directed towards the tester **(agg)**

In addition, measures of whining, barking and howling were made, both whilst in the kennel **(awhine1/2, abark1/2)**, in the room **(bwhineI/II, bbark I/II, bhowlI/II)**. The frequency of drinking was also recorded **(bdrinkI/II)**. Behaviours recorded on re-union were: the time taken to approach **(bapp)**, the tail position of the dog **(btail-p)**, any vocalisations **(bvoc)** and any pawing **(bpaw)**.

4.3 *Results*

4.3.0 *Summary of statistical analysis*

Initial analysis focussed on evaluating the level of intra-observer reliability between test days. Spearman's rank correlation coefficient and Kappa coefficient tests were used to find the level of agreement between behaviours observed on consecutive days. Those variables found to be sufficiently reliable, were then subject to Principal Factor Analysis (with varimax-rotation) to identify underlying linear combinations of variables accounting for most of the variance. The ten factors generated were subsequently modified to *composite measures* which could be used to examine the effects of various independent variables in both this and subsequent studies.

The reliability of the composite measures between tests was examined using Spearman's rank correlation coefficient (as a means of re-assessing the reliability of the tests) and Wilcoxon signed rank test to compare median scores.

Finally, the effect of various independent variables on each of the ten composite measures was investigated using one-way ANOVAs (for single variable effects) and multifactor ANOVAs (MANOVAs).

4.3.1 *Variable scoring and reliability testing*

A total of 40 measurements was recorded for each dog. Four methods of behaviour scoring were used: some behaviours were scored for their presence/absence (on a 1/0 scale); others were scaled according to the intensity of behaviour being displayed (e.g., on a 0, 1, 2, 3 scale); some were scored as a frequency of a behaviour being displayed in a given time; and finally a few were scored as the duration of a given behaviour in seconds over a fixed period of time.

Following transcription of the data into spreadsheet format (*LOTUS 1-2-3 version 5*) and subsequent examination of the results, the scoring of several measurements was modified. Descriptions of variable codings may be found in *Table 4.2*.

The modified variables were as follows:

aint1 & aint2 initially scored as duration of interaction with tester, re-scored as:

interacting: 0, none of the time

1, some of the time

2, all of the time

aapp initially scored as latency (s) of approach, re-scored as:

0, did not approach

1, delayed approach

2, immediate approach

bapp initially scored as latency of approach, re-scored as:

0, did not approach

1, delayed approach

2, immediate approach

3, immediate effusive greeting (including pawing and/or vocalisation)

If a variable was represented in the sample of measurements either 95% or 5% of the time, i.e., it was sufficiently common, or rare, to be discarded, it was not included in any further analysis unless it was felt to be of particular value to the study.

Variables discarded due to their relative frequency or infrequency were as follows:

bhowlI never occurred

Three additional variables were excluded from further analysis:

bvoc incorporated into the composite measure, **bapp**

bpaw incorporated into the composite measure, **bapp**

bsm5 this was not measurable for those dogs tested in room 2

The scores for the remaining 36 variables were then subject to reliability analysis calculating kappa (κ) coefficients (Martin & Bateson, 1993) for the presence/absence measures and Spearman rank correlations for frequencies, durations, and scaled measures with three or more points. Once the

kappa and Spearman's coefficient values had been generated, frequency distribution histograms were constructed to assist in the evaluation of arbitrary significance levels for each value (*Figure 4.7 & Figure 4.8*). The suggested level of significance of 0.7 for a correlation coefficient (Martin & Bateson, 1993) was unsuitable for this data as only five variables exceeded this value. The levels of significance selected were therefore: $k \geq 0.5$, $\rho \geq 0.5$

Figure 4.7 Frequency distribution histogram for Spearman's correlation coefficient values

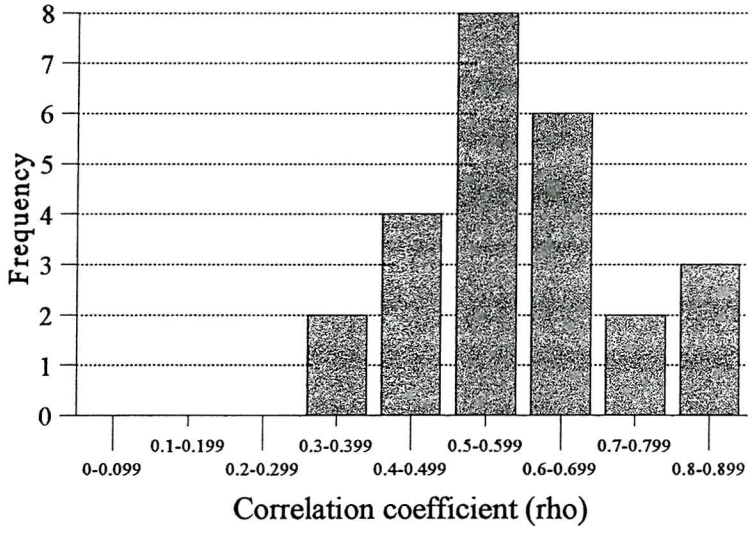
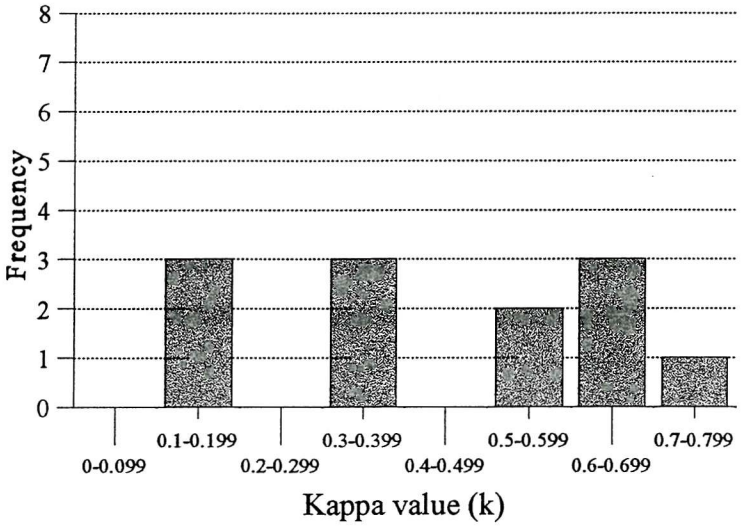


Figure 4.8 Frequency distribution histogram for kappa coefficient values



The individual variables and their associated reliabilities can be found in *Table 4.3*.

Ten variables were discarded due to low reliability. These were:

aapp1,	approach behaviour whilst in the kennel (no eye contact)
aapp2,	approach behaviour in the kennel with eye contact from the tester
awhine1,	whining whilst in the kennel (no eye contact)
aint1,	time spent interacting with the tester in the kennel (no eye contact)
aint2,	time spent interacting with the tester in the kennel during the eye contact section
aapp,	latency of approach in the kennel
bfoll,	duration of following behaviour
bbarkI	barking with tester in room
bdrinkI	drinking with tester in room
bsmII,	scent marking during separation
bdrinkII,	drinking during separation
btail-p	tail position of the dog following separation

In most instances, variables were discarded due to a significant increase in positive or "friendly" behaviours during the second test and a corresponding decrease in negative or neutral behaviours. *Table 4.3* lists the overall mean scores for each day for *all* variables; variables subsequently discarded are highlighted in bold. The difference in the behaviour of the dogs towards myself on the second day indicates that the dogs have become significantly familiarised over a relatively brief period of time. The second day of testing cannot therefore be considered to be a true replicate, since although the actual test procedure was identical on both days, inevitably the dogs were capable of learning and displaying differential behaviour from one day to the next.

Due to its potential predictive value, aggression displayed during any test part was retained despite having a κ value of only 0.191. Although aggression is not usually associated with a tendency to separation behaviour, it would be interesting to see whether this predicted non-association does in fact occur.

Table 4.3 Reliability scores for 36 variables

Variable	Kappa (κ)	Retained	Variable	Spearman (ρ)	Retained
aapp1	0.107	✗	abark1	0.549	✓
aapp2	0.108	✗	awhine1	0.4412	✗
bfood	0.632	✓	apaw1	0.5561	✓
bwhineI	0.63	✓	atail-p1	0.6569	✓
bbarkI	0.323	✗	aint1	0.3766	✗
bescI	0.528	✓	abark2	0.5945	✓
bsmI	0.541	✓	awhine2	0.5675	✓
bdrinkI	0.36	✗	apaw2	0.5692	✓
bdestrII	0.713	✓	atail-p2	0.5605	✓
bfurn	0.609	✓	aint2	0.331	✗
bdrinkII	0.399	✗	aapp3	0.4037	✗
agg	0.191	✓	atail-p3	0.5566	✓
			asm	0.6396	✓
			bplay	0.8804	✓
			bintI	0.7481	✓
			baloneI	0.6588	✓
			bintII	0.8029	✓
			baloneII	0.7492	✓
			bfoll	0.4017	✗
			bwhineII	0.8188	✓
			bbarkII	0.6719	✓
			bhowlII	0.5321	✓
			bescII	0.6757	✓
			bapp	0.6991	✓
			btail-p	0.4784	✗

Table 4.4 Comparison of mean scores (see ***Appendix B*** for scoring system) for days 1 and 2 together with the direction of change. Variables discarded due to non-reliability are highlighted in bold. →Indicates an increase in the exhibition of a specific behaviour and ← a decrease in the exhibition of a behaviour

Variable	Day 1	Day 2	Direction of change
aapp1	**0.91**	**0.97**	→
abark1	6.49	9.32	→
awhine1	**2.84**	**7.28**	→
apaw1	1.69	2.78	→
atail-p1	2.10	2.12	→
aint1	**2.45**	**2.71**	→
aapp2	**0.88**	**0.94**	→
abark2	5.74	9.18	→
awhine2	2.75	7.18	→
apaw2	2.01	2.82	→
atail-p2	2.15	2.11	←
aint2	**2.22**	**2.67**	→
aapp	**1.80**	**1.87**	→
atail-p3	2.10	2.04	←
sm	0.67	0.50	←
bplay	61.9	79.23	→
bint4ii	41.9	45.8	→
balone4ii	76.1	62.2	←
bint4iii	149.9	174.5	→
balone4iii	151.3	135.6	←
bfoll	**2.09**	**2.18**	→
bfood	0.91	0.91	No change
bwhineI	0.36	0.41	→
bbarkI	**0.07**	**0.11**	→
bescI	0.07	0.03	←
bsmI	0.13	0.16	→
bdrinkI	**0.68**	**0.74**	→
bwhineII	109.1	101.3	←
bbarkII	4.72	7.27	→
bhowlII	1.30	1.47	→

Variable	Day 1	Day 2	Direction of change
bdestrII	0.04	0.05	→
bfurn	0.14	0.14	No change
bescII	3.22	3.12	←
bsmII	**0.04**	**0.00**	←
bdrinkII	**0.18**	**0.12**	←
bapp	2.22	2.17	←
btail-p	**2.11**	**2.09**	←
agg	0.05	0.04	←

Twenty-six of the original forty variables were retained as reliable measures of behaviour. Principal components analysis and factor analysis were subsequently performed on these reliable measures to evaluate any underlying relationships between them.

4.3.2 *Multivariate statistical methods*

The scores for the remaining 26 variables were averaged to give a single score for each measure for each dog. Principal Components Analysis was then carried out on the 26 variables to look for linear combinations of the variables to explain most of the variability. Examination of the resulting scree diagram indicated that the first 10 factors had eigenvalues greater than 1.0, accounting for 73.8% of the total variance. These ten components were isolated and retained for additional investigation. In order to align the variables further, varimax-rotation (via factor analysis) was performed on the data set. *Table 4.5* shows the variables comprising each factor along with each factor score.

In several instances, a variable was represented in more than one factor despite the varimax rotation. In each case the weighting of the variable within each factor and the context of the other variables in each factor were considered before a decision was made as to the allocation of duplicated variables.

Composite measures based on each of the ten factors were made for ease of replication of the study and to facilitate comparisons with behaviour exhibited in the new home. Modification of the factors was required in several instances, either with regard to the scoring of the behaviours within a factor

or the actual variables comprising a factor. Generation of the ten composite measures, any alterations made and the reason for each modification are described hereafter. All subsequent analyses were performed on these composite measures in preference to the original factor scores.

Table 4.5 Weightings for the original variables on the ten varimax-rotated factors. Values highlighted in bold are those variables used to interpret a given factor, i.e. those accounting for 50% or more of each factor's maximum score.

Behaviour	Fac1	Fac2	Fac3	Fac4	Fac5	Fac6	Fac7	Fac8	Fac9	Fac10
abark1				**0.930**						
apaw1						**0.885**				
atail-p1	**0.971**									
abark2				**0.922**						
awhine2					**0.513**					-0.353
apaw2						**0.891**				
atail-p2	**0.953**									
atail-p3	**0.842**									
asm							**0.659**			-0.330
bplay			-0.853							
bint4ii		**0.643**	0.445							
balone4ii			**0.895**							
bint4iii		**0.952**								
balone4iii		-0.952								
bfood								**0.867**		
bwhineI					**0.766**					
bescI					**0.432**				-0.343	
bsmI							**0.820**			
bwhineII					**0.757**					
bbarkII									**0.757**	
bhowlII									**0.555**	
bdestrII										**0.741**
bfurn			-0.511						**0.358**	
bescII					0.436					**0.514**
bapp								**0.636**		
agg				0.430			**0.496**			

4.3.2.1 *Composite measure generation*

Composite measures were generated taking into account the nature of the variables comprising rotated factors and the appropriate scoring system.

All composite measures were composed of either a score, or a rate per minute of behaviour

Measure 1

Average of 3 tail positions: **avg(atail-p1, atail-p2, atail-p3)**
All scored on a 1, 2, 3 scale

Measure 2

Time interacting with the tester in part b: **avg[(bint4ii)/3 + (bint4iii)/5]**
(**balone4iii** excluded since mutually exclusive from **bint4iii**)
Scored as total time in a 3m/5m period and converted to a rate per min.

Measure 3

Time spent neither playing nor interacting with the tester, converted to a rate per min.
bplay and **bint4ii** excluded since mutually exclusive from **balone4ii**
bfurn excluded since loaded negatively and is more appropriate to Fac9 (see *Table 4.5*)

(balone4ii)/3

Measure 4

Rate of barking during part a: **abark1 + abark2**
Scored as frequency in a 30s time period,
converted to a rate of barking per min.
agg also loaded positively in this factor, although this has a higher loading on Fac7 (see *Table 4.5*)

Measure 5

Whining during parts a and b:

Escape attempts during part b, with person both present and absent (the latter has a higher loading in Fac10 (see *Table 4.5*))

awhine2 and **bwhineII** converted to a 1/0 scale

awhine2 + bescI + bwhineII

Measure 6

Pawing during part a: **apaw1 +apaw2**

Scored as frequency per 30s,

the two variables were added to make a rate per min.

Measure 7

Scent marking during walk from kennel to room (converted to 1/0 scale)

Scent marking in room with person present **asm + bsmI + agg**

Aggression shown during any test part

Measure 8

Acceptance of food and type of approach following separation:

The two variables were given an equal weighting by dividing **bapp** by three.

The scoring for this variable had previously been on a 0/1/2/3 scale, dividing each score by three therefore permitted equal weighting.

bfood + (bapp)/3

Measure 9

Barking during separation (converted to 1/0 scale)
Howling during separation (converted to 1/0 scale)
Jumping on the furniture during separation **bbarkII + bhowlII + bfurn**

Also loaded negatively, although with a higher loading on Fac5 (see *Table 4.5*), **bescI**

Measure 10

Destruction during separation **bdestrII + bescII**
Escape attempts during separation
Also loaded negatively on Fac 10, although loaded higher in other factors:
awhineII, asm

A description of each factor and the corresponding composite variables can be found in *Table 4.6*.

Table 4.6 Behavioural measures combined to form each of the ten composite measures with their descriptive names. In all instances, a high composite measure score represents a high level of the particular behaviours displayed

Measure	Name	Measures
1.	Tail position	Tail position whilst in the kennel (during squatting, casual eye contact and on entering the kennel). High score=high tail position
2.	Interactive	Interaction with the tester during the play section Interaction with the tester during the petting section
3.	Asocial	Non-interaction with person and lack of play behaviour (play section)
4.	Vocal (barking)	Barking whilst in the kennel (during squatting and with casual eye contact)
5.	Unsettled ("Anxious")	Whining whilst in the kennel (during eye contact) Attempting to escape from the room (with person both present and absent) Whining during separation
6.	Pawing	Pawing whilst in the kennel (during squatting and with casual eye contact)
7.	Scent-marking/aggression	Scent-marking during walk section Scent-marking in the room (person present) Aggression during any test part
8.	Subordinate/social	Acceptance of food Greeting behaviour following separation
9.	Vocal separation	Barking during separation Howling during separation Jumping on furniture during separation
10.	Destructive separation	Destruction during separation Attempting to escape during separation

4.3.3 *Internal reliability testing*

A score for each dog was constructed for each day of testing for all ten composite measures and an internal validity test for reliability applied using Spearman's rank correlation coefficient. The reliabilities for these ten composite measures were all greater than 0.41 (see *Table 4.7*).

Table 4.7 Reliability scores between days for the ten measures

Measure	Spearman's rank correlation value
1	0.41
2	0.76
3	0.66
4	0.50
5	0.53
6	0.65
7	0.58
8	0.67
9	0.63
10	0.63

Median values for each composite measure were calculated and a statistical comparison of the two test days was performed (Wilcoxon signed rank test), see *Table 4.8*.

Table 4.8 Median values for composite measures, days 1 and 2 compared. Values highlighted in bold are significant at the 5% level.

Measure	Median (day 1)	Median (day 2)	Probability
1	2.0	2.0	0.209
2	**20.0**	**24.0**	**0.017**
3	**25.7**	**16.0**	**0.002**
4	**0.0**	**0.0**	**0.002**
5	1.0	1.0	0.431
6	**1.0**	**2.0**	**0.003**
7	0.0	0.0	0.768
8	**1.67**	**1.67**	**0.001**
9	0.0	0.0	0.374
10	1	0	0.158

Measure 2 (interactive) displayed a significant increase in median values from day 1 to day 2, indicating a tendency for the dogs to spend more time interacting with the tester on the second day; this also being borne out by the corresponding significant reduction in time spent alone (measure 3).

Although median values for measure 4 (vocal) were identical, there was in fact a difference between them when individual values were subject to analysis. Inspection of the average rate of barking tells us that there was in fact an increase in the rate of behaviour displayed on the second day (a mean barking rate of 17.7 on day 2 compared to 12.2 on day 1).

The rate of pawing also increased significantly from day 1 to day 2.

Once again, although median values for factor 8 (subordinate/social) were identical, a significant result was found to exist between the whole data set. If the mean is looked at in this case, there is actually found to be a slight reduction in the average score for day 2 as opposed to day 1.

4.3.4 *Independent variable testing*

Since two rooms were actually used for the testing of the dogs, a one-way ANOVA was performed on the data to see whether the dogs tested in the second room behaved any differently from those tested in the first. No difference was found to exist with respect to any of the ten measures at the 0.05 level of significance.

Once the level of reliability had been evaluated, the effects of the sex of the dog and the age of the dog on each measure were assessed. A multifactor analysis of variance (ANOVA) was used to determine the effect of each of the variables on the individual animals as well as any interaction of age and sex. The results of the ANOVA can be found in *Table 4.9*

Table 4.9 Significance levels generated using multifactor ANOVA (1 degree of freedom). (*) indicates a significance level of ≤0.1, * ≤0.05, ** ≤0.01, *** ≤0.001

Measure	Name	Age		Sex	
		F ratio	p value	F ratio	p value
1	Tail position	3.513	(*)	**11.092**	***
2	Interactive	0.131		0.176	
3	Asocial	0.395		2.402	
4	Vocal (barking)	0.151		0.830	
5	unsettled	<0.001		1.251	
6	Pawing	4.100	*	1.737	
7	Scent-marking/aggression	15.870	***	13.689	***
8	Subordinate/social	11.421	***	0.179	
9	Vocal separation	3.445	(*)	0.055	
10	Destructive separation	0.098		0.249	

Of the significant differences found with respect to the age of the dog, the following observations were made: young adults showed a higher rate of pawing (measure 6) than adults, scored higher for subordinate, social behaviour (measure 8) than adults, and tended to be more vocal during separation (measure 9) than older dogs. On average, young adults displayed a lower tail position than adults (measure 1). In addition, a highly significant result was found with respect to the level of scent-marking and aggression (measure 7) displayed, adults in general scoring higher than young adults.

Regarding sex differences in behaviour, fewer associations were found: females tended to show a lower tail position than males (measure 1), and, not unexpectedly, males exhibited higher levels of scent-marking and aggression than females.

No significant age/sex interactions were found.

4.4 *Discussion*

4.4.1 *Sample characteristics*

The sample of dogs comprised more males than females (58% male, 42% female), and a large number of young adult dogs (33%), both characteristic of the rescue population as a whole (Bailey, 1991). The bias towards young adults is likely to reflect two confounding situations: firstly, young dogs are more likely than adults to display inappropriate behaviour of one form or another and secondly, dogs perpetuating this behaviour for any period of time are likely to be removed from the pet dog population before reaching full adult status.

The under-representation of pedigree dogs was to a certain extent controlled by the rescue process itself. It is common practice for pure-bred animals to be diverted to an appropriate single breed rescue organisation in preference to a general rescue centre. In most instances, the pedigree dogs resident at this particular shelter were present only in transitory status or, more commonly, because no relevant organisation was located within reasonable travelling distance.

Of the non-pedigree population, Border collie crosses, German shepherd crosses, greyhound/ lurcher types and Jack Russell terrier (JRT) crosses were in abundance. Many of the greyhounds and lurchers were obtained as strays, presumably surplus to requirements having exceeded their working/racing lives. Of the other three main types, Border collies and German shepherds are frequently cited as being prevalent in the problem dog population (Appleby & Magnus, 1994; Mugford, 1983; Landsberg, 1991) and it is postulated that their behaviour is a frequent cause of their abandonment. The high incidence of JRTs and JRT crosses has no documented foundation, although given their prevalence in this sample it seems unlikely that they are "problem free". It is also possible that regional breed preferences may account for the high incidence of these terrier types.

The remainder of the sample were largely representative of other cross-breeds and indistinct crosses, again this being typical of rescue centres in general.

4.4.2 *Reliability testing and factor generation*

Overall reliability of behavioural scoring between days was high, such that 26 of the original 40 variables were retained for further analysis. Of the variables which were discarded, many were as a result of an increase in the exhibition of affiliative behaviours on the second day of testing, together with a corresponding decrease in non-social behaviour. Dogs which were resident at the shelter for any length of time seemed to elevate their greeting behaviour over time, sometimes resulting in radical modifications to previously moderate behaviour. Frequently such individuals appeared relatively subdued, even nervous, on first contact. This change behaviour is likely to arise from an initial uncertainty of strange persons, subsequently overcome by familiarity. It is also possible that brief periods of individual attention (two half hour sessions) away from the disruptive kennel environment act to enrich the social capacity of such individuals and reduce behavioural inhibitions.

With respect to scores obtained over the two day period, a similar increase in social behaviour and decrease in asocial behaviour was revealed. The median values for measure 2 (interactive), and measure 6 (pawing) increased significantly whereas the median value for measure 3 (asocial) significantly decreased on day 2. These results support the aforementioned observations regarding familiarity of the observer. In addition, the rate of barking in the kennel was found to increase from one day to the next, although this cannot be regarded simply as an affiliative behaviour since vocalisation arises from more than one potential motivational state including that of aggression (Fox, 1978).

Of the ten composite measures generated from the 26 reliable measures, two related directly to separation behaviour. The first (measure 9), encompassed variables pertaining to vocalisation during separation (barking and howling) and jumping on furniture. The latter is indicative of a high level of activity and although destruction *per se* was not in evidence, such activity in a home environment is likely to result in damage to the surroundings. The second measure (measure 10) relating to separation behaviour encompassed both destructive behaviour and escape attempts. Although destruction was rare, it was commonly directed at the doorway through which the tester had previously departed, in itself a classic separation symptom. The form of the escape attempts varied widely from relatively mild pawing to frantic scrabbling and digging. In all instances, the behaviour was again directed towards the exit.

One measure, the acceptance/non-acceptance of food requires some further discussion. It was noted at the time of testing that many animals accepted the food but did not eat it. This reluctance to consume the food did not seem to reflect the palatability or otherwise of the food since such individuals apparently made no attempt to taste and subsequently reject the titbit. Moreover, it appeared the food had been accepted rather as a gesture than for consumption. The fact that this variable was linked to the greeting behaviour of the dog following separation in the derivation of measure 8 lends weight to this hypothesis since the acceptance of food from a superior (or rather the adaptation of food soliciting behaviour) and greeting by a subordinate are recognised gestures in canine society (Fox, 1978). In light of this association, it is notable that measure 8 was found to be significantly linked with the age of the dog, young adults generally scoring higher than adults. It is therefore plausible that these behaviours relate to juvenile characteristics observed in canine social interactions and are retained in inter-specific interactions. This factor may therefore have equally been named *juvenile* in preference to subordinate.

4.4.3 *The effect of independent variables on composite factors*

The sex of the dog was found to have little overall effect on the measure scores, only measures 1 (tail position) and 7 (scent-marking, aggression) being significantly influenced by sex. Conversely, several measures were associated with the age of subjects, all relating to young adult status. Measure 6 (pawing) and measure 8 (subordinate, social) were both found to be positively associated with young adults. Only one factor was influenced by both sex (male) and age (adult) although no age/sex interaction was found. This was as expected since the measure concerned (7) comprised scent-marking and aggressive behaviours.

No significant results were obtained with respect to the effect of independent variables on the two separation measures, although a loose positive relationship was revealed between young adults and dogs vocalising during separation.

4.4.4 *Criticisms of the experimental methodology*

The rooms utilised in this study were somewhat unsatisfactory for use in temperament testing. The first, although of an ideal size, in its normal capacity was employed as an electrical switch room.

Although no significant differences were found in the behaviour of the dogs from one room to the next, it was felt that the abundant ultrasonic activity could have influenced the animals to some extent. In addition, this room contained no windows. The additive effect of high ultrasonic activity and no visual contact with the outside world is likely to have induced greater states of arousal. Indeed the individual responsible for minor demolition of the switch room was later diagnosed as suffering from a "claustrophobia" condition rather than a true separation problem. This diagnosis, made by a professional behaviour counsellor following rehoming of the individual concerned, was arrived at as a result of the observation that the animal displayed severe separation symptoms when left in a confined space but showed no adverse reaction when allowed free access to the entire house. Indeed this was the only subject to be tested in *both* rooms and although he displayed a high level of vocalisation and escape attempts in response to separation in room 2, no destructive behaviour was encountered and the overall level of distress appeared much lower.

The second test room was again adequate in terms of size, contained windows and had reduced electrical activity; however its function as a food store room provided some distraction for several individuals. Moreover the door handle mechanisms meant that more than one dog succeeded in escaping from the room during the period of isolation and subsequent data was lost as a result. The fact that this room possessed two doors complicated the situation although in practice, behaviour directed towards entrances/exits was almost exclusively directed towards the door through which I had previously departed.

Having outlined the problems associated with each of the two rooms, it remains to point out that if this test were to be employed as a standard method of behavioural assessment, rooms similar or inferior to these are likely to be the only ones available in many shelters.

Regarding the test itself, this would perhaps benefit from some modification. Firstly, it was felt that several variables omitted from this test as a result of low reliability in the preceding general assessment test (***Chapter 3***), could be feasibly reinstated as behavioural measures. Whether the initial low reliability was obtained through the dogs behaving differently towards the two testers or whether this difference was obtained as a result of the actual scoring of the behaviours is indiscernible; however since many of the measures relate to submissive or nervous behaviour, it is possible that male and female observers elicited variable responses from the subjects (Lore & Eisenberg, 1986; Hennessy *et al.*, 1997). The measures felt to be worthy of reinstating were: (specifically in the kennel environment) shivering, cringing, retreating, licking lips, and yawning, although the previous points regarding familiarity of the tester must be borne in mind when

assessing reliability. One other frequently observed but non-recorded behaviour, was the tendency for some animals to persistently jump up at the tester whilst in the kennel. Although this may have no real value in behavioural assessment, it is possible that this behaviour may be linked to the sociability of the animal in a contact seeking capacity. Furthermore, regarding the approach behaviour of the dogs, it was noted that several dogs, although possibly not enough to be statistically valid, assumed a side-on presentation with the main torso in actual contact with the kennel bars. This seemed to be particularly common in male dogs and may be worthy of further investigation.

The measures recorded away from the kennel, provided some interesting observations. On entering the test room, subjects were released and allowed to explore freely for a period of approximately five minutes. Following this, the animals were encouraged to play for three minutes and then petted for five minutes. In hindsight, it may have been better to have reversed the order of playing and petting since in some cases once an individual had commenced playing, it then became preoccupied with the toys to the detriment of subsequent social interaction. In addition, several dogs (notably greyhound/lurcher types) became unduly disturbed by the sudden escalation in activity on the part of the tester prompting the premature cessation of this part of the test.

4.5 *General conclusions*

Intra-observer reliability between test days was good, much higher agreement being obtained than via *inter*-observer reliability in the previous study (***Chapter 3***).

The age of the dog generated several significant differences in the behaviour displayed by individuals, young adults usually displaying higher levels of particular behaviours. The sex of subjects did not generate any notable relationships with particular behaviours barring the increased rate of scent-marking and overtly aggressive displays in male dogs.

In general, the exhibition of behaviour towards the tester, in particular "friendly" social behaviour, increased over the two days and negative behaviour decreased indicating the development of a degree of familiarity with the tester.

POST-ADOPTION SURVEY OF RESCUE DOGS

5.1 *Introduction/Method*

In the previous chapter, separation behaviour was initiated by firstly establishing an affiliative relationship with a number of kennelled rescue dogs before abruptly leaving them alone. Statistical analysis revealed that those behaviours displayed during social isolation were not related to behaviours displayed during any other part of the test but that separation behaviour was represented as two distinct factors. It is hypothesized that dogs exhibiting these behaviours (vocalising during separation and / or destruction during separation) under test conditions will display similar behaviour in the home setting.

The predictive value of the assessment of canine behaviour in the kennel situation (*Chapter 4*), was established by a post-adoptive survey of owners. At the time of adoption, the owners of those dogs which had been duplicate tested were asked to complete a form outlining the aims and objectives of the study, and requesting permission to contact them by telephone in four to eight weeks time. Any persons not wishing to comply were given the opportunity to decline before any further contact was made. The four to eight week post-adoption period theoretically allowed the dog sufficient time to have settled in to its new surroundings and for some relationship to have developed between dog and owner. It has often been observed that several weeks elapse before a behaviour problem is fully manifested, a time commonly referred to as the "honeymoon period".

The material collected from the telephone questionnaire, although extremely useful, is entirely dependent on the disclosure of information from the new owners of the recently rehomed rescue dogs. Ideally, the animals would have been visited in their new homes and their behaviour assessed in person. Unfortunately due to time pressures, it was both impractical and unrealistic to collect observational information on each of the dogs even assuming all parties were amenable.

If, after repeated attempts at making contact by telephone, communication had not been achieved, questionnaires were sent by post together with a covering note and stamped addressed envelope for return by the new owner.

The questionnaire itself (***Appendix D***) was designed to reveal indicators of separation behaviour *only*, as opposed to more general undesirable behaviour. Additional information was gathered on household composition, household routines, and the behaviour of the dog when denied access to household members as well as the behaviour of the dog when left without human company. Inter-household comparisons of separation versus non-separation individuals could then be examined in addition to correlating the behaviour of the dog in the kennel with behaviour expressed in the new home.

5.2 *Results*

Of the 121 animals tested in the shelter, subsequent information was available on 101 individuals. Of the twenty dogs which were unavailable for follow-up, nine never left the rescue centre (two were still resident at the time of writing, four were euthanased for behavioural reasons, two died, and one was stolen from the premises). Of the eleven which were homed, one dog was reclaimed by its owner, one died, and one became lost. Furthermore, eight owners agreed to participate but were not contactable by telephone and neglected to return the questionnaire when issued by post; one person declined to be interviewed. A total of 88 interviews were conducted by telephone, and 13 questionnaires were returned by post.

Following completion of the questionnaires, responses to each of the questions were scored using either presence/absence measures (1/0), scaled measures (e.g. 1/2/3...) or categories (10/11/12...) (see ***Appendix D)***. Data was then transferred into spreadsheet format (*LOTUS 1-2-3 version 5*) prior to performing statistical analyses (*STATGRAPHICS version 5.0, STSC, 1988/ SPSS/PC version 5.0, 1992*).

5.2.0 *Summary of statistical analysis*

Initial statistical analysis concentrated on reducing the number of variables within the questionnaire for further investigation. Many questions were thought to be related, hence variables were examined pair-wise for their relative dependence/independence using Spearman's correlation coefficient and chi-squared. Those variables found to be sufficiently independent were retained alongside an arbitrary score of post-homing separation behaviour for each dog. Taking the post-

homing separation score as the independent variable in each instance, any relationships between the ten composite measures generated in the assessment test (***Chapter 4***), the post-homing variables in the questionnaire and the degree to which the dog displayed separation behaviour in the home were investigated using multiple linear regression. Where significant results were generated, forward multiple linear regression identified which variable had the strongest simple regression with the dependent variable. Further multiple linear regression (followed by forward stepwise multiple linear regression) was used to examine any effect of age and/or sex of the dog with measures obtained from the questionnaire, again using post-homing separation score as the dependent variable.

Any relationship between specific symptoms of separation behaviour displayed in the home (vocalisation/destruction) and the two composite measures relating to the behaviour of the dog during the kennel separation test (vocal during separation/destruction during separation) were investigated using logistic regression.

5.2.1 *Association of variables*

Those variables *not* pertaining to the behaviour of the dog were examined first, i.e. household composition, daily routines within the household *etc.*. The variables concerned were: all responses to ***Section 2***; and responses to questions numbered ***8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20***, and *21*. For simplification of subsequent analysis, these measures were investigated for their relative level of dependence/independence. Several of the variables initially scored as multiple categories were thereby modified to presence/absence measures. All relevant variables were examined pair-wise using either: cross-tabulations (chi-squared) for **1/0, 1/0** pairs or Spearman's Correlation for **1/0, scaled** measure pairs or **scaled, scaled** pairs.

Several variables were found to be highly associated (and therefore not independent) at the 0.05 level of significance. *Tables 5.1* and *5.2* describes the significant associations generated.

Table 5.1 Significant associations (<0.05) between non-behavioural measures using chi-squared goodness of fit test (1 degree of freedom in each case)

Variable 1	Variable 2	χ^2	Probability	Association
presence of children	presence of pets other than cats and dogs	7.42	<0.001	positive
presence of children	given free run when left	5.83	<0.001	negative
presence of children	restricted when left	5.69	0.017	positive
presence of another dog	sleeping with another dog	86.56	<0.001	positive
presence of another dog	left with another dog	87.66	<0.001	positive
presence of a cat	sleeping in owner's bedroom	4.02	<0.001	negative
presence of other pets	given free run overnight	7.19	0.007	negative
left with another dog	sleeping with another dog	87.66	<0.001	positive
restricted when left	restricted overnight	16.79	<0.001	positive
given free run when left	restricted overnight	12.04	<0.001	negative
given free run when left	sleeping in the bedroom	16.64	<0.001	positive
restricted when left	sleeping in the bedroom	23.16	0.01	negative
left outside	left with another dog	3.90	0.05	negative

Households with children were likely to have additional pets, sometimes one or more cats but frequently "other" non-canid and non-felid animals. Households without children were significantly less likely to have these other pets.

If another dog was present within the household, the rescue dog was almost certainly left with this dog both during periods of separation and overnight. Multiple dog households tended to keep their dogs indoors when household members were out rather than allowing them outside access. If there were pets other than dogs in the house, the dog was unlikely to be given free run of the house overnight; if there was a cat in the house, the dog was unlikely to be allowed in the owner's bedroom overnight.

For households with children, rescue dogs were unlikely to be allowed free access when no-one was in the house but were probably restricted to one or more rooms.

If the dog was restricted when left, is was also highly likely to be restricted overnight. Dogs which were allowed free access when left were *not* likely to be restricted overnight, but were more likely to stay in the owner's bedroom.

Table 5.2 Significant associations ($p<0.05$) between non-behavioural measures using Spearman's Rank Correlation Coefficient

Variable 1	Variable 2	Correlation
number of adults	presence of children	0.206
presence of a cat	sleeping place moved since acquirement	0.462
presence of pets other than cats & dogs	length of time left at first	-0.206
number of adults	restricted access when left	0.274
presence of pets other than cats & dogs	length of time left in evening	-0.210
restricted overnight	length of time left on initial acquirement	0.217
where left at first	where slept at first	0.456
free access overnight	owner departure routine	0.202
length of time left during day	length of time left at weekends	-0.504
free access when left	length of time left at weekends	0.214
owner departure routine	owner greeting behaviour	0.401

Although all of the results in *Table 5.2* are significant at the 5% level, none of the correlations explain substantially more than 25% of variance in common between any pair of variables.

The number of adults in a household was found to be positively correlated with the presence of children. The presence of a cat in the household revealed possible influences on the sleeping arrangements of the pets: the new dog was slightly more likely to be allowed to sleep in the owner's bedroom overnight and the current sleeping place was likely to have been altered since the dog was first obtained. Dogs now living with "other" (children's) pets had more chance of being gradually introduced to periods of separation; in addition, these dogs tended to be left less in the evenings.

In most instances, the length of time the dogs were currently left for reflected the length of time they were left for when first obtained, i.e. a minority were gradually introduced to periods of separation. Dogs which had not been introduced to separation tended to be restricted when left. Furthermore, the majority of dogs were in the same sleeping place overnight now as they were initially.

Dogs left for long periods of time during the day, were likely to be left for shorter periods at weekends. Animals left for any length of time at weekends were more likely to be given free run of the house than to be restricted when left.

As regards the behaviour of the owner towards the dog, pre-departure behaviour was found to be significantly correlated with the level of greeting behaviour.

Having identified numerous variables which were not independent, several could then be discarded from further analysis. In addition, several ambiguous variables and others which were felt to be misleading were eliminated from subsequent investigation. Only those measures felt to be of value as potential influencing factors regarding separation behaviour, in accordance with previous studies (including ***Chapter 2***, this thesis) and with respect to considerable anecdotal evidence, were retained for further analysis. The measures concerned were:

1. The number of adults in the household
2. The presence of children
3. The presence of another dog
4. Permitting the dog to sleep in the owner's bedroom
5. The gradual introduction of periods of social isolation
6. Pre-departure behaviour of the owner

The latter was chosen in preference to greeting behaviour of the owner (it was not possible to investigate both variables since they were not sufficiently independent) since it was felt that logically, separation behaviour is more likely to be influenced by pre-departure routines as opposed to post-separation greetings.

These six variables were once again examined for their level of dependency via Spearman's Rank

Correlation; no significant results were obtained at the 5% level.

5.2.2 *Incidence of separation behaviour*

In total, 45 (~45%) dogs exhibited some reaction to the departure of one or more persons. Vocalisation and destruction were equally prevalent behaviours, each displayed by 26 dogs. Six dogs eliminated when left; nine stole food (included as a behaviour manifested during separation, although not necessarily a *reaction* to separation). Of these 45 individuals, 29 displayed one behaviour only, 13 dogs displayed two behaviours (8 were vocal and destructive, 1 was vocal and stole food, 2 were destructive and stole food, one was vocal and eliminated, one was destructive and displayed "other" behaviour), two dogs exhibited three behaviours (vocalisation, destruction and elimination) and one dog exhibited four (vocalisation, destruction, elimination and stealing). In most instances the inappropriate behaviour commenced immediately the dog was obtained and was expressed as soon as the owner(s) departed.

5.2.3 *Scoring of separation behaviour*

Two dogs were never left alone and were thereby eliminated from further analysis.
The remaining 99 dogs were each allocated a score of separation behaviour on a scale of 0 to 3. The generation of the separation score was determined according to the following criteria (from *Appendix D, section 3*):

1. Any vocal, destructive, eliminatory or other unusual behaviour when left alone (***question 1***)
2. An absence of the above behaviours in the presence of people, or exhibition of this behaviour overnight only (***question 3***)
3. Behaviour displayed in response to the departure of a specific person (***question 4***)
4. The type of behaviour displayed in the presence of people (***question 5***)
5. The latency of separation behaviour post-departure (***question 7***)
6. Whether the behaviour is displayed during unexpected owner absence (***question 12***)
7. How the dog behaves when left in a car (***question 22***)
8. The dog's reaction to a denial of access to one or more persons (***question 24***)

The severity of separation behaviour exhibited was assessed according to the following scale:

0 *Mainly*: a negative response to ***question 1*** and a negative response to ***questions 3 and 4***
or: a long latency of separation behaviour post-departure (***question 7***)
A negative response to ***question 12***
absence of separation behaviour in the car (***question 22***)
absence of a reaction to a denial of access (***question 24***)

1 One behaviour exhibited to a very minor extent (positive responses to *at least* ***question 1, 3 and 4***), or exhibition but prompt cessation of one or more separation behaviours (e.g. for a duration of a day or two, or following modification of household routines)

2 Transitory separation behaviour
i.e., exhibition of one or more separation behaviours (positive responses to *at least* ***questions 1, 3*** and ***4***) over a period of a week or more following initial acquisition

3 Perpetuating separation behaviour of one or more types
positive responses to *at least* ***questions 1, 2*** and ***3***

Fifty-nine dogs were categorised as exhibiting no separation behaviour; thirteen obtained a score of 1; five were scored as expressing transitory separation problems; twenty-two were assessed as suffering from ongoing separation problems at the time of follow-up, i.e. eight weeks post-adoption.

5.2.4 *Correlates of behaviour in the kennel with behaviour in the new home*

Subsequent data analysis concentrated on the six independent variables described earlier, together with the separation score obtained for each dog, the age and sex of the dog, and the 10 composite measures obtained from the temperament assessment test (see *Table 4.6*).

5.2.4 *Correlates of behaviour in the kennel with behaviour in the home*

The six independent variables plus separation score for each dog were compared to the ten behaviour measures by a multiple linear regression test, utilising separation score as the dependent variable, with the six question variables and ten factor scores as independent variables. Initially, all independent variables were examined for their correlation with the dependent variable using basic multiple linear regression. The separation score following rehoming (see *Table 5.3*) was significantly affected by two of the composite behaviour measures:

1. Measure 9 - vocalising during separation (specifically barking, howling and jumping on furniture)
2. Measure 10 - destruction during separation (destruction and attempting to escape)

Notably these were the only measures in the kennel assessment test relating to separation behaviour.

Following the multiple linear regression test, a forward stepwise multiple regression was carried out on the same sixteen independent variables. In this test, variables are entered into the model one by one (or step by step). The first variable entered at step 1 is the one with the strongest simple regression with the dependent variable. At step 2 (and each subsequent step), the variable with the strongest partial correlation enters. In this case, the forward regression proceeded only three steps, the ANOVA revealing that measure 9 was most strongly correlated with the separation score ($F=11.164$, 1 d.f., $p=0.001$), followed by measure 10 ($F=8.261$, 2 d.f., $p<0.001$). The correlations obtained via forward stepwise multiple regression may be found in *Table 5.4*.

Table 5.3 Significance levels generated using multiple linear regression. Those highlighted in bold are significant at the 5% level.

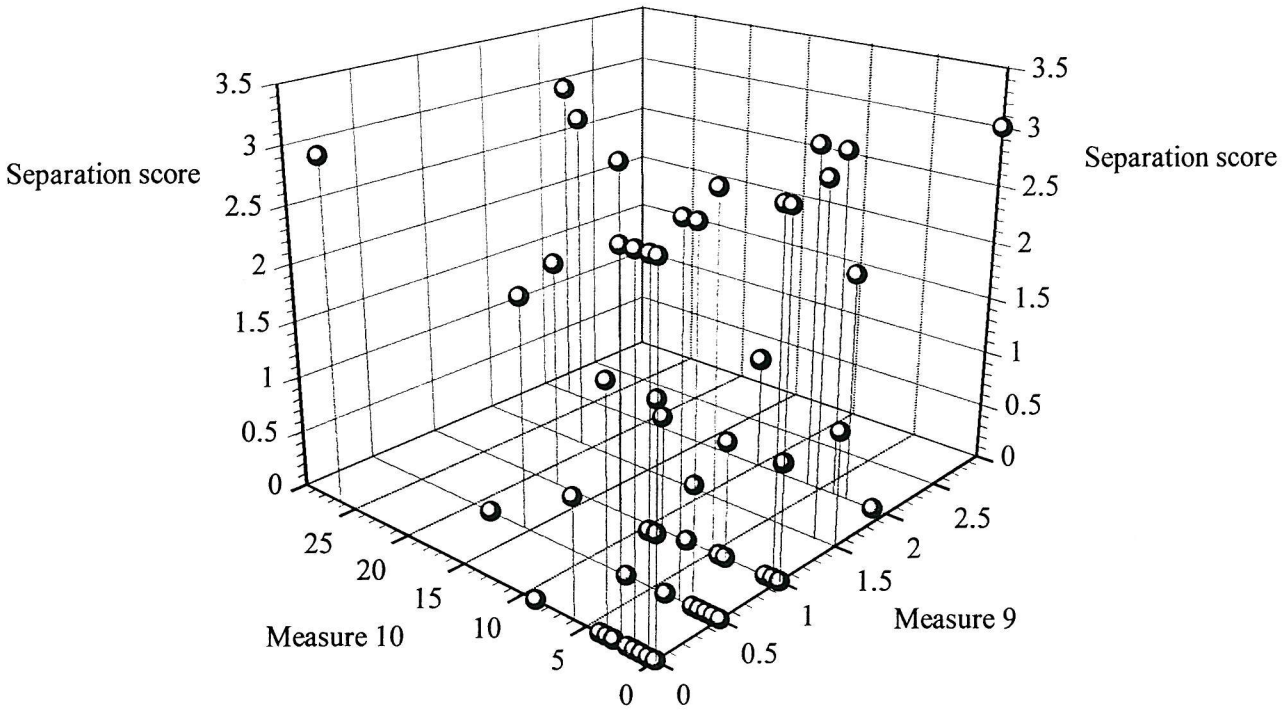
Independent variable	t value	Significance
Measure 1 (Tail position)	1.342	0.183
Measure 2 (Interactive)	0.825	0.412
Measure 3 (Asocial)	0.136	0.892
Measure 4 (Vocal - barking)	-0.656	0.514
Measure 5 (Unsettled)	-1.098	0.275
Measure 6 (Pawing)	0.718	0.475
Measure 7 (Scent-marking/aggression)	0.204	0.839
Measure 8 (Subordinate/social)	-0.151	0.880
Measure 9 (Vocal separation)	**2.292**	**0.024**
Measure 10 (Destructive separation)	**2.114**	**0.038**
Number of adults	0.373	0.710
Presence of children	-1.248	0.216
Presence of another dog	0.257	0.798
Sleeping in owner's bedroom	-0.912	0.365
Pre-departure behaviour of owner	-0.791	0.431
Gradual introduction to separation	-0.350	0.727

Table 5.4 Significance levels generated using forward multiple linear regression

Independent variable	t value	Significance
Measure 9	3.341	0.001
Measure 10	2.215	0.029
All other variables	<1.409	>0.162

This result confirms that measures 9 and 10 are the only independent variables which significantly predict the separation score of the dog in the new home, measure 9 (vocal during separation) apparently being more highly correlated than measure 10 (destructive during separation). None of the other composite measures obtained in the shelter, nor the type of home the dog entered apparently predicted the post-adoption separation score. *Figure 5.1* illustrates the relationship between measures 9, 10 and the separation score.

Figure 5.1 Graphical representation of the relationship between measure 9 (vocal during separation), measure 10 (destructive during separation) and the post-adoption separation score



5.2.5 *Correlates of age and sex with behaviour in the new home*

A multiple linear regression test was carried out using separation score as the dependent variable, and the six questionnaire measures as independent variables together with the age (adult/young adult) of the dog and its sex (male/female). Neither the ANOVA ($F=0.906$, 8 d.f., $p=0.516$), nor any of the of the 8 independent variables provided any significant results at the 5% level. It was not valid to use forward stepwise multiple linear regression on this data since none of the steps revealed any significant correlations. Splitting the age categories further (into 3-6 months, 7-12 months, 13-24 months, 25-48 months, 49 months+), as in McBride *et al.* (1995), still neglected to provide any associations regarding age. A one-way ANOVA of age category versus separation score also produced non-significant results ($F=1.39$, 4 d.f., $p=0.244$). The cross-tabulation of age category with the presence/absence of separation behaviour indicated that young adults were slightly more likely than adults to display some degree of separation behaviour ($\chi^2=2.733$, 1 d.f., $p=0.098$).

An additional investigation into the effect of age on specific symptoms revealed that young adults exhibited a higher incidence of destructive behaviour than adults ($\chi^2=7.699$, 1 d.f., $p=0.006$), this being largely accounted for by dogs of less than 12 months ($\chi^2=3.150$, 1 d.f., $p=0.076$).

5.2.6 *Association of measures 9 & 10 with vocalisation and destruction during separation*

All dogs had been scored as :

1 vocal(1) / not vocal (0) during separation in the new home

2 destructive (1) / not destructive (0) during separation in the new home

Logistic regression was used to measure the correlation between the above behaviours and scores obtained for measures 9 and 10 in the kennel. Logistic regression works in a similar context to multiple linear regression; however it is used only when the dependent variable has two values, i.e., an event either occurs or it does not. Two tests were performed: the first utilising vocal as the dependent variable under test, the second using destructive as the dependent variable, measure 9 and measure 10 representing the independent variables in each instance.

Table 5.5 Results of logistic regression test on vocal during separation with measures 9 and 10

Independent variable	Significance	D.f.
Measure 9	**0.023**	**1**
Measure 10	0.634	1

Table 5.6 Results of logistic regression test on destructive during separation with measures 9 and 10

Independent variable	Significance	D.f.
Measure 9	0.076	1
Measure 10	0.576	1

Dogs scoring highly on measure 9 (vocal during separation) whilst in the shelter were significantly likely to display vocal behaviour during periods of separation in the new home (*Table 5.5*). In addition, these dogs were also more inclined to exhibit destructive behaviour in the home, this relationship being slightly below the required level of significance (*Table 5.6*). Composite measure 10 (destructive during separation) was not associated significantly with either vocal or destructive behaviour after homing (*Tables 5.5* and *5.6*).

In a cross-tabulation of the incidence of vocal and destructive behaviour in the new home, it was found the two behaviours were significantly likely to occur together (chi-squared =18.970, 1 d.f., $p<0.001$). Given that measure 9 is composed of three behavioural measures: i) barking during separation, ii) howling during separation and iii) jumping on furniture, the latter may indicate a predisposition to destructive tendencies not fully manifested in the assessment test but transpiring following homing.

5.2.7 *General differences between dogs with and without signs of separation behaviour*

Median values for all variables within the original questionnaire (***Appendix D***) were calculated and examined for differences between those dogs exhibiting any separation behaviour regardless of severity (scores of 1, 2, 3) and those not displaying separation behaviour (scores of 0). *Table 5.7* illustrates the differences found between the two samples.

Table 5.7 Differences between those dogs scoring 0 and those scoring 1, 2, or 3.

Variable	**Median sepscore 1, 2, 3 (N=40)**	**Median sepscore 0 (N=59)**
Age	18m	48m
Length of time left during the day	(2) 1-2 hours	(3) 2.5-4 hours
Length of time left at weekends	(0) the same as during the week	(-1) less than during the week
Does the dog follow from room to room	(2) persistently	(1) occasionally
Person whom the dog is most attached to	Female owner	Male or female owner

One of the most interesting differences to emerge was the lower median age (18 months) for dogs displaying separation behaviour, although in all statistical analyses of age with respect to the exhibition or otherwise of separation behaviour (of any severity), no significant differences were found.

5.3 *Discussion*

5.3.1 *Incidence of separation behaviour*

Forty-five of the 99 dogs followed up displayed some form of separation behaviour (2 dogs were never left alone and were therefore discarded from further analysis). Of these, five were not thought to be exhibiting a reaction to the departure of one or more persons *per se* (according to the criteria outlined on pages 5.6-5.7) and were thereby given separation scores of zero. Forty dogs therefore scored 1 or more on a scale of 0 to 3, 22 exhibiting ongoing separation behaviour at the time of interview (eight weeks post-adoption). Previous estimates of the incidence of separation problems in the rescue dog population suggest 23% as an appropriate figure based on information obtained from owners giving up pets for adoption (Bailey, 1991). Although the figure obtained in this study (22.2%) accurately reflects this estimate, it must be noted that of these dogs, only 6 sought advice from a behaviour counsellor and very few returned the dog to the shelter citing separation problems as a contributing factor at the time of writing. It therefore seems that the number of dogs displaying separation behaviour of a severity notable to the Blue Cross is considerably less than previously estimated (i.e., less than 10%). It is likely that this is largely due to current adoption policies employed by the Blue Cross and a successful owner education programme, rather than a reflection of reduced tendency to exhibit inappropriate behaviour.

During the course of several interviews, it became apparent that the behaviour being displayed by the pet was, in my opinion, of a severity worthy of professional counselling. In some instances the owners of such animals seemed to view this behaviour as a normal consequence of the rescue process and therefore of no particular concern; however the relative dearth of owners actually requesting behavioural advice may not only be due to enviable tolerance on the part of the owners but is also likely to result from preconceptions regarding the effectiveness of "counselling" deterring many from seeking advice.

5.3.2 *Effect of environmental variables*

Several of the variables within the follow-up questionnaire were found to be highly associated with each other. Discretion was used in deciding which variables were retained and which were

discarded from further analysis. In total, only six measures were used in subsequent investigation, all others suggesting either insufficient independence, infrequent incidence, or ambiguity. It was anticipated that the number of people in the house (including the presence or absence of children) and the presence or otherwise of conspecifics would influence the exhibition of separation related behaviour (Smith, 1983; this study, ***Chapter 2***). In fact none of these variables proved to be significantly associated with the manifestation of inappropriate behaviour. In addition, allowing the animal to sleep in the owner's bedroom was not linked with the separation score obtained when left alone. Furthermore, the pre-departure routine of the owner towards the dog showed no relationship with separation behaviour.

Dogs exposed to ongoing periods of separation for whatever duration were just as likely to exhibit separation behaviour as those gradually introduced to periods of social isolation. In other words, although gradual exposure to separation it is commonly recommended as a preventative measure, in practice the animal was just as likely to display vocal or destructive behaviour regardless of the mode of introduction to periods of human isolation.

Several animals apparently showed symptoms of separation behaviour which resulted in modification of housing (7 individuals) or sleeping arrangements (12 individuals). Five dogs were subsequently moved both overnight and when left alone. In such instances, four dogs were moved due to persistent vocalisation overnight. Allowing the dog to sleep in the bedroom often results in extinction of the vocalisation, although permitting greater owner contact is not advisable according to modern counselling practice. Restricting access for destructive individuals (either overnight or during owner absence) not only potentiates damage limitation but is also thought to reduce stress levels in the animal concerned. These results of this study indicate that if the dog is moved in either instance, e.g. overnight, it is also significantly likely to have been moved during owner absence.

5.3.3 *Effect of age and sex on separation behaviour*

The age and sex of the dog was found to have no significant relationship with the separation score of the dog in the new home. In the preceding assessment test (***Chapter 4***), no significant relationship was found with age and the composite measures taken during separation although young adults scored slightly higher than adults on measure 9 (vocal during separation). This result is somewhat unexpected since in the study by McBride *et al.* (1995), young adults were

significantly more likely than adults to display separation behaviour in the home.

As would be expected, those dogs displaying separation behaviour to any extent, but particularly those scoring 3, tended to persistently follow their owners from room to room, more so than other "normal" individuals.

One interesting difference between those dogs displaying separation behaviour and those not, was a discrepancy regarding the dog's focal attachment figure. Dogs showing separation symptoms were more likely to be attached to a male owner; however when those displaying more severe ongoing symptoms (separation score of 3) were examined, it became apparent that *females* were more likely to be the dog's focus of attachment. This latter observation is in accordance with a similar finding in the APBC study (***Chapter 2***). No firm conclusions can be drawn as to the reason for this sex bias, although it is possible that this may reflect a difference in owner perception rather than a genuine disparity in canine behaviour.

5.3.4 *Prediction of behaviour in the home from behaviour exhibited behaviour in the rescue centre*

Multiple linear regression testing revealed that animals scoring highly on measure 9 (vocal during separation) and measure 10 (destructive during separation) were significantly likely to obtain a high post-adoption separation score. Further investigation showed that measure 9 was more predictive than measure 10. This significant relationship existed only for the separation score on a scale of 0 to 3. When this scale was modified to the presence or absence of separation behaviour (1/0) and a logistic regression performed, no relationship was found. Furthermore when the scale was modified further to assess only ongoing separation behaviour, i.e. those dogs scoring 3, once again no relationship was found. It therefore seems that although the behaviour during separation whilst in the kennel is predictive of behaviour during separation in the home, it is essential that not only information regarding the presence or absence of behaviour is obtained but also a measure of the severity of the behaviour.

More specific examination of measures 9 and 10 with respect to the type of separation behaviour expressed in the new home revealed that the most significant association existed between measure 9 (vocal during separation) and the manifestation of vocal behaviour in the new home. An interesting

result, although slightly outside the boundaries of significance, was that of the relationship between measure 9 (vocal during separation) and dogs which were destructive in the new home. Measure 10 (destructive during separation) was not found to correlate with either vocal or destructive behaviour in the new home. It therefore appears that measure 9 is of most use in predicting the *type* of separation behaviour displayed in the new home. Measure 10, although predictive in the exhibition of separation behaviour in general, gives no indication of the symptoms likely to be displayed.

Examination of *Figure 5.1* reveals that in some instances, separation behaviour displayed in the new home had *not* been predicted by the scores obtained for either measure 9 or measure 10. In such cases, either the test circumstances failed to reveal any latent inappropriate behaviour, (for example: insufficient period of separation, inhibition of behaviour systems due to novel environmental circumstances, inadequate familiarity with the handler) or the separation behaviour developed *following* rehoming. It has previously been suggested that the upheaval associated with the adoption process itself may trigger, or at least contribute towards the development of separation behaviours; it would seem that this, in combination with the confounding variation associated with the new household and the development of new social relationships, may account for the false negative prediction of separation behaviour in a few individuals.

The vast majority of dogs assessed obtained at least a minimal score for either measure 9 or measure 10. In many instances, the reaction observed was not particularly obtrusive but nevertheless still evident. It is postulated that this is the major reason for the number of false positive predictions of separation behaviour, i.e. the dogs are reacting to the absence of social contact but not to an extent perceptible to the absent human care-givers. Taking arbitrary threshold levels of 1.0 for measure 9 and 3.0 for measure 10, the actual numbers associated with the false positive and false negative prediction of separation behaviour were as follows: 23 false positive results (13 on measure 9, 16 on measure 10); 16 false negative results (21 on measure 9, 23 on measure 10). Out of a total of 59 animals *not* displaying separation behaviour in the new home, 36 were accurately predicted (specificity[1] 61%), and out of a total of 40 that *did* display separation

[1] **Specificity = [true negatives / (false positives + true negatives)] x 100**, where specificity is the percent of those who do not have the condition, and are so indicated by the test

behaviour, 24 were accurately predicted (sensitivity[2] 60%).

In a single published validated test of general problem behaviour, Van der Borg *et al.* (1991) found that 35% of dogs showed signs of potential separation behaviour whilst in animal shelters. This compares with 79% in this study, although it must be noted that Van der Borg *et al.* left the dog in a car as opposed to in a room. Results obtained from ***Chapter 2*** (this thesis) together which considerable anecdotal evidence suggest that behavioural reactions to separation are manifested at a much lower frequency when within a vehicle than when the animal is left inside a building (Voith & Borchelt, 1985). Furthermore, the measures of separation behaviour employed by the Dutch workers differed somewhat from those used in this study. "Restless behaviour" was utilised as a measure of potential separation behaviour (although no definition of this behaviour was provided) together with the chewing of objects *whilst in the presence of people*. In addition, "car-related problems" (vocalising, attention-seeking behaviour, vomiting, and not staying on the back seat), many of which may be interpreted as indicators of distress during separation, were recorded under the alternative categorisation of "miscellaneous behaviour". On the basis of owner (telephone) interviews one to two months post-adoption, 28% of new owners felt the dog was showing signs of "potential" separation behaviour, and 19% viewed the dog as already exhibiting a "real" problem; this contrasts with 40% of reported behavioural symptoms in the present study. According to assessments made by shelter staff prior to testing (based largely on information obtained from previous owners) and the actual tests performed, Van der Borg *et al.* (1991) claimed that 100% of separation problems had been accurately predicted[3]. Calculation of the predictive value of the tests (taking into account false positive and false negative results) generated a value of 91.9%. Although the present study generated a considerably lower level of accuracy in the prediction of separation behaviour (~60% as opposed to 100%), it is felt that the measures recorded in this study were not only more stringent but indicative of true separation behaviour rather than some of the ambiguous measures employed by Van der Borg *et al.*.

2

Sensitivity = [true positives / (true positives + false negatives)] x 100, where sensitivty is the percent of those who have the condition and are so indicated by the test

3

No information was provided as to the number or type of questions asked during the course of owner interview nor the criteria for categorisation of "separation problem" behaviour

5.4 *Conclusions*

As an assessment of prospective separation behaviour, the series of tests described in ***Chapter 4*** predict vocal and destructive behaviour in the new home with approximately 60% accuracy.

Animals which display a vocal or destructive reaction to separation during a five minute period of social isolation in a kennel assessment test are likely to show a reaction to separation, although not necessarily of the same type, in the home situation. Factors pertaining to the home environment are unlikely to influence separation behaviour; however those animals already showing symptoms in the kennels are likely to persist with this behaviour following rehoming. Neither the age nor sex of the dog was found to influence the impending reaction to separation.

Dogs scoring highly on measure 9 were, not surprisingly, likely to vocalise during separation, although it was possible they may display destructive tendencies. The type of separation behaviour shown by dogs scoring highly on measure 10 was indeterminable. In each case, it was not possible to predict how severe the separation reaction would be, merely that it would or would not occur.

Part III

ASSESSMENT OF PUPPY BEHAVIOUR AT SEVEN WEEKS

6.1 *Introduction*

Previous studies of the behavioural development of dogs have primarily focussed on the "socialisation period" (McCune *et al.*, 1995). As mentioned in ***Chapter 1***, there is an increasing amount of evidence to suggest that the adolescent period may also be of importance in the development of social relationships. I hypothesise that differences in social experience during the socialisation and juvenile periods predispose some dogs more than others to exhibit separation behaviour. It was therefore proposed that the year following initial socialisation be investigated, focussing on the formation and quality of attachments; it might then prove possible to delimit an equivalent "attachment period". Since separation problems are principally thought to arise from a fundamental disruption of attachment, this area of the project provides the greatest scope for enlightenment regarding the origins of separation problems.

A longitudinal study of the development of the dog-human relationship between seven weeks and eighteen months of age was therefore undertaken, using twelve litters of puppies. Two breeds, Labrador Retrievers and Border Collies were selected for investigation due to their relative abundance and correspondingly high representation in separation behaviour cases. In an analysis of information gathered for the 1994 APBC Annual report, it was found that 13% (353 dogs), from a total of 2,769 referred cases, exhibited symptoms during owner separation (Appleby & Magnus, 1994). Of the 2,769 problem behaviour cases, Border Collies were the third most common breed presented, an over-representation in relation to corresponding Kennel Club registrations. Labrador Retrievers were the sixth most frequently presented breed, although the Labrador ranks as the most popular breed in Britain (Kennel Gazette, 1994). On analysing the type of problem displayed by each breed, Labradors displayed separation behaviour more often than any other problem and more frequently than any other breed. Separation problems were located third in the frequency of

behaviour problems exhibited by the Border Collie. Given that in general, separation problems appear to be the third most common problem referred to behaviour counsellors overall, the Labrador would seem to be particularly prone to exhibiting this type of inappropriate behaviour.

6.2 *Subjects and methods*

Initially, observations were made of within-litter interactions prior to homing and of individual puppies' reactions to familiar and unfamiliar persons. At seven weeks of age, puppies have a brain activity approximating that of an adult dog and are therefore sufficiently mature to undergo a series of short, non-invasive tests. The age of homing puppies varies greatly between breeders; however, the majority are homed after seven weeks of age. Up to the time of dispersal, each litter has been exposed to (largely) identical experiences both in terms of the environment and socialisation/social referencing; hence any differences in behaviour observed between individuals may be assumed to arise from variations in temperament[1]. By testing the puppies at seven weeks whilst the litter is still intact, it was hoped that if any reliable predictors of temperament were to be obtained, this was the optimum age for testing.

The employment of structured "tests" as indicators of puppy personality has been under debate for some time. Conventional puppy tests incorporate numerous elements devised for the prediction of various aspects of temperament. Many breeders and trainers proclaim absolute confidence in the predictive value of such tests, though little evidence exists to substantiate them (Beaudet *et al.*, 1994). Fearfulness appears to be the only feature capable of being accurately predicted (Goddard & Beilhartz, 1986), the level of which can be determined without devising a comprehensive test. Potentially, a major impediment to determining the accuracy and reliability of "puppy tests", indeed the behavioural assessment of dogs at any age, is that frequently considerable skill is assumed on the part of the observer for accurate interpretation of the behaviours displayed.

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1 "Temperament can be seen as the external manifestation, characteristic of an individual, in which the different behaviours interact temporally and are modulated in intensity" (Manteca and Deag, 1993)

6.2.1 *Assessment at seven weeks*

Each litter was first exposed to a brief period of observation in the presence of the breeder or other familiar person. The tests were, wherever possible, carried out in circumstances familiar to the puppies since it was anticipated that moving them to a novel environment would induce a substantial level of exploratory behaviour, if not fearfulness, which would detract from the object of the tests. The tests themselves were intended to obtain information on the puppies' level of social attraction, both intra and interspecifically, and to compare the reactions of the puppies to familiar and unfamiliar persons with the aim of obtaining some measure of attachment. The elements comprising many traditional (mostly unpublished) puppy tests encompass aspects of temperament which are largely irrelevant to this project. It was therefore decided that the assessment of seven week old puppies would be adapted to an examination of specific behaviours directly applicable to this study only.

6.2.1.1 *Measuring attachment*

Quantification of attachment is an extremely difficult matter. Most models of attachment have been developed from human or primate studies primarily for the investigation of infant-maternal attachment. The criteria I chose from which to develop a series of measurements are outlined below.

Criteria of Attachment (Gubernick, 1981):

1 A preference for one individual over another *

2 Seeking and maintenance of proximity to that figure

3 Response to brief separation from the presumed attachment figure

4 Response to extended periods of separation

5 Response to reunion with the presumed attachment figure

6 Use of the attachment figure as a secure base from which to explore the environment

* considered most important when looking at attachment (Cohen, 1974)

The application of several of these measurements is restricted when using companion animals of such a young age. For obvious ethical reasons it was unacceptable to subject the puppies to any situation likely to cause unnecessary distress. At seven weeks of age the pups are in the middle of the socialisation period, hence by definition they are at an extremely sensitive and impressionable period in their development. The above criteria were therefore adhered to as far as possible without compromising the welfare of the puppies.

The tests were conducted at forty-nine days, or as close to this age as possible, preferably not immediately after feeding, or following worming, vaccination, or eye testing. As stated earlier, the area used for testing should be familiar but restricted - frequently some if not all of the test area represented the puppies' normal environment, where they had been housed since birth. All puppies were tested with standard protocol using myself as the unfamiliar person. The breeders were therefore able to observe my interactions with the puppies before repeating all test elements themselves. Each puppy in any given litter was tested four times, twice with littermates present and twice individually; this permitted comparisons of behaviour to be made between the presence/absence of siblings and with familiar/unfamiliar testers.

Following completion of puppy testing, the breeder was presented with a brief questionnaire (delivered by myself) requesting information regarding the puppies' age, sex, housing, social experience and when they were likely to be homed *etc.* (see ***Appendix E***), the details of which are analysed in ***Chapter 8***.

6.2.2.1 Test for the litter as a whole

The litter test served to ascertain the puppies' reactions to people when tested collectively as opposed to individually. Preliminary observations of Husky puppies in January 1994 suggested that timid individuals behave more confidently in the presence of their peers. Since the object of the tests was to examine social attraction and "bonding", it would have been ineffectual to disturb a fearful puppy by unduly exposing it to a series of intimidating experiences. By looking at the litter as a whole, one could also determine the social preference of each puppy, i.e. whether for humans, littermates or neither when given the option of unconstrained interaction. The tests were conducted out of sight and earshot of the dam and where possible, any other conspecifics. Individual puppies within a litter were identified by means of coloured collars which were put in place shortly before testing commenced.

1. Ignoring the litter

The tester entered the area where the puppies were already present, crouched down and ignored them for a period of thirty seconds. If any of the puppies approached and tried to attract the observer's attention, no physical reciprocation, verbal communication, or eye contact was made with the puppy. The measurements taken were: which puppies approached and how long it took them to do so, behaviours displayed towards the person, including affiliative and attention seeking behaviours, any fearful responses.

2. Encouragement to approach

The puppies were encouraged to approach verbally, and using body and facial gestures if required. On approach, the pups were gently spoken to and stroked. Any which seemed less willing to approach were given a higher level of encouragement. The puppies were allowed a maximum of thirty seconds to approach. It was essential that no preferential treatment was displayed to individual puppies, this being emphasised to the breeder prior to testing.

3. Response to social interaction

Once the puppies had been given adequate opportunity to approach, they were gently petted and the level of interaction increased to that of social "play" with the person. Once again, if any individuals seemed a little intimidated or more interested in other forms of interaction, further encouragement was given. The total time allocated was four minutes. These few minutes allowed the puppies to become familiar with the person conducting the tests before the impending departure.

4. Response to departure

The tester stood up and quietly left the test area for one minute, to an area where the puppy had no audio or visual contact with the person.

5. Reunion with the tester

The tester re-entered the test area, and took up a position similar to that prior to departure. The puppies were greeted as normal by the breeder (in a standard manner by myself).

All tests were recorded on video, to be analysed at a later date. The frequency and duration of

various behaviours, which had been pre-selected for their relevance to social preferences and response to separation, were recorded by hand. The full ethogram of behaviours measured can be found in *Table 6.1*. Unless stated otherwise, the behaviours measured refer only to actions made toward the person present (as opposed to a conspecific or inanimate object) at any particular time.

6.2.2.2 Test for individual puppies

Each puppy was removed from the litter and tested individually for approximately seven minutes. On completion of all litter members, the puppies were once again taken one at a time (in the same order) and exposed to exactly the same tests with the breeder present. If it was felt the puppies were becoming tired, a break was taken between tests to allow them some recovery time. This was particularly important during the summer months when weather conditions were extremely oppressive. The tests were conducted out of sight and earshot of the littermates and dam whenever possible.

The tester was already present in the test area when each puppy was introduced. The puppy was placed facing, but approximately four feet away from the person allowing it sufficient distance to either approach or retreat.

1. Ignoring the puppy

As in the litter test, the puppy was initially ignored for thirty seconds

2. Encouragement to approach

The puppy was called and gently encouraged to approach if it had not already done so. On approach the pup was spoken to and quietly petted. The time allocated for this part of the test was again thirty seconds, however, if an individual was particularly nervous, further time was provided to reassure the puppy.

3. Play

A suitably sized toy (small *Ragger*[2]) was introduced into the area and the puppy encouraged to

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2 A short length(~ 15cms) of coloured entwined rope, knotted at each end

play for three minutes. The object of this test was to ascertain whether the pup was willing to play, and if so how long it would play for before becoming distracted. These three minutes also served to familiarise the puppy with the environment and the person testing, prior to being left alone.

4. Social attraction

The toy was taken away from the puppy and removed from the test area. The tester then slowly stood up and moved away from the pup, ensuring the puppy had seen this happen, before walking around the test area encouraging the puppy to follow for a period of one minute. The function of this test was to see whether the puppy had developed a sufficient "bond" with the person during the first part of the test as opposed merely exploring the person and then behaving completely independently (as may have happened through measuring 1 and 2 alone).

5. Social isolation

The tester quietly departed the area leaving the puppy alone for one minute.

6. Reunion with the tester

The tester re-entered the area and greeted the puppy as normal. The puppy's reaction for the first thirty seconds was recorded.

The full ethogram of measurements recorded can be found in *Table 6.1*.

Following completion of all tests, a brief questionnaire was presented to the breeder of the puppies to determine how much socialisation/social referencing they had received since birth. This covered: the amount of time the breeder spent with the puppies, whether they had met strangers before, and whether or not they had met children. Information about the dam was also collected, including her age, the number of previous litters she had raised, and whether the breeder felt she was a good mother (see *Appendix E*).

Table 6.1 Ethogram of behaviours for seven week old puppies

Behaviour	**Description**
Approach	Orientation and advancement towards human contact
Look	Making direct eye contact with the person present
Investigate	Exploratory behaviour of the person, usually sniffing
Jump up	Standing on the hind legs or complete elevation from a surface in an attempt to make contact with or reduce distance between puppy and person
Raise Paw	The raising of a foreleg, normally in an extravagant manner, frequently interpreted as a play invitation
Groom	Licking performed by the puppy, usually targeted at the facial region of the person
Lick lips	Licking of the lips by a puppy, a signal usually associated with submission
Roll over	Revelation of the ano-genital region whilst the puppy is laid on its back
Play bow	Lowering of the front paws, head and chest towards the person concerned
Cringe	Adoption of a lowered head and body posture, frequently accompanied by a tucked tail position and diverted eye contact
Fearful	Any behaviour indicative of a generally nervous state including avoidance of human contact, trembling, exhibition of a startle response
Sit at exit	Approach and a period of hesitancy at the exit through which the tester most recently departed
Contact exit	Scratching or jumping up at the exit through which the tester most recently departed
Vocalise	Frequency of whining, yelping, barking and howling within a given time period
Destruction	Any chewing, biting or digging behaviour exhibited towards inanimate objects
Elimination	Urination or defecation throughout any part of the test
Time taken to approach	The time taken for the puppy to reach close proximity (within 30cm) with the person present
Time spent with person	The total amount of time spent interacting with the tester
Time spent with puppy	The total amount of time spent interacting with one or more littermates (only applicable to litter test)
Time spent playing	The total amount of time spent engaged in play with the toy provided (only applicable to individual test part 3)
Time spent alone	The total amount of time spent interacting with neither person nor littermates (during litter test only) The total amount of time spent not interacting with the person (during individual test) or playing with the toy provided (individual test part 3 only)

6.2.3 *Litter numbers and composition*

Great effort was made to find equal numbers of Border Collie and Labrador litters utilising previous contacts of the University, local dog training clubs, the Kennel Club, regional breed clubs, national puppy lines (*Petplan*), the *Crufts* catalogue of breeders, and personal networking. Unfortunately this proved far more difficult than anticipated and the target seven litters of each breed was not reached, Border Collies proving to be particularly elusive.

Thirty eight (24 male, 14 female) Labradors were tested from seven litters, which ranged in size from three to eight puppies (median=5) (see *Figure 6.1*). The Collies tested (14 male, 11 female) came from 5 litters, which ranged in size from four to seven puppies (median =5) (see *Figure 6.2*).

Many of the litters (both Collie and Labrador) had been bred with a specific aim in mind, usually as show dogs, although many in fact went on to be homed as companion animals. One Collie litter were intended to go on to perform as obedience/agility dogs and all litter members were trained as such following homing. Three Labrador litters were bred as working gundogs, although once again several were homed as pets. The majority of litters were bred and housed in outdoor kennels, only 4 of the 12 being reared within the household.

Figure 6.1 ***Labrador Retriever*** litter composition

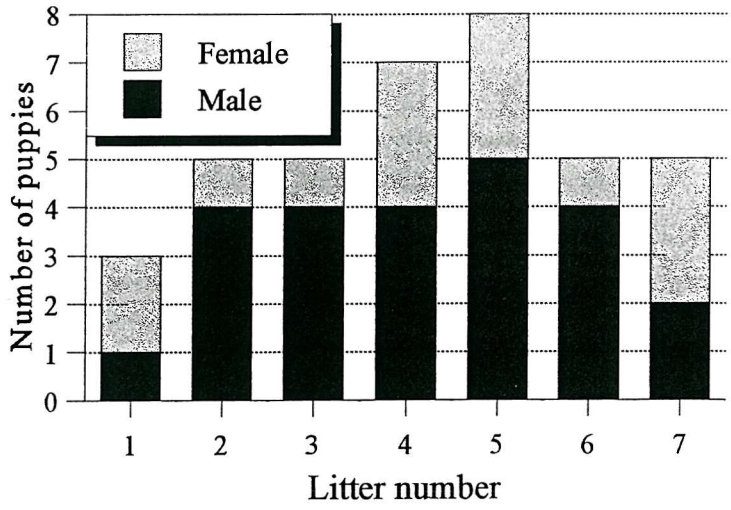
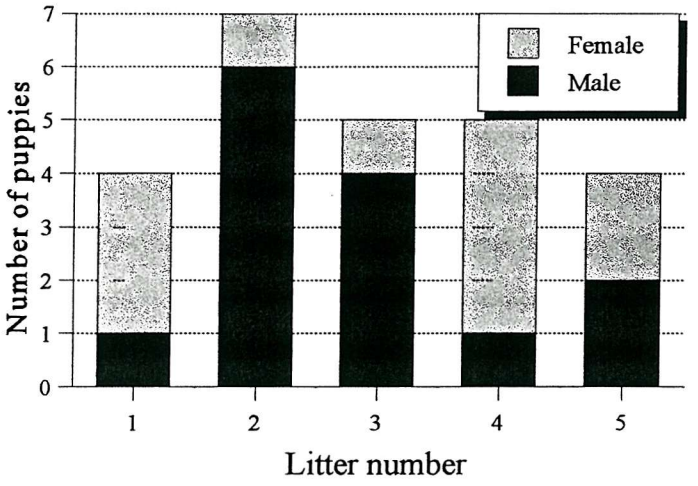


Figure 6.2 ***Border Collie*** litter composition



6.3 *Results*

6.3.0 *Summary of statistical analysis*

Initial statistical analysis investigated the association of behaviours displayed by puppies aged seven weeks using firstly Spearman's rank correlation coefficient and then Principal Factor Analysis (with varimax-rotation). Following the generation of a number of factors, breed, sex, breed/sex interaction, and litter effects were examined using a nested analysis of variance.

6.3.1 *Scoring of behaviour*

The frequencies and durations of all behaviours in the ethogram (*Table 6.1*) were recorded for all parts of each test wherever appropriate. Scoring and timing of behaviours were made by hand and subsequently imported into *LOTUS 1-2-3 VERSION 5*. For statistical analysis of measures, all variables were modified to percentages in the manner described below.

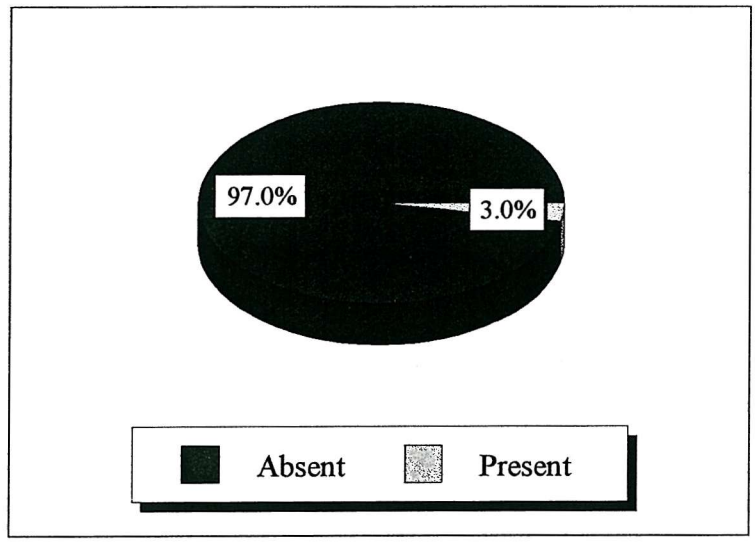
Latency of approach was the total amount of time taken for a puppy to approach to within 30cms of the tester, initially recorded as time in seconds but then converted to a 3-point scale. If a puppy began to approach immediately, i.e. within one second of the commencement of the test part, the latency of approach was scored as 2. If there was a delay in approach, a score of 1 was allocated; if

no approach was made, the puppy scored 0. Scores were then multiplied by a factor of 50 to convert them to percentages.

Duration of interaction (with either person or puppy) was initially scored as length of time of interaction in any test part. This was then modified to % of time interacting in order to adjust for different test element durations.

Separation behaviours: behaviours towards the exit, vocalisations (barking + whining) and eliminations were recorded across all elements of all tests; however examination of the incidence of these behaviours revealed that the vast majority of all behaviours occurred during the period of separation (see *Figure. 6.3*). This therefore appears to confirm such behaviours as quantifiable measures of distress and validates their use in both this and subsequent litter studies. Two variables were retained as measures of distress: approach exit (sit at exit) and vocalisation (whining + barking), both recorded as behavioural frequencies. Eliminatory behaviour was not retained as a behavioural measure due to its relatively infrequent occurrence.

Figure 6.3 Incidence of vocalisations and approaches towards the exit throughout individual tests (as a rate per minute), person present (present) and person absent (absent) compared



The *maximum* number of vocalisations and exit behaviours was noted, this value was then rounded up to a figure slightly higher than this maximum, and all frequencies of behaviour were modified to a percentage of this value. For example, the maximum number of vocalisations in a one minute

period of isolation was 128 and the maximum number of exit approaches was 9; all subsequent percentages were therefore calculated taking 130 as 100% of vocalisations and 10 as 100% of exit behaviours.

The complete set of variables retained for statistical analysis were as follows:

1. Latency of approach during stage 1 (ignore), stage 2 (call), stage 3 (social/object play), stage 4 (follow), and stage 6 (greet) for tests with: litter unfamiliar, litter familiar, individual unfamiliar, individual familiar.

2. Time interacting with person during stage 1(ignore), stage 2 (call), stage 3 (social/object play), stage 4 (follow), stage 6 (greet) for tests with: litter unfamiliar, litter familiar, individual unfamiliar, individual familiar.

3. Time interacting with puppy during stage 1 (ignore), stage 2 (call), stage 3 (social play), stage 5 (separation), stage 6 (greet) for tests with: litter unfamiliar, litter familiar.

4. Vocalisations and behaviours towards the exit during stage 5 (separation) for tests with: litter unfamiliar, litter familiar, individual unfamiliar, individual familiar.

A total of 54 measurements per puppy were retained for statistical analysis. Due to the restricted sample size of 63 individuals, it was felt that to include any additional frequency behaviours would invalidate any multivariate statistical analysis as strictly speaking, the number of subjects should be at least twice the number of variables measured.

6.3.2 *General Observations*

Considerable inter and intra-litter variation was found to exist in the litter tests for both unfamiliar and familiar testers.

6.3.2.1 *Latency of approach to tester*

The vast majority of puppies had approached within the initial 30 second period, one litter being a notable exception to this trend. *Figure 6.4* displays the approach time (on a logarithmic

transformed scale[3]) for each test and tends to indicate that puppies were more keen to approach the tester when their littermates were present. In fact fewer puppies approached within the initial 30 second period when their littermates were present (largely as a result of alternative littermate interaction) as opposed to during individual testing, however the use of logarithmic transformation for latency of approach necessarily reduces the effect of these outliers and somewhat masks the overall impression. For all of the following graphs the abbreviation LU refers to the litter test with the unfamiliar person, LF the litter test with the familiar person, IU the individual test with the unfamiliar person, and IF the individual test with the familiar person.

In a comparison of the latency of approach for each breed, very little difference was found to exist during individual testing; however, Collies appeared to be slightly more hesitant than Labradors regarding an approach to an unfamiliar person during the litter test and, conversely, were more eager to greet the familiar person (see *Figures 6.5* and *6.6*)

3

Since so many puppies approached immediately (i.e, latenct of approach = 0), log. transformation was used as opposed to actual approach times

Figure 6.4 Mean latency of approach for ***all*** puppies in all four tests, where x is the time to approach (in seconds)

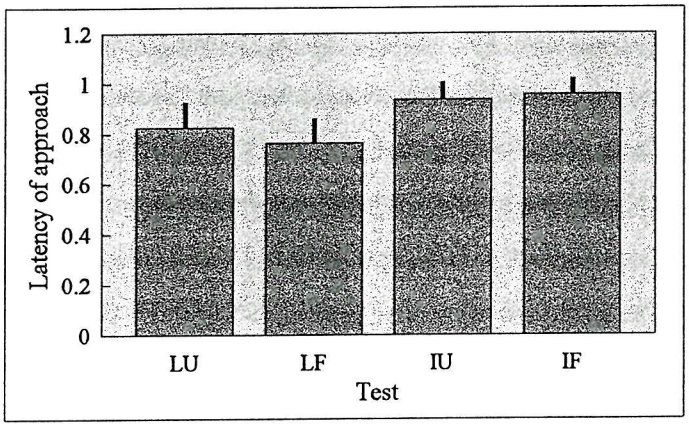


Figure 6.5 Mean latency of approach for ***Border Collies*** in all four tests, where x is the time to approach (in seconds)

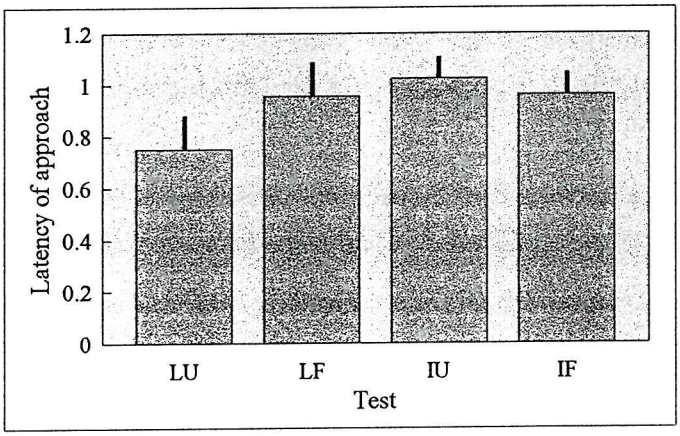
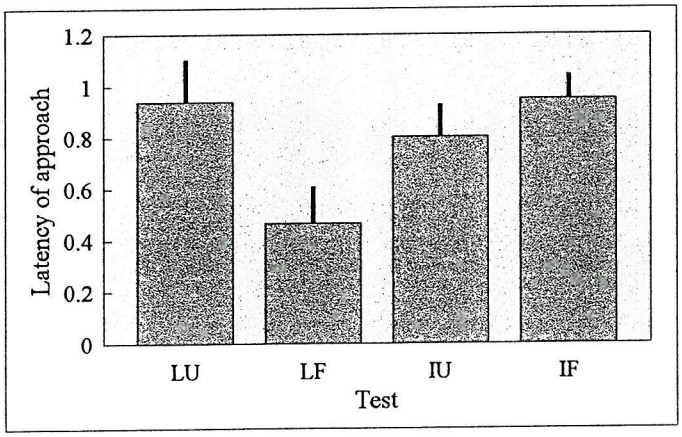


Figure 6.6 Mean latency of approach for ***Labradors*** in all four tests, where x is the time to approach (in seconds)



6.3.2.2 *Puppy sociability*

When the relative sociability (amount of time spent seeking and maintaining contact with tester/littermates) of litters was examined, it was observed that some litters were far more conspecific interactive than others. In general, the sociability of the litters was relatively constant; however, two litters apparently expressed a preference for puppy interaction (litters 2 and 3), spending more time with littermates than with the *unfamiliar* person (*Figures 6.7* and *6.8*). Littermate interaction tended to decrease with the presence of the breeder together with a slight increase in human orientated behaviour. This is not unexpected since it would seem logical that the presence of a familiar human provides a more powerful stimulus for social interaction than an unfamiliar person.

The amount of time spent engaged in canine social interaction seemed to be very litter specific (see *Figure 6.8*). Five of the twelve litters spent on average two to five times as much time in puppy interaction than the other seven; four of these were Labrador litters (litters 2, 3, 6, and 7).

In an examination of breed differences in sociability, it became apparent that minimal distinction existed between the two breeds in terms of overall sociability, although Labradors showed a greater attraction for littermate interaction in both litter tests. This can clearly be seen in *Figure 6.9* where the Labradors spent on average more than twice as much time with other puppies as the Collies did.

A minimal number of puppies displayed a reluctance to participate in social activity. Of these four individuals, three were Collies, all of which interacted more with the familiar person than any other potential source of social contact. One Labrador exhibited little social activity, although according to the breeder, was behaving slightly out of character at the time of testing.

Figure 6.7 Mean duration of interaction with the ***tester*** throughout litter tests, unfamiliar and familiar person tests summed. Labrador litters are numbered 1 to 7, those numbered 8 to 12 are Border Collies

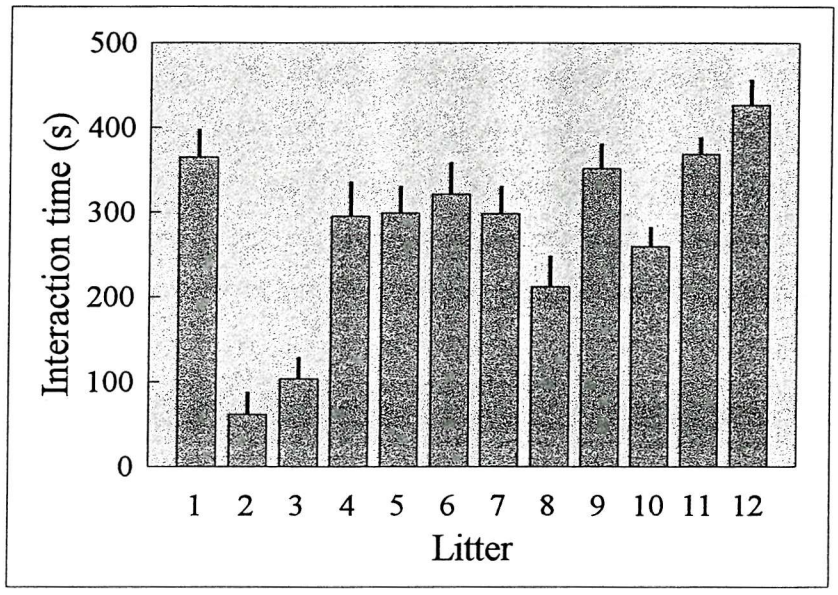


Figure 6.8 Mean duration of interaction with ***littermates*** throughout litter tests, unfamiliar and familiar person tests summed. Labrador litters are numbered 1 to 7, those numbered 8 to 12 are Border Collies

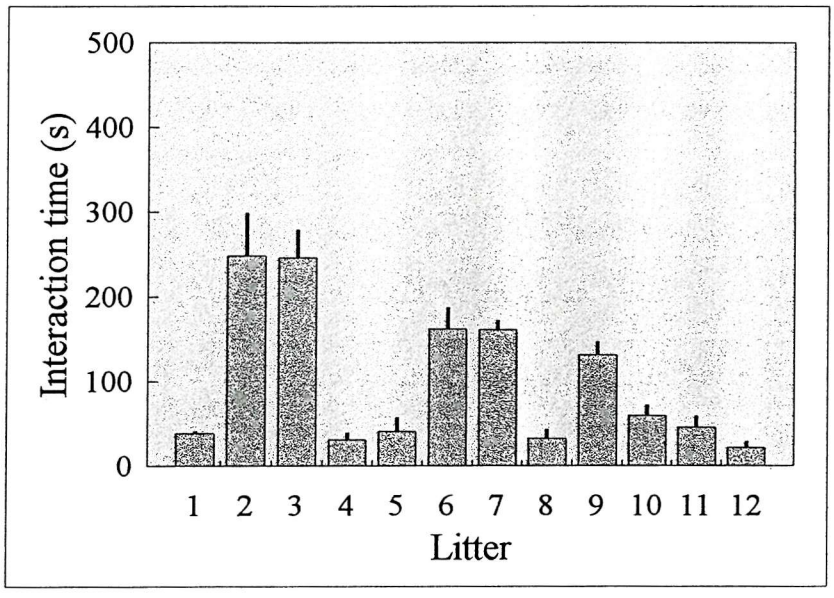


Figure 6.9 Breed comparison of the mean duration of interaction with the ***tester*** throughout litter tests, unfamiliar and familiar person tests combined

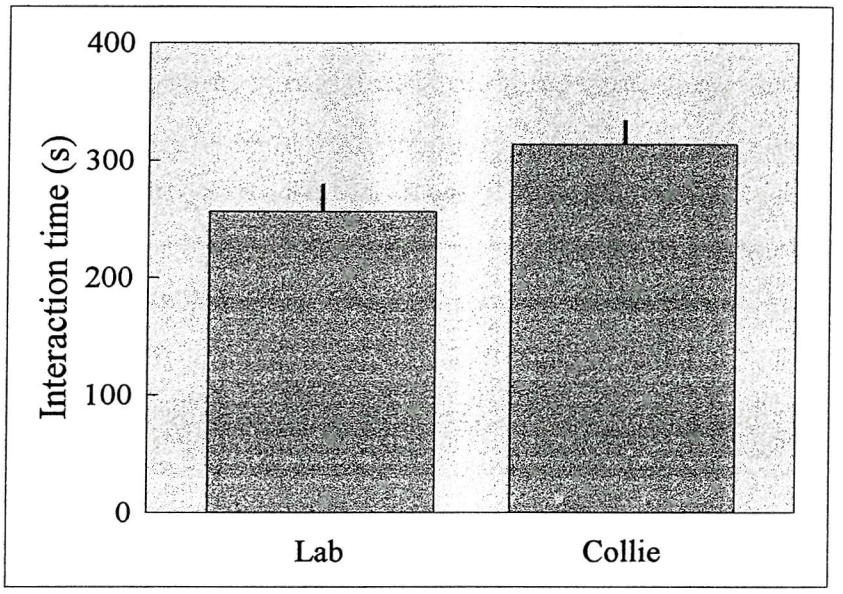
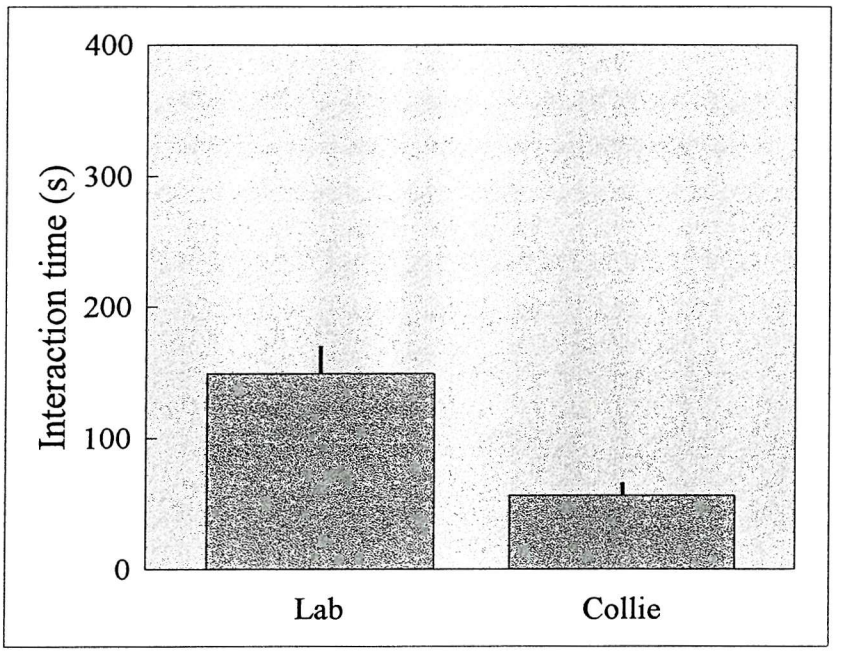


Figure 6.10 Breed comparison of the mean duration of interaction with the ***tester*** throughout litter tests, unfamiliar and familiar person tests combined



6.3.2.3 *Separation behaviour*

The behaviour of puppies during separation was highly variable. All litters displayed some indicator of distress although a few at a very low level. In general, Labradors showed a tendency to exhibit separation behaviours at a higher rate, particularly vocalisations (*Figures 6.11* and *6.12*).

Examining the occurrence of separation behaviours across the four tests yielded interesting but again unsurprising results; the frequency of both exit behaviours (*Figure 6.13*) and vocalisations (*Figure 6.14*) increased when puppies were isolated from the litter. This finding is in line with that of previous researchers who suggested that isolation from the litter induces distress which is alleviated by warm, social interaction (Pettijohn, Wong and Ebert, 1977).

6.3.2 *Association of behaviours*

Initially a Spearman's Rank Correlation matrix containing all 54 variables was generated via *SPSS*. This allowed preliminary examination of significant associations of measurements prior to any multivariate statistical operations.

Principal factor analysis and varimax factor rotation were then performed as a method of data reduction and to extract specific relationships between variables. Fifteen factors were generated with eigenvalues greater than one, thirteen of which were retained for further analysis. Several of the factors contained duplicated variables and discretion was used in allocating measures to factors in accordance with the numerical value of the duplicated variable and its relevance to other measures within a given factor. The values obtained following varimax rotation can be found in *Table 6.2* together with the final allocation of measures to factors in *Table 6.3*.

Figure 6.11 Breed comparison of the mean frequency of approaches to the exit during a one minute period of complete social isolation, tests with the unfamiliar and familiar person summed

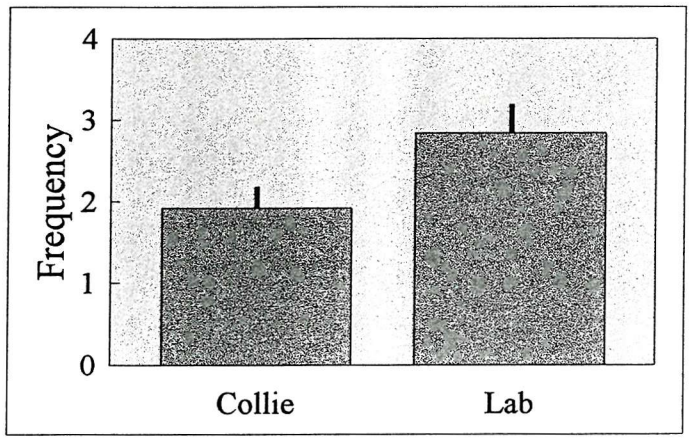


Figure 6.12 Breed comparison of the mean frequency of vocalisations during a one minute period of complete social isolation, tests with the unfamiliar and familiar person summed

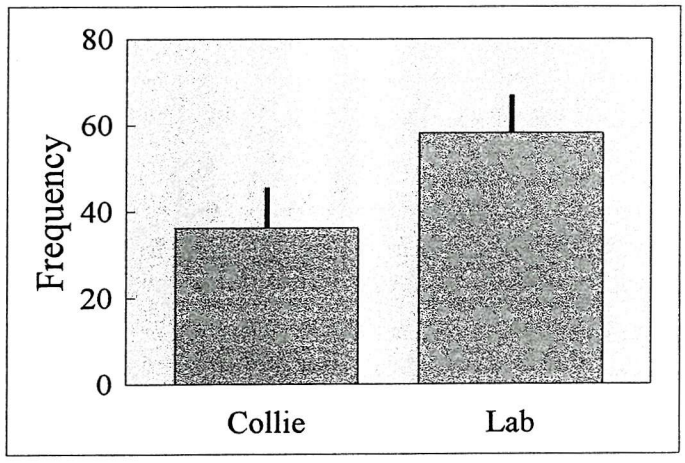


Figure 6.13 Mean frequency of approaches to the exit during a one minute period of separation, where LU is the litter/unfamiliar test, LF litter/familiar test, IU individual/unfamiliar test, and IU the individual/familiar test

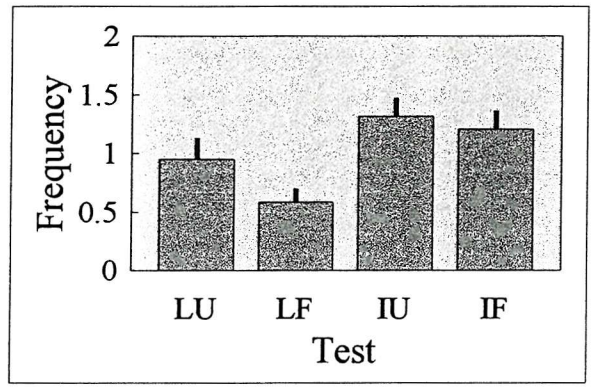


Figure 6.14 Mean frequency of vocalisations during a one minute period of separation, where LU is the litter/unfamiliar test, LF litter/familiar, IU individual/unfamiliar, and IU the individual/familiar test

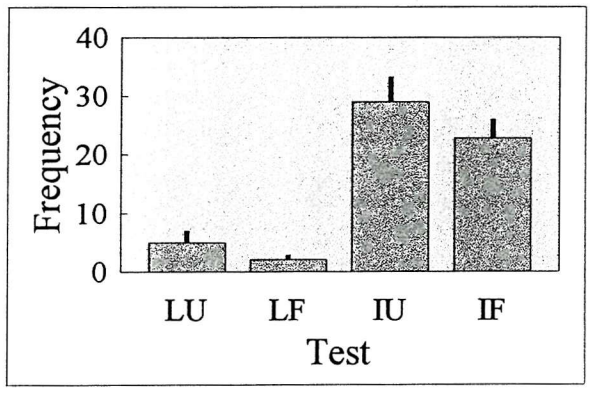


Table 6.2 Weightings for the original variables on the thirteen varimax-rotated factors. Values highlighted in bold are those variables used to interpret a given factor, i.e. those accounting for 50% or more of each factor's maximum score. Prefix *lu* refers to litter unfamiliar, *lf* litter familiar, *iu* individual unfamiliar, and *if* individual familiar. In each instance, numbers within the variable refer to the test part concerned, i.e. 1, ignore; 2, call; 3, play/interact; 4, follow; 5, separation; 6, reunion. Other abbreviations are: *appro*, approach; *perso*, interaction with person; *puppy*, interaction with puppy; *vocal*, vocalisation; *sitex*, sit at / approach exit.

Variable	Fac 1	Fac 2	Fac 3	Fac 4	Fac 5	Fac 6	Fac 7	Fac 8	Fac 9	Fac 10	Fac 11	Fac 12	Fac 13
lu1appro						**0.614**							
lu1perso			0.456			**0.524**							
lu1puppy						**-0.503**							
lf1appro	**0.840**												
lf1perso	**0.876**												
lf1puppy		**0.701**											
iu1appro					**0.760**								
iu1perso					**0.767**								
if1appro								**0.606**					
if1perso								**0.543**				0.427	
lu2appro			**0.829**										
lu2perso					**0.658**								
lu2puppy		**0.683**			**0.747**								
lf2appro	**0.831**												
lf2perso	**0.762**												

Variable	Fac 1	Fac 2	Fac 3	Fac 4	Fac 5	Fac 6	Fac 7	Fac 8	Fac 9	Fac 10	Fac 11	Fac 12	Fac 13
lf2puppy						-0.741							
iu2appro													
iu2perso													
if2appro								0.801					
if2perso								0.787					
lu3appro			0.755										
lu3perso			0.312*										
lu3puppy		0.604											
lf3appro	0.763												
lf3perso	0.732												
lf3puppy													
iu3perso													
iu3play													0.517
if3perso							0.867						
if3play							-0.889						
iu4appro											0.843		
iu4follow											0.801		
if4appro				0.491									
if4follow				0.694									
lu5sitex									0.579				

Variable	Fac 1	Fac 2	Fac 3	Fac 4	Fac 5	Fac 6	Fac 7	Fac 8	Fac 9	Fac 10	Fac 11	Fac 12	Fac 13
lu5vocal									**0.788**				
lu5puppy				-0.506									
lf5sitex													**0.752**
lf5vocal									**0.680**				
lf5puppy		**0.448**											
iu5sitex						**0.404**							
iu5vocal							**0.515**						0.385
if5sitex				**0.556**	-0.343								
if5vocal							**0.533**		0.431				
lu6appro										**0.808**			
lu6perso										**0.884**			
lu6puppy		**0.696**											
lf6appro	0.449												
lf6perso	0.480												
lf6puppy		**0.680**											
iu6appro												**0.774**	
iu6perso						**0.426**						**0.578**	
if6appro				**0.781**									
if6perso				**0.767**									

* despite having a value of less than 50% maximum, this variable was retained within factor 3 as a measure appropriate to this factor.

Table 6.3 Behavioural measures loaded positively on each of thirteen varimax-rotated principal factors with descriptive names.

Factor	Factor name	Test	Person	Test part	Behaviour
1	Familiar interactive, littermates present	Litter Litter Litter Litter Litter Litter	Familiar Familiar Familiar Familiar Familiar Familiar	Ignore Ignore Call Call Pet Pet	Approach person Interact person Approach person Interact person Approach person Interact person
2	Conspecific interactive	Litter Litter Litter Litter Litter Litter	Unfamiliar Unfamiliar Unfamiliar Familiar Familiar Familiar	Call Pet Greet Ignore Separation Greet	Interact puppy Interact puppy Interact puppy Interact puppy Interact puppy Interact puppy
3	Unfamiliar interactive, littermates present	Litter Litter Litter Litter	Unfamiliar Unfamiliar Unfamiliar Unfamiliar	Call Call Pet Pet	Approach person Interact person Approach person Interact person
4	Individual familiar attached	Individual Individual Individual Individual Individual	Familiar Familiar Familiar Familiar Familiar	Follow Follow Separation Greet Greet	Approach person Follow person Sit at exit Approach person Interact person
5	Initial attraction unfamiliar, littermates absent	Individual Individual Individual Individual	Unfamiliar Unfamiliar Unfamiliar Unfamiliar	Ignore Ignore Call Call	Approach person Interact person Approach person Interact person

Factor	Factor name	Test	Person	Test part	Behaviour
6	Unfamiliar interactive, response to unfamiliar separation	Litter Litter Litter Litter Individual Individual	Unfamiliar Unfamiliar Unfamiliar Familiar Unfamiliar Unfamiliar	Ignore Ignore Ignore Call Separation Greet	Approach person Interact person Interact puppy (-) Interact puppy (-) Sit at exit Interact person
7	Vocal separation, interactive familiar, littermates absent	Individual Individual Individual Individual	Familiar Familiar Familiar Unfamiliar	Play Play Separation Separation	Interact person Play (-) Vocalise Vocalise
8	Initial attraction familiar, littermates absent	Individual Individual Individual Individual	Familiar Familiar Familiar Familiar	Ignore Ignore Call Call	Approach person Interact person Approach person Interact person
9	Separation behaviour, littermates present	Litter Litter Litter	Unfamiliar Unfamiliar Familiar	Separation Separation Separation	Sit at exit Vocalise Vocalise
10	Greet unfamiliar, littermates present	Litter Litter	Unfamiliar Unfamiliar	Greet Greet	Approach person Interact person
11	Follow unfamiliar, littermates absent	Individual Individual	Unfamiliar Unfamiliar	Follow Follow	Approach person Interact person
12	Greet unfamiliar, littermates absent	Individual Individual	Unfamiliar Unfamiliar	Greet Greet	Approach person Interact person
13	Playful, unfamiliar Response to familiar separation, littermates present	Individual Litter	Unfamiliar Familiar	Play Separation	Play Sit at exit

Several of the factors appear to relate only to specific tests, for example factors 1, 3, 4, 5, 8, 10, 11 and 12.

6.3.3 *Effects of Independent variables*

Once the thirteen factors had been generated, the effect of breed and sex were examined in relation to the factor scores. In addition, since subjects were not entirely independent but housed as litter units, a nested analysis of variance was performed. Analysis of nested designs allows the effect of one or more independent variables (breed) to be investigated with respect to one response variable (factor score) when the data is completely nested (in litters) and the number of observations is approximately equal at all combinations of factor levels (STSC, 1988).

Statistical analysis was performed on the effect of:

1. Breed
2. Litter (nested within breed)
3. Sex
4. Breed/sex interaction

Table 6.4 Effect of breed and sex as independent variables on each of 13 factor scores. Values highlighted in bold are significant at the 5% level. Values asterisked are outside of the 5% significance level but within 0.1 limits

Factor	Breed		Litter		Sex		Breed/ sex	
	F ratio	p value	F ratio	p value	F ratio	p value	F ratio	p value
1	2.060	0.181	**6.065**	**<0.001**	0.084	0.773	0.991	0.324
2	1.815	0.207	**5.486**	**<0.001**	1.996	0.164	2.373	0.130
3	0.010	0.922	**2.369**	**0.022**	0.082	0.776	0.465	0.498
4	0.007	0.934	**9.373**	**<0.001**	3.985	0.051*	**5.365**	**0.022**
5	0.054	0.821	**4.385**	**<0.001**	0.068	0.796	0.157	0.694
6	1.938	0.193	**2.784**	**0.008**	1.501	0.226	0.713	0.402
7	0.408	0.537	**5.237**	**<0.001**	0.171	0.681	0.827	0.368
8	1.238	0.290	2.002	0.053*	0.135	0.715	0.656	0.422
9	0.328	0.578	1.590	0.138	3.382	0.072*	0.000	0.986
10	1.065	0.324	1.649	0.121	0.150	0.700	1.145	0.290
11	0.617	0.449	**2.183**	**0.035**	**5.051**	**0.029**	3.843	0.056*
12	0.006	0.939	**2.740**	**0.009**	**6.712**	**0.013**	**8.908**	**0.004**
13	0.461	0.512	**4.838**	**<0.001**	0.457	0.502	1.987	0.167

Substantial variation *within litters* was evident in Factors 1, 2, 3, 4, 5, 6, 7, 11, 12, and 13. No significant differences were found to exist between breeds at seven weeks of age, however several sex differences were revealed, together with two interactions of breed and sex (*Table 6.4*). Females were found to score higher than males on both Factor 9 (separation behaviour) and Factor 12 (greeting unfamiliar, littermates absent), whereas males generally scored higher on Factor 11 (following unfamiliar). With respect to Factor 4 (individual familiar attached), female Labradors were found to score higher than any other breed/sex grouping; females Border collies scored *lower* on Factor 11 (following unfamiliar) than any other breed/sex category.

6.4 Discussion

Considerable inter and intra-litter variation was found to exist in the puppy tests for both unfamiliar and familiar testers. My own general impression was that the litters used in this study were comprised of highly sociable, well adjusted puppies. Even those receiving relatively little human contact still received a fair amount of socialisation and this was reflected in their willingness to interact with both myself and the familiar person. Only 4 out of 63 puppies displayed a slight reluctance to interact with myself, one of which was reported to be behaving out of character at the time of testing. Indicators of nervous behaviour were rarely encountered (only 5 instances throughout all tests) and even then at an extremely low level.

Overall, puppies were more keen to approach the tester when their littermates were not present. Collies displayed a discrepancy between the time to approach each tester, the familiar being preferred to the unfamiliar tester. As regards interaction with littermates, the amount of time spent with conspecifics was greater when the unfamiliar person was present, presumably not as great a social attractant as the familiar person. In general, Labradors tended to interact with other puppies more than Collies, but this effect was very litter specific.

In line with other studies, this project confirms the use of vocalisations as quantifiable measures of distress in domestic puppies (e.g., Ross *et al.*, 1960; Elliott & Scott, 1961; Pettijohn *et al.*, 1977)), occurring at a rate per minute 33 times that when social contact was present. Labradors displayed separation behaviour at a higher rate than Collies, particularly vocalisations. Separation behaviour was found to be exhibited at considerably higher levels during complete social isolation than when only the tester was absent; once again this is in agreement with the findings of previous workers (Pettijohn *et al.*, 1977). The rate of separation behaviour was not, as had been anticipated, higher during absence of the familiar as opposed to absence of the unfamiliar. This may be due to an order effect, since testing by the familiar always followed testing by the unfamiliar person.

The 13 factors generated following retention of 54 variables relating to social preferences and separation activity revealed several associations with particular test parts. Five factors related to behaviour during litter tests only (1, 2, 3, 9, 10), one with the familiar person (1) and two with the unfamiliar person (3, 10). One of these five comprised variables relating only to conspecific interaction (2). Six factors were associated with behaviour during individual testing (4, 5, 7, 8, 11, 12), two towards the familiar tester (4, 8) and three to the unfamiliar (5, 11, 12). *None* of the

factors pertained to an absence of interaction with people although one factor contained variables describing a lack of interaction with littermates (6).

In total, five factors contained variables relating to separation behaviour (4, 6, 7, 9, 12), one of these comprised exclusively of separation behaviour whilst in the litter (9). One factor associated only with behaviour occurring during individual familiar testing (4) tends to suggest an attachment with this person, i.e. following, sitting at the exit during separation, and greeting following separation. Another factor contained variables of separation behaviour both during litter testing and individual testing, both with the unfamiliar person present (6). Two other factors related to a high level of interaction with a person combined with a reaction to separation (7, 13).

In summary, the tests performed on puppies at seven weeks of age revealed considerable intra and inter litter differences. Although no breed differences were found at this age, several sex differences were found to be in existence. Preferences for human and conspecific contact were revealed together with a preference for familiar/unfamiliar interaction. Most puppies reacted to a minute of separation from the familiar/unfamiliar person whilst they were with their littermates; however almost all reacted to complete social isolation over an equivalent period.

OBSERVATIONAL STUDY OF PUPPIES FROM THREE TO EIGHTEEN MONTHS

7.1 *Introduction*

It is hypothesized that the onset of separation behaviour peaks between six and eighteen months of age and that differences in social experience during the socialisation and juvenile periods predispose some dogs more than others to exhibiting separation behaviour. A full exploration of the changes occurring during the socialisation and juvenile periods was therefore undertaken, paying particular attention to the development of interspecific attachments, social experience and any incipient separation behaviours.

The tests of social attraction, sociability and social separation on litters of seven week old puppies in ***Chapter 6*** revealed substantial inter and intra-litter variation. The thirteen factors generated from these factors suggested that puppies of this age are able to differentiate familiar from unfamiliar persons. In this Chapter, I describe a protocol designed to investigate the level of attachment these puppies develop with their owners over a period of 16 months, with the aim of elucidating the ontogenic process of dog-human attachment. Measures of behaviour towards the owner (familiar person) in the presence of myself and an additional unfamiliar person, together with a brief period of separation from the familiar person and a minute of complete social isolation, were used to determine behavioural links as potential indicators of attachment. Following this, the behaviour of the dogs from 3 to 18 months could be examined in relation to the behaviour exhibited by the same individuals at 7 weeks (i.e., the 13 factors). An evaluation of the predictability of the puppy tests in terms of potential social preferences, general sociability and response to social isolation could then be determined.

7.2 Methods

Prior to homing of puppies assessed at seven weeks (***Chapter 6***), all breeders were issued with a letter to be handed on to the potential owners of each puppy, which outlined the aims and objectives of the project and requested permission to visit the puppy periodically over the next sixteen months. For statistical reasons, a minimum of two puppies per litter were required to participate in the longitudinal study. The vast majority of owners agreed to comply with the study, with loss of puppies being mainly due to either travelling distance, illness, death, or households acquiring more than one puppy from the same litter. In the latter instance, only one puppy from a particular litter in a given household was selected for study, since the sharing of a common environment in addition to genetic relatedness was inappropriate to this study. In total, 40 puppies were followed through from three to eighteen months, details of which may be found in *Table 7.1*.

Following homing of the puppies, a total of five visits were made to the new home when the pups were aged 3, 6, 9, 12 and 18 months. At the first visit, at three months of age, the puppy had been in its new home for approximately four to five weeks, giving it adequate time to settle in. With the exception of those puppies remaining at the breeder's residence the age of homing ranged from 49 days to 72 days, with the majority homed between seven and eight weeks. The initial attachment of the puppy to its new owner was assessed using criteria similar to those outlined in ***Section 6.2.1.1***.

Owners agreeing to participate in the longitudinal study were contacted approximately one week prior to each puppy reaching three months of age and a subsequent visit to the home arranged. It was requested that only one person from the family be involved in the testing and the puppy be isolated from any other pets throughout as a means of standardising each situation. In addition, I asked that the puppy be prevented from greeting myself and my assistant until filming had commenced[1].

1

It was agreed that for videos of sufficient quality to be obtained, a second person was required to record events on video tape whilst I was involved with the puppy and the owner, and that this person should behave in a neutral manner towards the puppy, acknowledging the puppy's initial approach and ignoring any subsequent attempted interaction.

Table 7.1 Litter composition of puppies studied from 3m to 18m

Litter number	Breed	Number & sex of puppies
1	Labrador	1♂, 2♀
2	Labrador	2♂, 1♀
3	Labrador	4♂, 1♀
4	Labrador	1♂, 3♀
5	Labrador	3♂
6	Labrador	2♀
7	Labrador	3♂
8	Border collie	3♀
9	Border collie	1♂, 1♀
10	Border collie	4♂, 1♀
11	Border collie	1♂, 3♀
12	Border collie	1♂, 2♀

Each puppy was permitted free access to the owner and myself as an unfamiliar person. Ideally, each puppy would have been given a choice of interaction with: owner (presumed attachment figure), familiar but non-attached person, and unfamiliar person as a standard preference test. As this was not viable given the available persons and time restrictions, no familiar unattached persons were used. Information regarding socialisation/social referencing was collected via a questionnaire delivered at the time of each visit (see ***Appendix G***).

7.2.1 *Test procedures*

The scenario for each visit was kept essentially the same both as a means of control and for ease of analysis. The following description of events can therefore be applied to all five visits over the sixteen month period.

1. The puppy was introduced to a familiar but restricted area after the video equipment had been set up and all persons were seated.

2. If the puppy approached, it was greeted and mildly petted. It was suggested to the puppy owner that the animal be allowed to behave without restriction unless its behaviour became unacceptable either socially or with regard to any obedience training. The owner was asked to behave as normal towards the puppy and to provide it with neither more nor less attention than usual.

3. Once the puppy had overcome its initial excitement (or fear) a questionnaire regarding the housing, daily routine and socialisation/social referencing of the puppy was delivered by myself to the owner (see ***Appendix G***). This questionnaire served not only as a method of gathering essential information but also to distract the owner from the puppy thereby preventing an artificially intense period of interaction.

4. Following the period of questioning (approximately 15 minutes), the owner was asked to leave the area completely for one minute. During this time, both experimenters remained in the area with the puppy, rewarding it verbally and physically on approach without actively encouraging interaction.

5. After one minute, all persons left the room, with the camera in a strategically placed position to record all behaviour during the period of brief isolation.

6. After a further duration of one minute, the owner was asked to re-enter the test room and to greet the puppy as normal, closely followed by myself and my assistant. This reunion was filmed for approximately one minute.

7. The final test component involved observing the pup's response to a mildly frightening experience. Mechanical children's toys were used for this purpose since they permitted the detachment of myself from the source of the fearful stimulus. Since I needed to observe the puppy on several prospective occasions, it would have been detrimental to allow an association between myself and an adverse experience to develop.

Referring back to Gubernick's (1981) criteria for the measurement attachment, the above scenario fulfilled many of the required practical applications.

i. A preference for one individual over another - determined in parts 1, 2, 3, 4 and 7

ii. Seeking and maintenance of proximity to that figure - again determined through parts 1, 2, 3, 4 and 7

iii. Response to brief separation from the presumed attachment figure - determined in parts 4 and 5

iv. Response to extended periods of separation - determined via the questionnaire

v. Response to reunion with the presumed attachment figure - determined in part 6

vi. Use of the attachment figure as a secure base from which to explore the environment - determined in parts 1, 2, 3, 4 and 7

The final test component (7) was included since animals (particularly juveniles) exposed to an unfamiliar and startling experience frequently seek consolation from social support (attachment) figures (Gubernick, 1981); in effect the puppy may be using this figure as a secure base, potentially providing additional evidence for attachment behaviours observed throughout other areas of the tests. Although the toys selected for part 7 were by definition both auditory and visually slightly disturbing, the intention was not to induce a lasting fearful response, although it was anticipated that some individuals would experience more distress than others. In light of this, the toys were only presented on every other occasion, i.e. at three months (*METRO, CIRCUS SEA LION, ITEM NO.0177*), nine months (*CE, MOTORIZED CRAZY SHAKER*) and eighteen months of age (*TYCO INDUSTRIES INC., PLAYTIME KITTIES, REG. NO. PA.5284(RC)*). This also assisted in the prevention of a learned association developing between a visit from a behavioural researcher and an unpleasant experience.

7.2.1 *Behaviours recorded and method of scoring*

All behaviour was recorded on video (*PANASONIC VHS-C MOVIE CAMERA, NV-R30B* or *SONY VIDEO 8, CCD-TR370E*). The behaviour patterns transcribed mainly pertained to affiliative, attention seeking, nervous and separation behaviour. All were recorded as potential indicators of attachment. The full ethogram of behaviours recorded is displayed in *Table 7.2*.

Table 7.2 Ethogram of behaviours recorded for 3-18 month old puppies

Behaviour	Description
During interview	
Approach	Orientation and advancement towards human contact
Bark	Immediate barking in response to unfamiliar persons
Urinate	Urination in response to unfamiliar persons
Look	Making direct eye contact with a particular person
Investigate	Exploratory behaviour of a person, usually sniffing
Jump up	Standing on the hind legs or complete elevation from a surface in an attempt to make contact with or reduce distance between puppy and person
Raise Paw	The raising of a foreleg, normally in an extravagant manner, frequently interpreted as a play invitation, or an attention seeking behaviour
Groom	Licking performed by the puppy, usually targeted at the facial region of the person
Lick lips	Licking of lips by the puppy, a signal usually associated with submission
Roll over	Exposure of the ano-genital region whilst the puppy is laid on its back
Play bow	Lowering of the front paws, head and chest towards the person concerned
Cringe	Adoption of a lowered head and body posture, frequently accompanied by a tucked tail position and diverted eye contact
Fearful	Any behaviour indicative of a generally nervous state including trembling, exhibition of a startle response
Avoid contact	Active avoidance of human contact
Latency of approach	The time taken for the puppy to reach close proximity (within 30cm) of the unfamiliar person/camera person
Duration of interaction	The total amount of time spent interacting with the unfamiliar, familiar and camera persons

Behaviour	Description
During separation	
Sit at exit	Approach and a period of hesitancy at the exit through which the familiar/unfamiliar person most recently departed
Contact exit	Scratching or jumping up at the exit through which the familiar/unfamiliar person most recently departed
Whine	Frequency of whining during familiar/all persons absent
Bark	Frequency of barking during familiar/all persons absent
Howl	Frequency of howling during familiar/all persons absent
Destruction	Any chewing, biting or digging behaviour exhibited towards inanimate objects
Elimination	Urination or defecation during familiar/all persons absent
Interaction unfamiliar	Amount of time spent interacting with the unfamiliar person/camera person following departure of the familiar person
Greeting	Latency and type of greeting (immediate effusive/delayed/none) shown towards familiar/unfamiliar persons during reunion
Reaction to toy	
Look	Direction of eye contact towards toy
Investigate	Exploratory behaviour (usually sniffing) of toy
Paw	Raising of paw towards or making direct contact with toy
Play bow	Lowering of the front paws, head and chest towards toy
Cringe	Adoption of a lowered head and body posture, frequently accompanied by a tucked tail position and diverted eye contact in reaction to toy
Startle	Sudden alarm in response to toy
Avoid	Active avoidance of toy
Lick lips	Licking of lips in response to toy
Whine	Frequency of whining in response to toy
Bark	Frequency of barking in response to toy
Mouth	Expression of oral behaviour towards toy
Approach person	Deliberate orientation of puppy towards owner/unfamiliar person/camera person
Look at person	Eye contact made with owner/unfamiliar person/camera person
Latency of approach (toy)	Time taken from activation of toy to puppy approaching to within 30cms

For all human directed behaviour, the target of interaction was recorded in each instance, i.e., familiar or unfamiliar person. Behaviour towards the camera-person was not recorded except for an overall interaction time, which was combined with the interaction time for myself (unfamiliar) when the owner was *not* present.

The majority of behaviours were recorded as frequencies within a given time period with the exception of several durations: latency of approach (to unfamiliar/camera person during interview; to toy in the final test part), interaction time (with familiar, unfamiliar and camera person during owner interview; with unfamiliar, camera person during owner absence). Behaviours towards the toys were initially scored as frequencies which were later modified to presence/absence measures following video analysis.

Although it would have been possible to transcribe behavioural information from the full duration of each owner interview (~15 minutes) it soon became apparent that the initial 10 minutes of filming were the most useful, particularly with respect to the 3 month and 6 month visits when the puppies displayed high levels of activity initially, only to sleep soon after. For this reason, behavioural observations consisted of recording the following periods only:

1	At three months:	first 10 minutes only
2	At six months:	first 10 minutes only
3	At nine months:	first 12.5 minutes only
4	At twelve months:	first 15 minutes
5	At eighteen months:	first 15 minutes

In order to account for the different durations of recordings at each age, all frequencies were modified to a rate per minute and all durations to a percentage of available time.

7.3 *Results*

7.3.0 *Summary of statistical analysis*

Initial examination of the data concentrated on reducing the number of variables for analysis. Behavioural variables were investigated for their relative consistency or inconsistency with age using either Spearman's rank correlation coefficient or chi-squared as statistical tests. Those found to be sufficiently reliable as behavioural measures were retained within a correlation matrix. Due to the large number of variables found to correlate with the age of the puppy, Principal Factor Analysis was performed as an additional method of data reduction. Unfortunately this generated insubstantial results hence hierarchical agglomerative cluster analysis (using the correlation matrix) was used as an alternative multivariate statistical test to reveal more complex relationships between variables.

Those (reliable) variables retained for further investigation were examined with respect to any breed or sex effects using chi-squared Fisher's exact test and Mann-Whitney U-tests. Kruskal-Wallis tests were used to examine breed/sex interactions on reliable post-homing variables.

Finally, an evaluation of the predictive value of the puppy tests performed at seven weeks was carried out by comparing the valid post-homing variables with the 13 factors obtained in *Chapter 6*. Initially, canonical correlations were used to identify non-specific significant associations between factors and a particular post-homing variable. Spearman's rank correlation coefficient was then used to identify specific factors related to a given variable, and where multiple factors were found to be associated with a variable, partial correlation coefficients were used to establish which factor was *most* responsible for driving this association.

7.3.1 *Reducing the number of variables for analysis*

To reduce the number of variables retained for further analysis, infrequently occurring behaviours were excluded along with others which were felt to hold little interpretable value. In addition, variables expressing little variation between dogs were eliminated from further analysis. The variables eliminated were as follows: play bow, fearfulness, howl during separation, destruction during separation, elimination during separation, greeting following separation, pawing toy, play

bow towards toy, cringe in response to toy, whining in response to toy, barking in response to toy, mouthing toy, licking lips in response to toy.

The remaining variables were examined for their consistency over the five ages using Spearman's Rank Correlation Coefficient for scaled measures and chi-squared (or Fisher's Exact Test, FET) for presence/absence measures. In general, the correlation of variables between ages was good (see *Tables 7.3 - 7.28* for correlation coefficients and chi-squared values of retained variables) with the following exceptions: pawing (unfamiliar), grooming (unfamiliar), interaction with camera person, approach (familiar), look (familiar), investigate (familiar), paw (familiar), grooming (familiar), lick lips (familiar), roll over (familiar), avoid (familiar), interact (familiar), sit at exit (familiar absent), contact exit (familiar absent). None of the behaviours exhibited in response to the toys (part 7) were sufficiently similar from one test to the next to be retained. Although interact/familiar was found to have relatively poor correlations across age (*Table 7.20*), it was retained due to its potential as an indicator of attachment.

Table 7.3 Chi-squared tests (or FET) of initial barking (*inbark*) between ages.
* denotes significant at the 0.05 level, ** at the 0.01 level

	inbark3	**inbark6**	**inbark9**	**inbark12**
inbark6	(FET)			
inbark9	(FET)	* (FET)		
inbark12	(FET)	** (FET)	(FET)	
inbark18	(FET)	** (FET)	(FET)	** (FET)

Table 7.4 Chi-squared tests (or FET) for urination (*urinate*) between ages.
* denotes significant at the 0.05 level, ** at the 0.01 level

	urinate3	**urinate6**	**urinate9**	**urinate12**
urinate6	(FET)			
urinate9	(FET)	(FET)		
urinate12	* (FET)	(FET)	(FET)	
urinate18	(FET)	* (FET)	(FET)	* (FET)

Table 7.5 Spearman's correlation coefficients for approaching the unfamiliar person (*unapp*)
* denotes significant at the 0.05 level, ** at the 0.01 level

	unapp3	**unapp6**	**unapp9**	**unapp12**
unapp6	0.326*			
unapp9	0.003	0.596**		
unapp12	0.283	0.480**	0.418**	
unapp18	0.288	0.551**	0.499**	0.618**

Table 7.6 Spearman's correlation coefficients for looking at the unfamiliar person (*unlook*)
* denotes significant at the 0.05 level, ** at the 0.01 level

	unlook3	**unlook6**	**unlook9**	**unlook12**
unlook6	0.054			
unlook9	0.139	0.552**		
unlook12	0.284	0.479**	0.402*	
unlook18	0.133	0.472**	0.578**	0.375*

Table 7.7 Spearman's correlation coefficients for investigating the unfamiliar person (*uninv*)
* denotes significant at the 0.05 level, ** at the 0.01 level

	uninv3	**uninv6**	**uninv9**	**uninv12**
uninv6	0.419**			
uninv9	0.434**	0.746**		
uninv12	0.155	0.576**	0.469**	
uninv18	0.125	0.445**	0.567**	0.398*

Table 7.8 Spearman's correlation coefficients for jumping up at the unfamiliar person (*unjump*)
* denotes significant at the 0.05 level, ** at the 0.01 level

	unjump3	**unjump6**	**unjump9**	**unjump12**
unjump6	0.175			
unjump9	0.063	0.415**		
unjump12	0.085	0.596**	0.291	
unjump18	0.094	0.440**	0.549**	0.474**

Table 7.9 Spearman's correlation coefficients for rolling over towards the unfamiliar person (*unroll*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	unroll3	**unroll6**	**unroll9**	**unroll12**
unroll6	0.294			
unroll9	0.323*	0.385*		
unroll12	0.506**	0.536**	0.617**	
unroll18	0.292	0.331*	0.428**	0.519**

Table 7.10 Spearman's correlation coefficients for cringing at the unfamiliar person (*uncringe*) * denotes significant at the 0.05 level, ** at the 0.01 level

	uncringe3	**uncringe6**	**uncringe9**	**uncringe12**
uncringe6	0.764**			
uncringe9	0.256	0.513**		
uncringe12	0.351*	0.232	0.315*	
uncringe18	0.523**	0.730**	0.711**	0.428**

Table 7.11 Chi-squared tests (or FET) for avoiding the unfamiliar person (*unavoid*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	unavoid3	**unavoid6**	**unavoid9**	**unavoid12**
unavoid6	** (FET)			
unavoid9	* (FET)	** (FET)		
unavoid12	* (FET)	** (FET)	* (FET)	
unavoid18	** (FET)	** (FET)	** (FET)	** (FET)

Table 7.12 Spearman's correlation coefficients for latency of approach to unfamiliar person (unlatap) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	unlatap3	**unlatap6**	**unlatap9**	**unlatap12**
unlatap6	0.092			
unlatap9	0.258	0.682**		
unlatap12	0.115	0.603**	0.397*	
unlatap18	0.259	0.637**	0.408*	0.623**

Table 7.13 Spearman's correlation coefficients for duration of interaction with the unfamiliar person (*uninter*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	uninter3	**uninter6**	**uninter9**	**uninter12**
uninter6	0.393*			
uninter9	0.613**	0.651**		
uninter12	0.162	0.543**	0.440**	
uninter18	0.313*	0.367*	0.327*	0.260

Table 7.14 Spearman's correlation coefficients for approaching the familiar person (*famapp*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	famapp3	**famapp6**	**famapp9**	**famapp12**
famapp6	0.222			
famapp9	-0.083	0.141		
famapp12	0.053	0.236	0.342*	
famapp18	-0.003	0.231	0.362*	0.409**

Table 7.15 Spearman's correlation coefficients for looking at the familiar person (famlook) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	famlook3	**famlook6**	**famlook9**	**famlook12**
famlook6	0.235			
famlook9	0.175	0.461**		
famlook12	0.236	0.225	0.390*	
famlook18	0.154	0.048	0.235	0.384*

Table 7.16 Spearman's correlation coefficients for investigating the familiar person (*faminv*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	faminv3	**faminv6**	**faminv9**	**faminv12**
faminv6	-0.102			
faminv9	0.120	0.342*		
faminv12	-0.189	0.137	0.232	
faminv18	-0.155	0.127	0.150	0.397*

Table 7.17 Spearman's correlation coefficients for jumping up at the familiar person (*famjump*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	famjump3	**famjump6**	**famjump9**	**famjump12**
famjump6	0.220			
famjump9	0.122	0.448**		
famjump12	0.031	0.618**	0.336*	
famjump18	-0.063	0.486**	0.454**	0.451**

Table 7.18 Spearman's correlation coefficients for investigating the familiar person (*faminv*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	faminv3	**faminv6**	**faminv9**	**faminv12**
faminv6	-0.102			
faminv9	0.120	0.342*		
faminv12	-0.189	0.137	0.232	
faminv18	-0.155	0.127	0.150	0.397*

Table 7.19 Spearman's correlation coefficients for cringing at the familiar person (*famcringe*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	famcringe3	**famcringe6**	**famcringe9**	**famcringe12**
famcringe6	0.391*			
famcringe9	-0.026	-0.067		
famcringe12	1.000**	0.391*	-0.026	
famcringe18	0.716**	0.521**	-0.037	0.716**

Table 7.20 Spearman's correlation coefficients for duration of interaction with the familiar person (*famint*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	famint3	**famint6**	**famint9**	**famint12**
famint6	0.270			
famint9	0.308	-0.061		
famint12	0.283	0.145	0.545**	
famint18	0.288	-0.043	0.410**	0.303

Table 7.21 Spearman's correlation coefficients for sitting at the exit during absence of the familiar person (*fexit*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	fexit3	**fexit6**	**fexit9**	**fexit12**
fexit6	0.221			
fexit9	0.475**	0.217		
fexit12	0.054	0.333*	0.067	
fexit18	0.104	0.440**	0.137	0.255

Table 7.22 Spearman's correlation coefficients for whining during absence of the familiar person (*fwhine*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	fwhine3	**fwhine6**	**fwhine9**	**fwhine12**
fwhine6	0.293			
fwhine9	0.151	0.470**		
fwhine12	0.138	0.416**	0.316	
fwhine18	0.107	0.344**	0.465**	0.805**

Table 7.23 Spearman's correlation coefficients for barking during absence of the familiar person (*fbark*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	fbark3	**fbark6**	**fbark9**	**fbark12**
fbark6	0.507**			
fbark9	-0.055	0.685**		
fbark12	-0.064	0.370*	0.366*	
18	-0.064	0.301	0.581**	0.320*

Table 7.24 Spearman's correlation coefficients for duration of interaction with the unfamiliar person during absence of the familiar person (*intunf*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	intunf3	**intunf6**	**intunf9**	**intunf12**
intunf6	0.138			
intunf9	0.230	0.364*		
intunf12	0.240	0.367*	0.267	
intunf18	0.141	0.425**	0.608**	0.308

Table 7.25 Spearman's correlation coefficients for contacting the exit during complete social separation (*conexit*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	conexit3	**conexit6**	**conexit9**	**conexit12**
conexit6	0.086			
conexit9	0.299	0.601**		
conexit12	-0.155	0.258	0.250	
conexit18	0.112	0.597**	0.513**	0.544**

Table 7.26 Spearman's correlation coefficients for whining during complete social separation (*whine*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	whine3	**whine6**	**whine9**	**whine12**
whine6	0.436**			
whine9	0.242	0.599**		
whine12	0.149	0.492**	0.545**	
whine18	0.236	0.585*8	0.491**	0.530**

Table 7.27 Spearman's correlation coefficients for barking during complete social separation (*bark*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	bark3	**bark6**	**bark9**	**bark12**
bark6	0.057			
bark9	0.021	0.838**		
bark12	-0.166	0.707**	0.799**	
bark18	0.039	0.560**	0.527**	0.418**

Several of the variables were combined to generate composite measures. In order to verify the validity of these composite measures, further correlations were performed on each composite measure across the ages. If the correlation values obtained for the composite measure were of equal or greater value than the original variables, then the composite measure was used in further analysis. Conversely, if the composite correlations were found to be less reliable than the individual measures, then the latter were retained for subsequent analysis.

Composite measures investigated and retained were (*Tables 7.28 - 7.31*):

1. *investigate* (familiar and unfamiliar): approach + look + investigate
2. *vocalise* (during owner absence): whine + bark
3. *vocalise* (all persons absent): whine + bark

Table 7.28 Spearman's correlation coefficients for the composite measure "investigate" the unfamiliar person (*uninv*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	uninv3	**uninv6**	**uninv9**	**uninv12**
uninv6	0.215			
uninv9	-0.018	0.705**		
uninv12	0.300	0.551**	0.457**	
uninv18	0.022	0.541**	0.582**	0.442**

Table 7.29 Spearman's correlation coefficients for the composite measure "investigate" the familiar person (*faminv*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	faminv3	**faminv6**	**faminv9**	**faminv12**
faminv6	0.155			
faminv9	0.125	0.423**		
faminv12	0.212	0.281	0.366*	
faminv18	0.032	0.106	0.277	0.478**

Table 7.30 Spearman's correlation coefficients for the composite measure vocalising during absence of the familiar person (*fvoc*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	fvoc3	**fvoc6**	**fvoc9**	**fvoc12**
fvoc6	0.308			
fvoc9	0.274	0.562**		
fvoc12	0.116	0.394*	0.342*	
fvoc18	0.243	0.363*	0.612**	0.578**

Table 7.31 Spearman's correlation coefficients for the composite measure vocalise during complete social separation (*voc*) between ages. * denotes significant at the 0.05 level, ** at the 0.01 level

	voc3	**voc6**	**voc9**	**voc12**
voc6	0.387*			
voc9	0.227	0.631**		
voc12	0.158	0.541**	0.612**	
voc18	0.161	0.632**	0.617**	0.574**

In total, eighteen measures were retained for further analysis. These were, with coding in italics:

Bark on entry	*inbark*
Urinate	*urinate*
(Composite) investigate unfamiliar	*uninv*
(Composite) investigate familiar	*faminv*
Jump up (unfamiliar)	*unjump*
Jump up (familiar)	*famjump*
Roll over (unfamiliar)	*unroll*
Cringe (unfamiliar)	*uncringe*
Cringe (familiar)	*famcringe*
Avoid contact (unfamiliar)	*unavoid*
Latency of approach (unfamiliar)	*unlatap*
Interaction time (unfamiliar)	*unint*
Interaction time (familiar)	*famint*
Sit exit (familiar absent)	*fexit*
Vocalise (familiar absent)	*fvoc*
Contact exit (all persons absent)	*conex*
Vocalise (all persons absent)	*voc*
Interaction time (unfamiliar, familiar absent)	*intunf*

A correlation matrix of all eighteen variables at each age was generated (i.e., 5 matrices in total) to examine the links between behaviours at each age, and whether these associations remained consistent over time. *Table 7.32* illustrates the significant associations found between variables at each age, the significance level being taken as a correlation value of greater than *0.4*. *Table 7.33* illustrates similar information in a different format, but taking Spearman's correlation value of 0.3 ($p=0.05$) as the level of significance.

Table 7.32 Significant associations between variables measured at each age. Only associations having a (positive unless stated otherwise) Spearman's correlation value of >0.4 are shown. Numbers within cells indicate the age in months for which this association is valid.

variable	inbark	urinate	uninv	unjump	unroll	uncrin	unavoid	unlatap	unint	faminv	famjump	famcrin	famint	fexit	fvoc	intunf	conex
urinate																	
uninv																	
unjump			6 9 12 18														
unroll																	
uncrin	6	3		-3 -9													
unavoid	3 6 12 18	3 9				6 9 12 18											
unlatap	-18		6 9	3 9		-6 -18	-6 -12 -18										
unint			6 9 12 18	3 6 9	3 6 18			6 9									
faminv																	
famjump	12						12			6 9 12							
famcrin	9					6 12 18	6 9										
famint										3 9 12	9 12						
fexit	6									6	6						
fvoc	6 12						12							3 12 18			
intunf			6 12	6	6 9			6	6						-9 -18		
conex																	
voc	6 12						9 12 18							6 18	6 9 12 18	9	

Table 7.33 Associations between variables at the 0.3 correlation level. Positive correlations are shown above the dotted line and negative associations below. Negative behaviours (initial barking, submissive urination, avoidance, cringing) are shown in blue (italics), and separation behaviours in red (bold). In each instance, the variables associated are described in relation to each variable, i.e., the association appears twice, for example, inbark/uncringe, and uncringe/inbark.

Variable	3m	6m	9m	12m	18m
inbark +*ve*		*uncringe, unavoid,* **fexit, fvoc, voc**	*famcringe*	*unavoid,* famjump, **fvoc, voc**	*uncringe, unavoid,* famjump, **fexit**
-ve		unlatap		unlatap	unlatap
urinate +*ve*	*uncringe, unavoid*	uninv, **fexit**	*uncringe, unavoid*	*uncringe,* **fvoc**	
-ve					
uninv +ve		*urinate,* unjump, unlatap, uninter, faminv, intunf	unjump, unlatap, uninter	unjump, *unavoid,* uninter, intunf	unjump, unroll, uninter
-ve					
unjump +ve	unlatap, uninter, intunf	uninv, uninter, faminv, famjump, intunf, **conexit**	uninv, unlatap, uninter	uninv, uninter, faminv	uninv
-ve	*uncringe*		*uncringe,* **fexit, voc**		
unroll +ve	uninter	uninter, intunf	intunf		uninv, uninter
-ve			**voc**		
uncringe +*ve*	*urinate, unavoid, famcringe*	*inbark, unavoid, famcringe*	*urinate, unavoid*	*urinate, unavoid, famcringe*	*inbark, unavoid, famcringe*
-ve	unjump, unlatap, uninter	unlatap	unjump, unlatap, famjump		unlatap
unavoid +*ve*	*urinate, uncringe, faminter*	*inbark, uncringe, famcringe,* **voc**	*urinate, uncringe, famcringe,* **voc**	*inbark, uninv, uncringe, famjump,* **fvoc, voc**	*inbark, uncringe,* **fexit, fvoc, voc**

Variable	3m	6m	9m	12m	18m
-ve		unlatap	unlatap, intunf	unlatap	unlatap
unlatap +ve	unjump	uninv, uninter, intunf	uninv, unjump, uninter, intunf		
-ve	*uncringe*	*inbark, uncringe, unavoid, famcringe*	*urinate, uncringe, unavoid,* **voc**	*inbark, unavoid*	*inbark, uncringe, unavoid*
uninter +ve	unjump, unroll, intunf	uninv, unjump, unroll, unlatap, intunf	uninv, unjump, unlatap	uninv, unjump, unavoid, voc	uninv, unroll, intunf
-ve	*uncringe*		**conexit**		
faminv +ve	famjump, faminter, intunf	uninv, unjump, faminv, **fexit**	famjump, faminter	uninv, unjump, famjump, faminter,	famjump, intunf
-ve					
famjump +ve	intunf, faminv, famcringe	unjump, faminv, **fexit**	faminv, faminter, **fvoc**	*inbark, unavoid,* faminv, faminter	*inbark,* faminv *famcringe*
-ve			*uncringe*		
famcringe +ve	*uncringe,* famjump	*unavoid, uncringe*	*inbark, unavoid*	*uncringe*	*uncringe,* famjump, intunf
-ve		unlatap			
faminter +ve	*unavoid,* faminv, **fexit,** intunf, **voc**		faminv, famjump	faminv, famjump	
-ve					
fexit +ve	faminter, **fvoc, voc**	inbark, urinate, faminv, famjump, **fvoc, voc**	**fvoc**	**fvoc**	*inbark, unavoid,* **fvoc, voc**
-ve			unjump		
fvoc +ve	**fexit**	*inbark,* **fexit, voc**	famjump, **fexit, voc**	*inbark, urinate, unavoid,* **fexit, voc**	*unavoid,* **fexit, voc**

Variable	3m	6m	9m	12m	18m
-ve			intunf	intunf	intunf
intunf +ve	unjump, uninter, faminv, famjump, faminter	uninv, unjump, unroll, unlatap, uninter	unroll, unlatap	uninv	uninter, faminv, *famcringe*
-ve			*unavoid,* **fvoc, voc**	**fvoc, conexit**	**fvoc**
conexit +ve		unjump, **voc**			*unavoid,* **fexit, fvoc**
-ve			uninter	intunf	
voc +ve	faminter, **fexit**	*inbark, unavoid,* **fexit, fvoc, conexit**	*unavoid,* **fvoc**	*inbark, unavoid,* uninter, **fexit, fvoc**	
-ve			unjump, unroll, unlatap, intunf		

On examination of the above table, it appears that negative behaviours, i.e. cringing, avoidance, submissive urination, initial barking (interpreted as nervous barking) are correlated together (although not necessarily the same variables over time), as are positive or friendly behaviours (at least towards the unfamiliar person), e.g. low latency of approach, investigatory behaviour, jumping up, rolling over, duration of interaction. Separation behaviours correlate well with each other and interestingly, negative behaviour was frequently found to be associated with separation behaviour.

Due to the number of associations found between variables, it was decided to use Factor Analysis as a method of data reduction. A factor analysis was performed on all variables for each age i.e., 5 factor analyses in total. Unfortunately the results generated were rather disappointing, with different numbers of factors being generated at each age (ranging from 5 to 7) and factors containing quite different variables which were often apparently meaningless. It was therefore decided that an alternative approach was required, hence the employment of hierarchical agglomerative cluster analysis using correlation coefficients.

All variables at *all ages* were included in the cluster analysis and assessments made from the

resulting dendrogram (see ***Appendix F n°. 1***). On examination of this dendrogram, it became apparent that where discrepancies existed within clusters, this was frequently as a result of variables measured at three months of age. For this reason, a further cluster analysis was performed using only information from 6, 9, 12, and 18 month visits (see ***Appendix F n°. 2***).

As can be seen from the second dendrogram, in many instances the same variable at different ages became clustered. If different variables at the same age had become clustered, this would have suggested that the test at that particular age was not comparable with the others.

Once again, it was not possible to drastically reduce the number of variables as a result of the cluster analysis; however the following modifications were made:

1 Since vocal behaviour during familiar absence (*fvoc*) and during complete separation (*voc*) had previously been shown to be highly correlated and all were found to occur within the same cluster, a decision was made to combine both variables to generate one composite measure: ***vocsep***

2 *famcringe* was split between two clusters and since it also occurred infrequently, was eliminated from further analysis.

3 *fexit*, split between 3 clusters, was also eliminated from further analysis

4 *uncringe* and *unroll* were combined and renamed *unsub* with a scoring system of: neither cringing nor rolling (0), cringe or roll (1), and cringe + roll (2), since both variables occurred exclusively within the same cluster

Following the reduction of the data set to 14 variables, a further cluster analysis was performed on all 14 variables at 6, 9, 12 and 18 months of age (*Figure 7.1*). This final analysis generated the most satisfactory dendrogram in respect of the cluster divisions. One of the most interesting clusters was the apparent association of nervous behaviours (avoidance of the unfamiliar person, initial barking, submissive urination) with vocalisation during separation, confirming the results previously generated from the correlation analysis.

7.3.2 *Effect of sex and breed on post-homing variables*

Once the variables to be retained for further examination had been determined, investigations were made as to the effect of sex and breed on these variables. For presence/absence measures, chi-squared Fisher's Exact Test values were calculated via cross-tabulations, and Mann-Whitney U tests were performed for all other variables.

Table 7.34 Significant sex differences within post-homing variables (1 degree of freedom). Those variables highlighted in bold are significant at the 0.05 level. Significance levels marked with an asterisk are those obtained using Fisher's Exact Test (FET), where one or more cells have a count of less than 5.

Variable	Test	Test statistic	Significance	Sex scoring highest
inbark 6	**FET**		**0.026***	**female**
inbark 12	**FET**		**0.029***	**female**
unavoid 3	**FET**		**0.026***	**female**
unavoid 6	**FET**		**0.003***	**female**
unavoid 9	FET		0.069*	female
unavoid 12	**FET**		**0.026***	**female**
unavoid 18	**FET**		**0.026***	**female**
urinate 3	**FET**		**0.003***	**female**
unlatap 3	M-W	115.0	0.073	female
unlatap 18	M-W	115.0	0.073	female
unjump 3	M-W	134.5	0.095	male
unsub 6	**M-W**	**91.0**	**0.004**	**female**
vocsep 12	M-W	130.0	0.075	female

Females generally displayed higher levels of initial (nervous) barking and avoidance behaviour, although on examination of the raw data, both behaviours were found to occur infrequently. Females also took longer to approach at both 3 and 18 months, exhibited higher levels of submissive cringing and rolling at 6 months and were more vocal during separation at 12 months. The only variable which males performed more frequently than females was in jumping up towards the unfamiliar person at 3 months. It may therefore be concluded that in general, nervous behaviour was infrequently encountered, but that those individuals displaying uncertainty of the unfamiliar person were usually females.

Figure 7.1 Dendrogram obtained using hierarchical cluster analysis on 14 retained variables at 6, 9, 12, and 18 months of age. Major cluster divisions are indicated by solid red lines and minor divisions by dotted blue lines

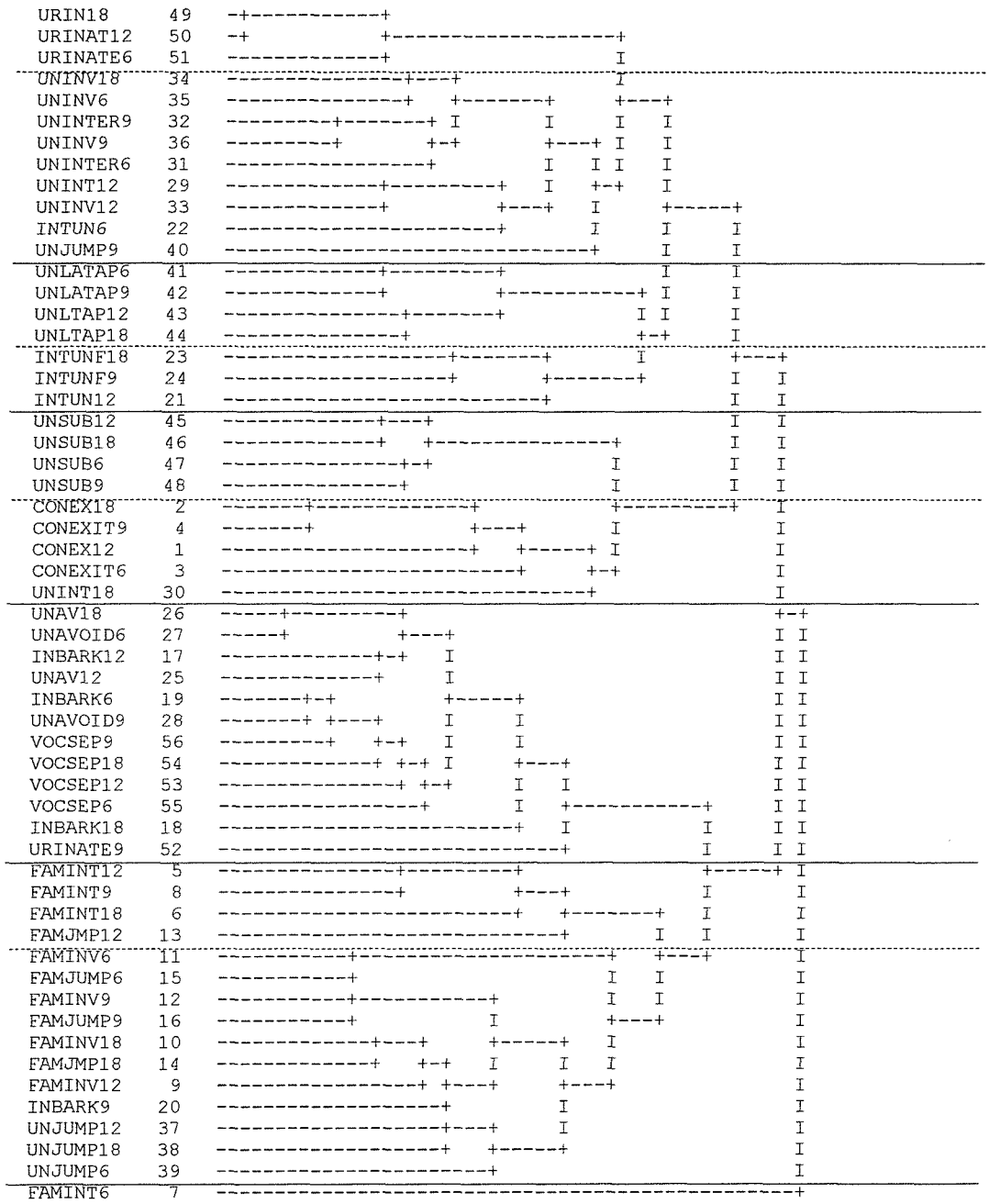


Table 7.35 Significant **breed** differences within post-homing variables (1 degree of freedom). Those variables highlighted in bold are significant at the 0.05 level. Significance levels marked with an asterisk are those obtained using Fisher's Exact Test (FET), where one or more cells have a count of less than 5

Variable	Test	Test statistic	Significance	Breed scoring highest
inbark 6	**FET**		**0.026***	**Collie**
inbark 12	**FET**		**0.029***	**Collie**
unavoid 6	χ^2	**9.550**	**0.028**	**Collie**
unavoid 9	FET		0.069*	Collie
unavoid 18	**FET**		**0.026***	**Collie**
unlatap 6	**M-W**	**102.0**	**0.015**	**Collie**
unlatap 9	**M-W**	**94.5**	**0.023**	**Collie**
unlatap 12	**M-W**	**111.5**	**0.020**	**Collie**
unlatap 18	M-W	115.0	0.073	Collie
unjump 3	**M-W**	**111.5**	**0.020**	**Labrador**
faminv 3	M-W	133.5	0.090	Labrador
famjump 12	**M-W**	**114.5**	**0.025**	**Collie**
famint 12	M-W	133.5	0.090	Collie
vocsep 18	**M-W**	**123.5**	**0.048**	**Collie**
intunf 3	M-W	120.5	0.059	Labrador

Once again nervous behaviours were predominant in generating breed differences in behaviour, with initial (nervous) barking, avoidance of the unfamiliar person, and reluctance to approach the unfamiliar at two or more ages revealing significant breed differences. In all instances, Border collies were the breed displaying higher levels of negative behaviour. Three differences in interactive behaviour were found, all as a result of an elevated incidence of friendly behaviour by Labrador puppies.

In order to investigate breed/sex interactions, Kruskal-Wallis tests were performed on all four categories of breed/sex on variables which were not presence/absence measures; for those which were presence/absence measures, cross-tabulations were calculated, significant results obtained are shown in *Table 7.36*

Table 7.36 Significant **breed/sex** differences within post homing variables (3 degrees of freedom). Those variables highlighted in bold are significant at the 0.05 level.

Variable	Test	Chi-squared	Significance	Sex/breed scoring highest
inbark 6	χ^2	**13.333**	**0.004**	**Female/Collie**
inbark 12	χ^2	**10.810**	**0.013**	**Female/Collie**
inbark 18	χ^2	**9.486**	**0.023**	**Female/Collie**
unavoid 3	χ^2	7.143	0.067	Female/Collie
unavoid 6	χ^2	**13.669**	**0.003**	**Female/Collie**
unavoid 9	χ^2	**9.730**	**0.021**	**Female/Collie**
unavoid 12	χ^2	7.143	0.067	Female/Collie
unavoid 18	χ^2	**13.333**	**0.004**	**Female/Collie**
urinate 3	χ^2	9.972	0.019	Female/Collie
urinate 12	χ^2	**9.925**	**0.019**	**Female/Labrador**
unlatap 3	K-W	6.923	0.074	Female/Collie
unlatap 6	**K-W**	**10.108**	**0.018**	**Female/Collie**
unlatap 9	**K-W**	**11.686**	**0.009**	**Female/Collie**
unlatap 12	**K-W**	**12.601**	**0.006**	**Female/Collie**
unlatap 18	**K-W**	**11.963**	**0.008**	**Female/Collie**
unjump 3	K-W	6.773	0.080	Female/Collie (lowest)
unsub 6	**K-W**	**10.574**	**0.014**	**Female/Collie**
famjump 3	**K-W**	**8.722**	**0.033**	**Male/Collie (lowest)**

Not surprisingly, almost all breed/sex differences were found to be driven by female Border collies, the vast majority of these being nervous, submissive or hesitant behaviours.

7.3.3 *Association of post-homing variables with behaviour at seven weeks*

To determine the predictive value of the tests at 7 weeks, the valid post-homing variables were compared with the factor scores obtained from the behaviour of the puppies at 7 weeks of age (*Chapter 6*).

Initially, canonical correlations were performed, taking all of the 13 factors as one set of variables, and each of the 14 post-homing variables in turn as the other set. Canonical correlations, which allow the relationship between two sets of variables to be examined by identifying linear combinations of variables in one set that are most highly correlated with a second set, were in this instance used as a method of reducing Type I errors. The generation of a significant result (at the 0.05 level of significance) indicated that at least one of the factors was correlated with the post-homing variable in question. Several significant associations were obtained (*Table 7.37*).

Table 7.37 Significant results ($p<0.10$) obtained using canonical correlations on each of the post-homing variables on the thirteen puppy factors. Variables highlighted in bold are significant at the 5% level

Variable (age)	Chi-squared	Degrees of freedom	Significance level
inbark (9)	**30.924**	**13**	**0.0035**
urinate (6)	21.741	13	0.0595
uninter (6)	21.367	13	0.0660
faminv (3)	**25.531**	**13**	**0.0196**
faminv (9)	**24.105**	**13**	**0.0302**
famjump (6)	**22.539**	**13**	**0.0475**
famint (3)	**26.618**	**13**	**0.0140**
famint (12)	21.763	13	0.0591
conexit (3)	21.844	13	0.0578
vocsep (9)	21.749	13	0.0594
vocsep (12)	**23.608**	**13**	**0.0349**
vocsep (18)	20.337	13	0.0871

Spearman's Rank Correlation Coefficients were calculated for each significant post-homing variable with all 13 factors (*Table 7.38*).

Table 7.38 Factors significantly associated (using Spearman's Correlation Coefficient) with the post-homing variables stated. Variables highlighted in bold are those significant at the 0.05 level in the canonical correlations (see *Table 7.8*)

Variable (age)	Single factor correlations	Correlation coefficient	Significance level
inbark (9)	**Factor 5** **Factor 7** **Factor 8** **Factor 9** **Factor 12**	**0.318** **0.361** **0.325** **0.387** **0.384**	**0.046** **0.022** **0.041** **0.014** **0.014**
urinate (6)	Factor 7	0.358	0.023
uninter (6)	Factor 6 Factor 10	0.355 0.477	0.025 0.002
faminv (3)	none		
faminv (9)	none		
famjump (6)	**Factor 13**	**0.395**	**0.012**
famint (3)	**Factor 12**	**0.356**	**0.024**
famint (12)	Factor 3 Factor 10	0.324 0.367	0.042 0.020
conexit (3)	Factor 6 Factor 7 Factor 8	-0.326 -0.328 -0.495	0.046 0.044 0.002
vocsep (9)	Factor 4	-0.330	0.038
vocsep (12)	**Factor 7**	**0.325**	**0.041**
vocsep (18)	Factor 4 Factor 11	-0.394 -0.316	0.012 0.047

Since some variables were shown to be associated with several factors, partial correlation coefficients were used to ascertain which factor was most responsible for driving the association *(Table 7.39)*.

Although *faminv 3* and *faminv 9* produced significant results when examined by canonical correlation, both variables were found to have no significant correlations with any single factor.

Table 7.39 Results generated from the partial correlation coefficient analysis of variables previously shown to be significantly correlated with multiple factors

Variable	Significant associations	Partial correlation value	Significance level
inbark (9)	Factor 5	0.238	0.162
	Factor 7	**0.421**	**0.011**
	Factor 8	0.125	0.469
	Factor 9	0.213	0.212
	Factor 12	0.162	0.344
uninter (6)	Factor 6	0.284	0.080
	Factor 10	**0.393**	**0.013**
famint (12)	Factor 3	0.114	0.491
	Factor 10	**0.276**	**0.089**
conexit (3)	**Factor 6**	**-0.333**	**0.047**
	Factor 7	-0.166	0.333
	Factor 8	-0.185	0.280
vocsep (18)	Factor 4	-0.199	0.226
	Factor 11	-0.192	0.242

Having identified the litter factors associated with the post-homing variables, the *age* associations were subsequently examined. Although all of the post-homing variables retained had previously been shown to be consistent with respect to age, with the exception of *faminv, famint,* and *vocsep,* all variables found to be significantly correlated with factors referred to one age only. A Spearman's correlation of each significant variable at each age was therefore performed to measure the consistency of association with factors, particularly with respect to the direction of association.

Several variables were found to be inconsistent with respect to age in their association with particular factors. These inconsistencies were: *inbark*, with respect to Factor 8; *famjump* with respect to Factor 13; *famint* with respect to Factor 10; *vocsep* with respect to Factor 4. All variables inconsistent with age were omitted from further consideration.

In total, eleven of the thirteen factors were found to have one or more variables significantly associated with them. For those factors which had more than one variable association, partial correlation coefficients were calculated to determine which variable had the strongest correlation with a particular factor (*Table 7.11*).

The partial correlation of each multiple association was examined on the following basis:

e.g., for Factor 7 (correlation with *inbark 9* and *vocsep12)* partial correlations were calculated for *inbark 9* with *vocsep 9*, and *inbark 12* with *vocsep12* (*Table 7.40).*

Table 7.40 Results of the partial correlations for factors correlated with multiple post-homing variables. Variables highlighted in bold are those driving the association

Factor	Variable 1	Controlling for	Correlation	Significance
7	**inbark 9**	**vocsep 9**	**0.477**	**0.002**
	vocsep 9	inbark9	-0.045	0.783
	inbark 12	vocsep 12	-0.000	0.999
	vocsep 12	inbark 12	0.268	0.100
12	inbark3	famint 3	0.343	0.032
	famint3	inbark 3	0.125	0.448
	inbark 9	**famint 9**	**0.381**	**0.017**
	famint 9	inbark 9	0.130	0.430

The final association of post-homing variables with pre-homing factors is illustrated in *Table 7.41.*

Table 7.41 The thirteen factors generated from litter tests at seven weeks (repeated from *Table 6.3*) and their correlations with post-homing variables. Variables in brackets are those significant at $0.05<p<0.1$ level, variables highlighted in bold are those significant in the partial correlation coefficient calculation of multiple variable factor associations, and those in italics are the factors which that particular variable is most highly associated. All associations are positive unless stated otherwise.

Factor	Factor name	Test	Person	Test part	Behaviour	Associated variables
1	Familiar interactive, littermates present	Litter Litter Litter Litter Litter Litter	Familiar Familiar Familiar Familiar Familiar Familiar	Ignore Ignore Call Call Pet Pet	Approach person Interact person Approach person Interact person Approach person Interact person	
2	Conspecific interactive	Litter Litter Litter Litter Litter Litter	Familiar Unfamiliar Unfamiliar Familiar Unfamiliar Familiar	Ignore Call Pet Separation Greet Greet	Interact puppy Interact puppy Interact puppy Interact puppy Interact puppy Interact puppy	
3	Unfamiliar interactive, littermates present	Litter Litter Litter Litter	Unfamiliar Unfamiliar Unfamiliar Unfamiliar	Call Call Pet Pet	Approach person Interact person Approach person Interact person	(famint 12)
4	Individual familiar attached	Individual Individual Individual Individual Individual	Familiar Familiar Familiar Familiar Familiar	Follow Follow Separation Greet Greet	Approach person Follow person Sit at exit Approach person Interact person	(vocsep 18, negative)
5	Initial attraction unfamiliar, littermates absent	Individual Individual Individual Individual	Unfamiliar Unfamiliar Unfamiliar Unfamiliar	Ignore Ignore Call Call	Approach person Interact person Approach person Interact person	inbark 9

Factor	Factor name	Test	Person	Test part	Behaviour	Associated variables
6	Unfamiliar interactive, response to unfamiliar separation	Litter Litter Litter Litter Individual Individual	Unfamiliar Unfamiliar Unfamiliar Familiar Unfamiliar Unfamiliar	Ignore Ignore Ignore Call Separation Greet	Approach person Interact person Interact puppy (-) Interact puppy (-) Sit at exit Interact person	(uninter 6) (conexit 3, negative)
7	Vocal during separation, interactive familiar, both during absence of littermates	Individual Individual Individual Individual	Familiar Familiar Familiar Unfamiliar	Play Play Separation Separation	Interact person Play (-) Vocalise Vocalise	***inbark 9*** (urinate 6) (*conexit 3*, negative) vocsep 12
8	Initial attraction familiar, littermates absent	Individual Individual Individual individual	Familiar Familiar Familiar Familiar	Ignore Ignore Call Call	Approach person Interact person Approach person Interact person	(conexit 3, negative)
9	Separation behaviour, littermates present	Litter Litter Litter	Unfamiliar Unfamiliar Familiar	Separation Separation Separation	Sit at exit Vocalise Vocalise	inbark 9
10	Greet unfamiliar, littermates present	Litter Litter	Unfamiliar Unfamiliar	Greet Greet	Approach person Interact person	(*uninter 6*)
11	Follow unfamiliar, littermates absent	Individual Individual	Unfamiliar Unfamiliar	Follow Follow	Approach person Interact person	(vocsep 18, negative)
12	Greet unfamiliar, littermates absent	Individual Individual	Unfamiliar unfamiliar	Greet Greet	Approach person Interact person	**inbark 9** famint 3
13	Playful, unfamiliar Response to familiar separation, littermates present	Litter Individual	Unfamiliar Familiar	Play Separation	play Sit at exit	

7.4 *Discussion*

Overall, little of the variation between individual puppies in their pre-homing behaviour could be predicted from observations made of litters at seven weeks. Although many behaviours measured from 3 to 18 months were highly correlated between ages, particularly adjacent ages, very few of these behaviours could be correlated back to behaviour shown during early puppyhood. Notably, nervous behaviour stood out as a category of negative interactions which displayed a high degree of consistency with age after 3 months. Unfortunately the incidence of nervous behaviour at seven weeks was extremely low, hence it was not possible to make comparisons with behaviour whilst in the litter and behaviour over the next sixteen months.

Several of the variable/factor associations provided interesting results; however, others generated unexpected associations which require careful interpretation. Post-homing interaction with the familiar person was positively associated with Factors 3 and 12, which is rather surprising since these original factors referred to the behaviour directed at an *unfamiliar* person. Puppies initially attracted to unfamiliar people in the presence of littermates and likely to greet an unfamiliar person following separation (during individual testing) were therefore likely to express a preference for familiar social contact at a later stage. It may be tentatively suggested that these puppies were using their (familiar) littermates as "social backup" to facilitate interaction with the unfamiliar person and that in the post-homing tests, preferential interaction with the familiar person is due to the use of that person as a secure base. This need for social backup indicates a cautiousness in the puppies' nature, in that although they are prepared to interact with unfamiliar people, this interaction is somewhat guarded. The additional association of initial barking with Factor 12 tends to support this hypothesis since immediate barking at the unfamiliar person implies a level of hesitancy.

The association of a *lack* of vocal behaviour during separation with actor 4 was also a somewhat surprising result. The variables comprising Factor 4 were indicative of animals attempting to maintain social contact with the familiar person during separation from the litter. It would therefore be reasonable to expect some vocalisation during separation from the familiar person, although this did not occur in the seven week tests. In fact the opposite association was found to exist, a significant *absence* of vocal behaviour during a brief period of social isolation. A similar result was found in relation to Factor 11, which also comprised variables pertaining to the maintenance of social contact, this time with respect to the unfamiliar person. It therefore seems that puppies which

follow at seven weeks do *not* vocalise when subsequent access to a person is denied.
Initial barking was found to correlate with several variables, most significantly with Factor 7. In some aspects this is possibly the factor most suggestive of separation behaviour at seven weeks, and was indeed shown to be associated with separation vocalisation at a later age (12 months). The only other factor related to vocalisation, Factor 9, was also found to be positively associated with initial barking. It has been suggested that this may merely reflect individuals which were vocal in general, however I am of the opinion that since initial barking was often exhibited in a nervous context, the association is between nervous dogs and separation rather than simply "noisy" dogs. Further evidence for this link is provided through the additional association of submissive urination with Factor 7.

Factor 6 and Factor 10 were both revealed to have weak correlations with duration of interaction with the unfamiliar person, which is the expected result, since both factors are made up of variables pertaining to the unfamiliar person, particularly in the presence of littermates.

The apparent association of nervous behaviour with separation behaviour after three months of age (*Table 7.4*) is interesting in that it appears to confirm observations made by behaviour counsellors. Although the measurements made in this study took place over a very limited period of time (maximum 15 minutes) and the "separation" resembled that of a brief denial of access, this association was apparent at all ages barring 3 months. Although dogs showing uncertainty of the unfamiliar person also tended to be vocal during separation, other than reacting to the absence of the familiar person prior to complete social separation they did not display higher levels of any behaviour towards the familiar person, as may have been expected if they were particularly attached to that person. No correlations were found with negative behaviour in response to the unfamiliar person and positive behaviour towards the familiar person (except for a positive correlation between jumping up at the familiar person at 12 and 18 months with initial barking). High levels of interaction with the familiar person (investigating, jumping up, duration of interaction) correlated with a response to that persons departure up to 9 months of age. In general, variables relating to interaction with the familiar person were correlated with each other, as were variables relating to interaction with the unfamiliar. It therefore seems that the puppies were either familiar orientated (presumably attached since they rarely displayed avoidance of the unfamiliar) or, more generally sociable towards people (as shown by their behaviour towards the unfamiliar person).

In summary, correlations were found between behaviours towards the familiar person, and a reaction to that person's departure (at least up to nine months of age) suggesting that these dogs were indeed attached to that person; however there appears to exist an additional category of *nervous* dogs who are not so obviously attached (although they do react to the departure of the familiar person) but which display similar behaviour during separation. In instances of generally nervous animals, it is postulated that the familiar social contact suppresses the overt fear reaction but that once this contact is no longer there, a reaction ensues which is not alleviated by the presence of an unfamiliar person (as shown by the incidence of separation behaviour when the unfamiliar person was present but not the familiar person), rather than a response to the departure of an attachment figure (APBC members, *pers. comm*). The dog in effect uses the familiar person as a figure of *security* rather than attachment.

With regard to the breed and sex of puppies, Border Collies, in particular females, seemed to display significant variation in the levels of certain behaviours, usually those associated with hesitancy and submission. Labradors were not outstanding in any instance of negative behaviour but exhibited higher levels of interactive behaviour towards the unfamiliar during owner separation, jumping up at the unfamiliar, and investigatory behaviour towards the familiar person. Females of both breeds were found to display higher levels of vocal behaviour during separation at twelve months; however this was superseded by Collie vocalisation during separation (of either sex) at 18 months.

7.5 Criticisms of the experimental methodology

Unfortunately the use of an unfamiliar person as a control in a preference test may provide misleading information regarding the measurement of attachment. It is feasible that an individual may show fear or uncertainty of the stranger, and a correspondingly increased amount of time with the familiar person, rather than reacting to the new person as a neutral stimulus (Gubernick, 1981).

Theoretically, the puppy's response to the unfamiliar will to some extent depend on how well it has been socialised/social referenced. With a well socialised puppy it is perhaps easier to distinguish between "friendly" behaviour and that which it displays to its owner (presumed attachment behaviour); however, persistent and repeated interaction with an unfamiliar person by a particularly friendly puppy may generate an illusion of lesser attachment to the owner.

If a puppy has not been particularly well socialised/social referenced or is of a nervous disposition, it may be more useful to compare the young animal's behaviour towards the owner with that displayed towards a person who is familiar but to whom the puppy can be said to be not particularly attached. Unfortunately it was not possible to arrange for familiar but unattached persons to be present at each visit with each puppy, hence testing was performed with familiar and unfamiliar persons only.

Although some interesting conclusions may be drawn from this longitudinal study, one of the major obstacles to the collection of useful and meaningful data was the immense variation in environmental circumstances. Despite all efforts to standardise home visits and recording sessions, numerous instances of interruption occurred which unfortunately remain an inherent problem of behavioural study in the home environment. The measurement and quantification of attachment is in itself fraught with difficulty even under stringent, rigidly controlled circumstances, without the complications, intrusions and distractions of a typical multi-person, multi-child, multi-pet household. In addition, it was not possible to maintain the constancy of the same camera-person, even to the extent of keeping the sex of the person the same, and as was discussed in ***Chapter 3***, this variability in sex and personality can have a considerable influence on the behaviour of individuals, even when the person concerned is largely non-interactive.

Many of the dogs in this study were housed in outdoor kennels which created complications in restricting the dog to a particular area for the duration of filming, particularly during complete social separation. Furthermore, it was not always possible to use the same test area at each visit, not only for dogs housed outdoors but also those kept indoors.

One of the main problems in requesting the exclusion of other family pets from test situations was the preoccupation of some puppies with separation from other dogs. This was particularly noticeable in puppies which were permitted constant access to other pets, particularly if audio contact was unavoidable. In several instances, owners remarked that they thought the puppy was more attached to another dog than it was to themselves and was consequently responding to separation from the familiar conspecific than to the absence of familiar human contact. It is suggested that if a study in a similar to this is ever repeated, multi-dog households be excluded from investigation.

LONGITUDINAL QUESTIONNAIRE STUDY

8.1 Introduction

Given the inherent unreliability of behavioural data measured over a short period of time, impressions gained from pet owners, including instances of rare but significant events in the dog's life might be more informative. During the course of the behavioural observations described in *Chapter 7*, detailed factual information regarding the puppy's general routines, duration and nature of interaction with household members, social experiences, and the puppy's behaviour during separation was collected by means of a questionnaire. I delivered this as a casual interview to eliminate any ambiguity or confusion regarding specific questions and to extract the required information with as much detail as possible.

8.2 *Methods*

It was planned that the answers would be supplied by the same household member throughout the study period. For a number of dogs two different people completed questionnaires, but in no instance were obvious discrepancies in the attitudes towards the animal concerned in evidence.

The questionnaire itself was designed with the "pet" dog in mind since it was anticipated that the majority of litters would fulfill this category, as was indeed found to be the case. There were nonetheless a number of individuals which were bred for and reared as working gundogs. Several puppies were destined to be show dogs and were also treated quite differently to others in the study group, including their own littermates. In such cases the questionnaire was modified to fit specific circumstances as far as possible.

A different questionnaire was presented at each visit, although all were structured around a similar framework. Specific questions were modified and adapted to the age and corresponding experience of the puppies, culminating in the most extensive questionnaire delivered during the eighteen-month visit (see *Appendix G*). All questionnaires were designed to be delivered in a maximum of 15

minutes; however, interviews of up to an hour were not uncommon.

The main aims of the questionnaire were:

1 To evaluate the level of household interaction and social referencing the puppy was currently and had been receiving over the preceding weeks

2 To accumulate evidence or otherwise for the existence of separation behaviour over a period of owner absence longer than that occurring during the observational study

3 To ascertain the level of "problem" behaviour exhibited by the dog, and the degree of overall displeasure/contentment on the owner's part

8.2 *Results*

Unfortunately, for the purposes of this study, this incidence of ongoing separation symptoms was extremely low. In my opinion only one of the 40 individuals involved displayed behaviour indicative of true separation behaviour to the extent it could be called a "problem" (incidentally, this behaviour was not viewed to be problematical by the owners). Nevertheless, several other dogs did express transient separation behaviour, often seen to develop between 6 and 12 months and reduce drastically after 12 months. Overall, most puppy owners were delighted with their pets, a total of 33 giving them a maximum satisfaction score of 5, and none a score of less than 4 out of 5.

8.2.0 *Summary of statistical analysis*

Following the generation of arbitrary scales of owner interaction, social referencing and separation behaviour, preliminary investigations focussed on the correlation of these scores between ages (using Spearman's rank correlation coefficient).

The level of social referencing and social interaction provided by the breeder prior to homing was then investigated with respect to the factor scores obtained during puppy testing (***Chapter 6***) using firstly canonical correlation analysis followed by Spearman's rank correlation analysis. In addition,

firstly canonical correlation analysis followed by Spearman's rank correlation analysis. In addition, the behaviour of the puppy prior to homing (i.e., during testing) in relation to subsequent post-homing separation scores was investigated using multiple linear regression and forward stepwise linear regression.

In order to examine whether any relationship existed between separation score and interaction score/social referencing score, multiple linear regression was employed as the test statistic, using cross-tabulations to reveal the exact nature of any relationship. Similarly, multiple linear regression and cross-tabulations were used to look at the relationship between social referencing score and puppies' responses to various social situations.

8.2.1 *Scoring of questionnaires*

Questionnaire responses were first transcribed into *LOTUS VERSION 5.0* spreadsheets prior to statistical analysis using the same scaling systems as in ***Chapters 2*** and ***5***.

Only a small proportion of the questionnaire was actually used in the analysis, since as a result of the apparent lack of significant separation symptoms, it would have been inappropriate to investigate many responses in depth. The main analysis focussed on the generation and investigation of indices of owner interaction, social referencing and separation behaviour at each age, which were calculated as follows. All variables were converted to an arbitrary four point scale of 0 to 3.

1. Owner interaction score

Generated from:

Question 19: " how much contact do you have with the dog in an average day?"
scaled from 1 to 6 according to the response:
less than one hour (1) ..... more than eight hours (6)

Question 20: "how much of this time do you spend directly interacting with the dog, e.g. playing with it, taking it out, training it?"
scaled from 1 to 5 according to the response:
less than half an hour (1) ..... more than four hours (5)

Unfortunately, little variation in response was found with respect to **Question 19**, therefore the socialisation score was calculated from **Question 20** only.

Dogs obtaining a response of **1 or 2** were given an **interaction** score of **1**
Dogs obtaining a response of **3 or 4** were given an **interaction** score of **2**
Dogs obtaining a response of **5** were given a maximum **interaction** score of **3**

2 Social referencing score

Generated from the following responses:

i) At *three* months:

Question 21: "does the dog regularly meet people outside of the family?"
yes (1), no (0)

Question 23: "does the dog meet strangers often?"
yes (1), no (0)

Question 24: "does the dog ever come into contact with children?"
frequently (3), occasionally (2), rarely (1), never (0)

Question 25: "are these your own children or other children?"
own children only (1), other children only (2), both (3)

Question A1: "do you make an active effort to accustom the puppy to a wide range of experiences?"
yes (1), no (0)

The responses to **Questions 24** and **25** were added to make a cumulative maximum score of 6. Since this would have resulted in inappropriate weighting towards these two questions, this additive score was modified to a 0-2 scale according to the following system:

0 = 0
1/2/3 = 1
4/5/6 = 2

The modified score obtained from **Questions 24** and **25** was then added to the scores from **Questions 21, 23** and **Question 1**, to generate a possible maximum score of 5. This score was then modified to a 0-3 scale according to the following system:

0	=	0
1/2	=	1
3	=	2
4/5	=	3

ii) *At six months*

Question 21: "does the dog regularly meet people outside of the family?"
yes (1), no (0)

Question 23: "does the dog meet strangers often?"
yes (1), no (0)

Question 24: "does the dog ever come into contact with children?"
frequently (3), occasionally (2), rarely (1), never (0)

Question 25: "are these your own children or other children?"
own children only (1), other children only (2), both (3)

Question 26: "does the dog regularly receive off-territory exercise?"
yes (1), no (0)

Question 27: "how often?"
several times a week (4) ..... never (0)

Question 29: "do you attend training/socialisation classes?"
yes (1), no (0)

Question 30: "have you ever attended the above or a similar establishment?"
yes (1), no (0)

Question 36: "do you encourage your dog to interact with strange dogs and strange people?"
both dogs and people (2), people only (1), dogs only (1), neither (0)

Question 37: "do you prevent it from interacting with strange dogs and strange people?"
yes (1), no (0)

Question A1: "do you make an active effort to accustom the dog to a wide range of experiences?"
yes (1), no (0)

Question A2: "have you introduced the dog to a variety of situations, e.g. town, rural?"
yes (1), no (0)

Once again the scores referring to contact with children were added and a modified scoring system of 0-2 generated. In addition, the regularity of off-territory exercise (**Question 27**) was also adapted to a 0-2 scale, this being arrived at by simple division of the original score (0-4) by 2. These two modified scores were then added to the original scores obtained from all other questions, to generate a maximum cumulative score of 13. This was then re-scaled to a 0-3 scoring system in the following manner:

0-5	=	1
6-10	=	2
11-13	=	3

iii) *At 9 months*

Identical scoring system to that used at 6 months

iv) *At 12 months*

Question 21: "does the dog regularly meet people outside of the family?"
yes (1), no (0)

Question 23: "does the dog meet strangers often?"
yes (1), no (0)

Question 24: "does the dog ever come into contact with children?"
frequently (3), occasionally (2), rarely (I), never (0)

Question 25: "are these your own children or other children?"
own children only (1), other children only (2), both (3)

Question 26: "does the dog regularly receive off-territory exercise?"
yes (1), no (0)

Question 27: "how often?"
several times a week (4) ..... never (0)

Question 29: "do you attend training/socialisation classes?"
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Question 30: "have you ever attended the above or a similar establishment?"
yes (1), no (0)

Question 36: "do you encourage your dog to interact with strange dogs and strange people?"
both dogs and people (2), people only (1), dogs only (1), neither (0)

Question 37: "do you prevent it from interacting with strange dogs and strange people?"
yes (1), no (0)

Addition of all question scores (with response to **Questions 24** and **25** modified), producing a possible maximum score of 10, which was then re-scaled to:

1-5	=	1
6-9	=	2
10-11	=	3

v) *At 18 months*

Identical scoring system to that used at 12 months

3. Separation score

The separation score for each dog was calculated using exactly the same scoring system at each age.
Questions taken into account were:

Question 11: "how does the dog react to being left?"

Question 13: "if the dog shows any of the following behaviours when it is left: vocalising, elimination, destructiveness, when exactly does the behaviour begin?"

Question 14: "do any of these behaviours occur when people are present?"

Question 15: "please indicate which of these behaviours are exhibited in the presence of people"

The score allocated to each individual was determined according to specific responses to **Questions 13** and **14**. If, for example, it became apparent that the dog was displaying behaviour during separation but that this only occurred after a considerable period, e.g. several hours, then the dog was assumed to be exhibiting symptoms based on a reaction other than that of separation. The expression of symptoms in the presence of people was also of great importance in the determination of a separation score. Behaviour (of the same type) exhibited to the same or greater extent in the presence of people was not viewed to be true separation behaviour; however, behaviour displayed to a lesser extent (including behaviour displayed overnight) or the expression of symptoms of a different nature were classed as separation behaviour.

Unfortunately, many facets of separation behaviour were revealed during the course of the interviews making it extremely difficult to design and adhere to a stringent scoring system. The following system therefore describes the scoring as accurately as possible:

0 no symptoms of separation behaviour at any time

1 exhibition of extremely mild symptoms, usually of only one behaviour type or,
expression of symptoms over a very brief period of time (less than one week) or,
exhibition of behaviour overnight only

2 exhibition of transitory separation behaviour (of more than one week), of one or more types

3 ongoing separation behaviour of one or more types during isolation only or,
exhibition of behaviour during complete isolation, and to a lesser extent in the presence of people (i.e. overnight, frequently of a different type)

The scores of socialisation, social referencing and separation were thereby all scaled using a 0-3 system. A score for all three variables was calculated from information gathered during interviews conducted at each age, including an interaction and social referencing score for litters whilst they were resident at the breeding establishment. This latter information was gathered via the

questionnaire in ***Appendix E***, using the following system:

1 ***Breeder interaction with litters***

Response to the question: "how much time do you spend with the puppies per day?"

0 - 1.5 hours	=	1
>1.5 - 3 hours	=	2
3+ hours	=	3

2 ***Social referencing of litters***

Responses to the questions:

Do the puppies have regular contact with people outside of your own family?

yes (1), no (0)

How much contact?

several times a week (2), less than weekly (1), never (0)

Do they meet strangers regularly?

yes (1), no (0)

Do they have regular contact with children?

yes (1), no (0)

The scores for the above responses were added, generating a maximum score of 5, and adapted to the following scale:

0	=	0
1/2	=	1
3/4	=	2
5	=	3

The majority of litters were very well social referenced, 7 of the 12 receiving a maximum score of 3, three a score of 2 and only two litters receiving minimal social referencing. Four litters received several hours of owner interaction per day, three more than one and a half hours and 5 litters less

than this amount. Both scores were apparently irrespective of whether or not the puppies were bred and kept indoors or in outdoor kennels.

8.2.2 Distribution of variable scores and relationship of separation score with age

The distributions of each variable with age from 3 to 18 months are illustrated in *Figures 8.1* to *8.3*.

Figure 8.1 Frequency distribution of owner interaction score with age

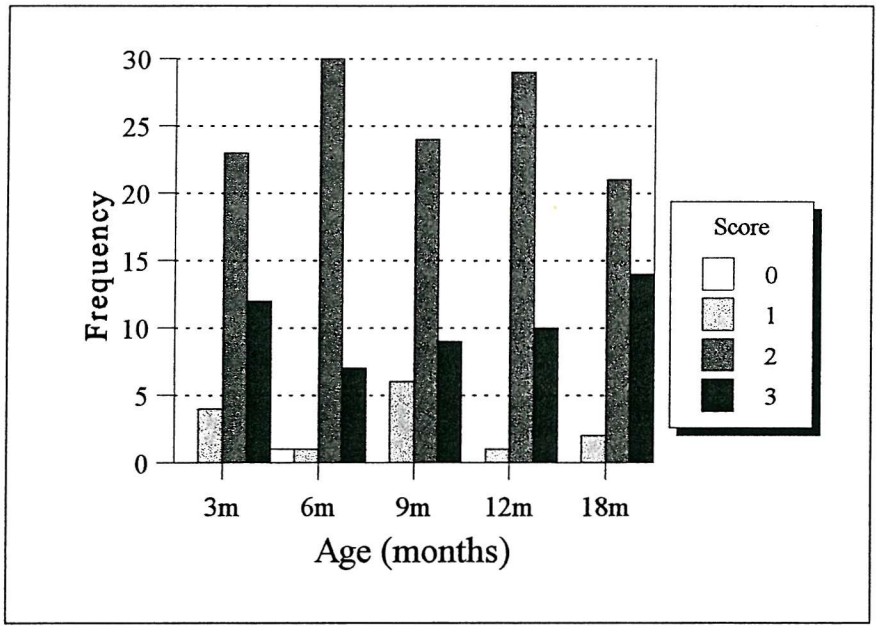


Figure 8.2 Frequency distribution of social referencing score with age

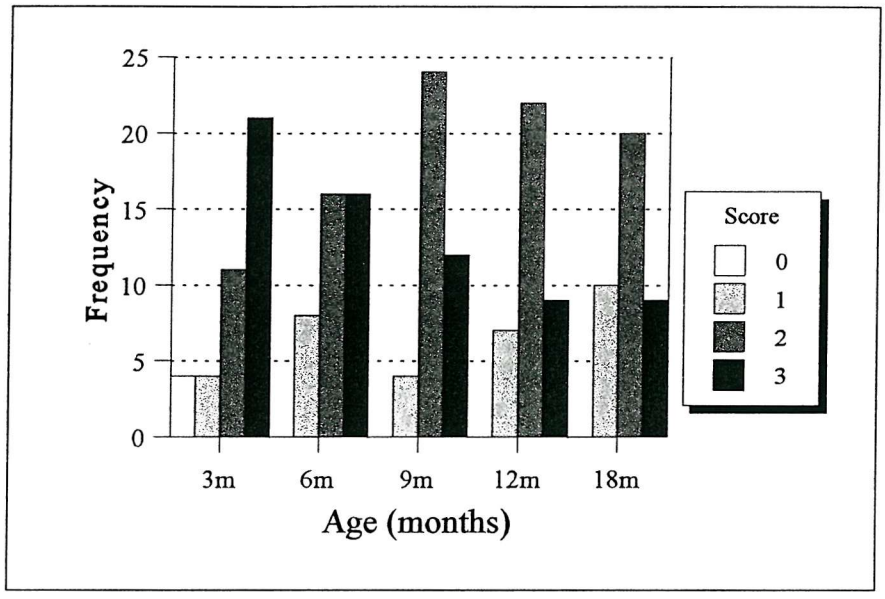
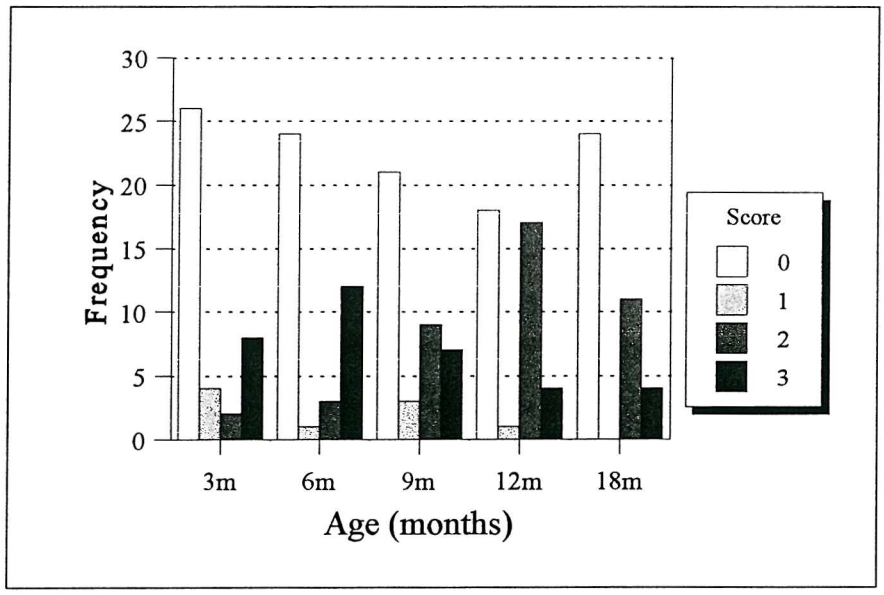


Figure 8.3 Frequency distribution of separation score with age



The number of dogs with a separation score of 3 reached its greatest value at 6 months and declined thereafter, whereas the dogs obtaining scores of 2 reached a peak at 12 months before a decline was observed.

Figure 8.4 Changes in separation score from 3m to 6m

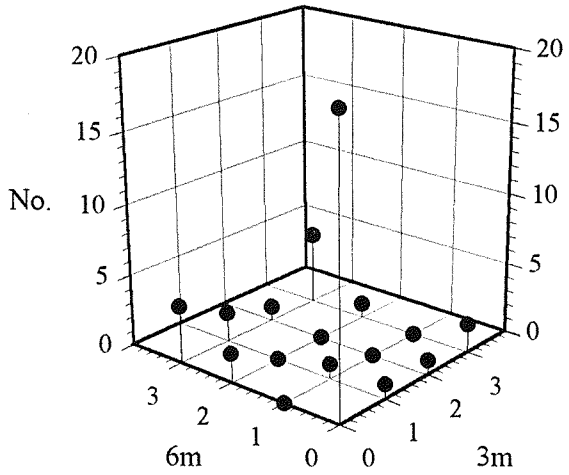


Figure 8.5 Changes in separation score from 6m to 9m

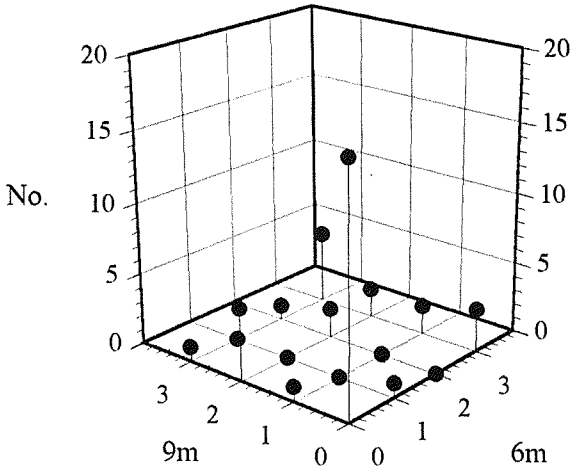


Figure 8.6 Changes in separation score from 9m to 12m

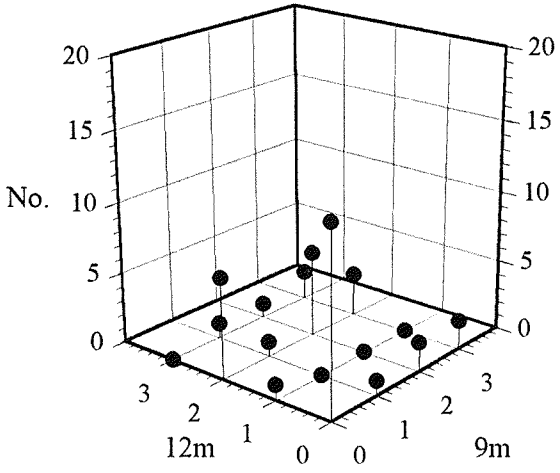
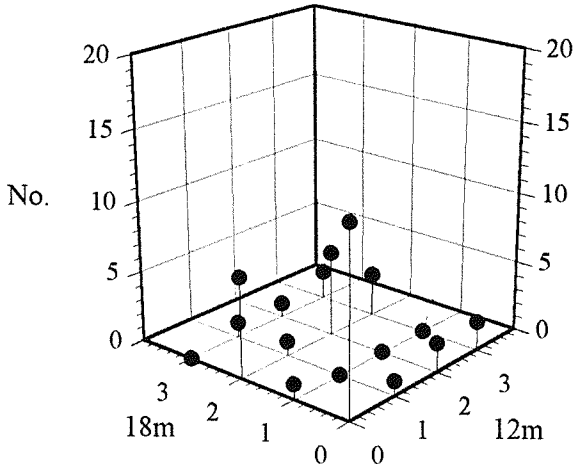
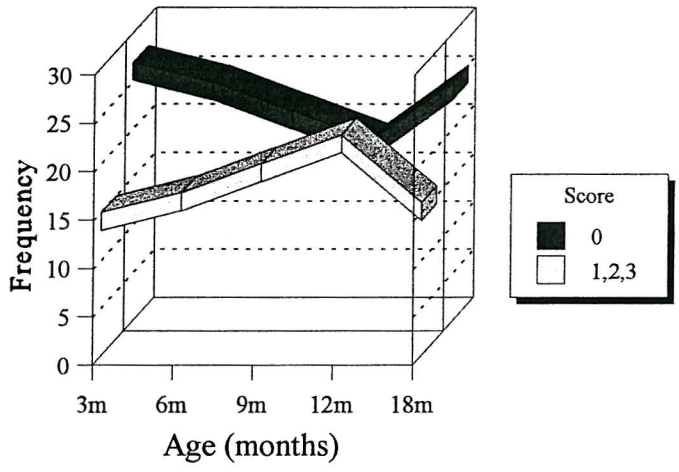


Figure 8.7 Changes in separation score from 12m to 18m



Figures 8.4 to *8.7* show that many dogs consistently displayed no separation behaviour. The consistent response appeared to be front to back diagonal, many individuals showing substantial changes from one age to the next (e.g. 3 or 2 at one age, and 0 at the next). Overall, a gradual increase in some degree of separation behaviour occurred up to 12 months of age before declining at 18 months (*Figure 8.8*).

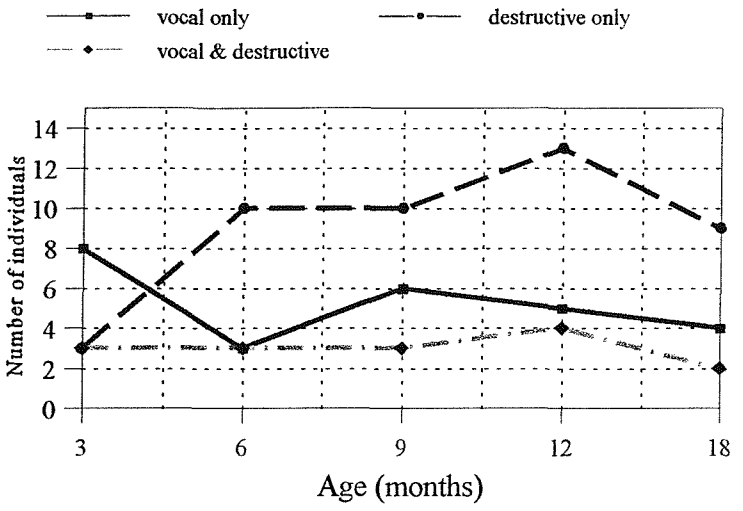
Figure 8.8 Frequency distribution of any separation behaviour with age



8.2.3 Symptoms displayed during separation

The most commonly encountered symptoms of separation behaviour were either vocalisation or destruction, the two rarely occurring together. In a breakdown of the symptoms displayed at each age, it became apparent that vocal behaviour predominated at 3 months but that this was greatly exceeded by destructive behaviour at 6 months. *Figure 8.9* illustrates the incidence of vocal and destructive behaviour displayed during separation at each age.

Figure 8.9 Incidence of vocal and destructive behaviour in dogs having a separation score of 1 or more



In general, vocal and destructive behaviour were more commonly encountered in Labradors. If one examines the incidence of vocal and destructive behaviour in the two breeds (*Figure 8.10*) it becomes apparent that early vocal behaviour was almost entirely accounted for by Labradors as was the sudden increase in destructive behaviour at 6 months. Overall, Collies took longer to display separation behaviour of any kind. Up to 9 months of age, almost all of those puppies receiving separation scores of 3 were Labradors, many of these derived from the same litter.

Figure 8.10 Incidence of vocal and destructive behaviour in Labradors and Border collies at each age. LD=Labrador destructive, LV=Labrador vocal, DC=Collie destructive, CV=Collie vocal

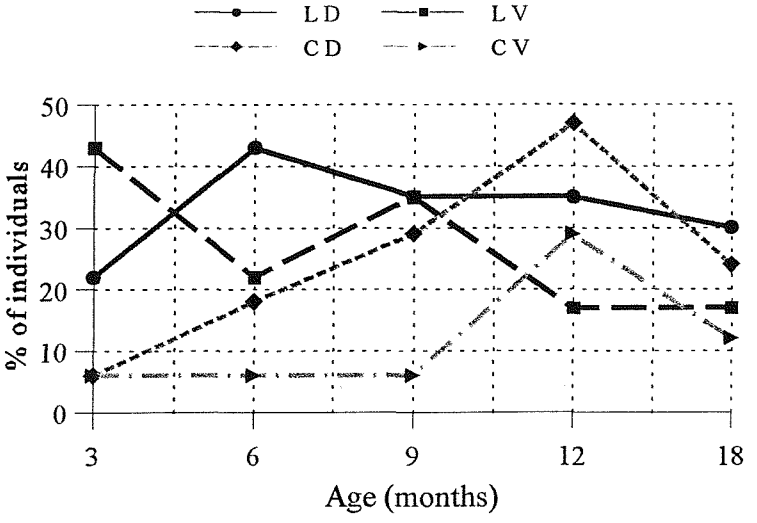
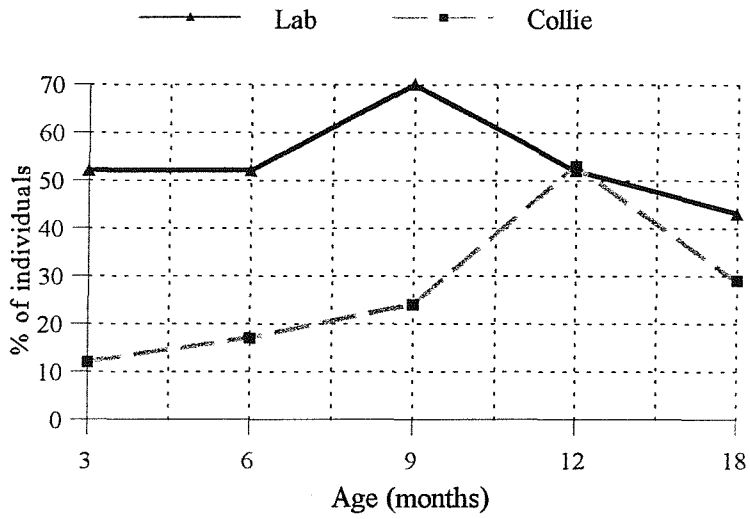


Figure 8.11 Incidence of separation behaviour in Border Collies and Labradors



8.2.4 *Correlation analysis of questionnaire data*

Initially, Spearman's Correlation Coefficients were calculated using *SPSS* on the owner interaction, social referencing and separation score at each age.

The level of interaction the puppies received was found to be significantly correlated from 3 to 18 months at both adjacent and non-adjacent ages (minimum correlation value 0.369, $p=0.012$; maximum correlation 0.517, $p<0.001$). Similar results were obtained for the social referencing scores from three to eighteen months (minimum correlation 0.391, $p=0.014$; maximum 0.603, $p<0.001$). Several of the separation scores were found to correlate well, although the pattern of associations was a little more complex (see *Table 8.1*)

Table 8.1 Spearman's correlation coefficients, with significance levels in brackets, obtained for separation scores at various ages. Values highlighted in bold are significant at the 0.05 level

Age	3m	6m	9m	12m
6m	**0.476 (0.002)**			
9m	**0.399 (0.011)**	**0.480 (0.002)**		
12m	0.115 (0.479)	**0.333 (0.036)**	**0.418 (0.007)**	
18m	0.122 (0.467)	**0.498 (0.001)**	**0.424(0.008)**	**0.366 (0.024)**

All adjacent ages were found to be correlated, as were most non-adjacent ages. The only correlations which were not significant were the very first (3 months) with the latest (12 and 18 months). Separation behaviour scores at 3 months were therefore *not* predictive of those at 12 and 18 months; but separation scores from 6 months onwards were reasonably consistent, implying that once established, symptoms of separation behaviour were likely to be expressed for three months or longer.

8.2.5 The relationship between breeder interaction/social referencing and pre-homing behaviour

The amount of time the breeders spend with the puppies and other associated social experiences was expected to influence the factor scores obtained from pre-homing behaviour (***Chapter 6***).

Canonical correlations were used to investigate the effect of breeder interaction and breeder social referencing on all of the 13 factor scores simultaneously. Breeder interaction was found to be unrelated to any of the factor scores; however the social referencing score generated a significant result (chi-squared=22.904, p=0.043). Spearman's correlation coefficient was then used to determine which individual factors were associated with this variable; Factor 6 (unfamiliar interactive + separation) was the only significant link (Spearman's rho=0.373, p=0.018).

In any investigation of the effect of environmental influences on puppy behaviour whilst in the litter, it is not particularly useful to use breeder interaction scores and breeder social referencing scores for *individual puppies* since at this stage the puppies were not treated as individuals rather as a single entity. Using the same score for each puppy assumes the within-litter variation to be zero thereby artificially reducing the errors and increasing the likelihood of obtaining a significant result. For a more reliable test of external influences whilst puppies are housed as a litter, litter *averages* are required. Additional correlation tests utilising litter averages for the levels of breeder interaction time and social referencing with each of the factor scores generated no significant results. A positive correlation was revealed between the amount of social referencing provided and Factor 6, although this was less than the previous test using individual puppy scores and was outside the 5% level of significance (Spearman's rho=0.553, p=0.062, n=12). High levels of social referencing by the breeder may therefore encourage the puppies to approach an unfamiliar person

whilst in the litter but may also influence sitting at the exit during separation and greeting following separation.

8.2.6 The relationship between separation scores and pre-homing behaviour

Multiple linear regression was used to investigate whether any of the factors generated during initial puppy testing at seven weeks (***Chapter 6***) predicted separation behaviour at any subsequent age. In each instance, separation score was the dependent variable under investigation and each of the 13 factors the independent variables.

Only one significant result was obtained specifically relating to the separation score at 3 months ($F=2.191$, $p=0.043$ preliminary ANOVA). The factors found to significantly influence this score were:

Factor 4:	$t=2.580$, $p=0.016$
Factor 12:	$t=2.133$, $p=0.044$
(Factor 6):	($t=1.928$, $p=0.065$):

Forward stepwise regression subsequently revealed that Factor 4 (individual, familiar attached) was most predictive of the separation score at three months followed by Factor 12 (greet unfamiliar, no littermates present) and an additional, tenuous association with Factor 6 (unfamiliar interactive + separation). If the individual variables comprising these Factors are examined, they seem to be highly representative of the typical "separation personality", e.g. a high degree of following behaviour, sitting at the exit during separation, and greeting following separation. It therefore seems that in several respects the puppy tests fulfilled their requirements in the prediction of separation behaviour, but that this predictive value was valid for a limited period only. The fact that none of the factors were found to associate with separation behaviour after 3 months suggests that considerable changes occur after this age. It has already been noted that the behaviour of puppies at three months is somewhat different to that exhibited under similar circumstances at later ages (*cf.* exclusion of data obtained at three months from the cluster analysis, ***Chapter 7***). It is possible that the disruption caused by removal from the litter and homing to a new environment has not subsided by 13 weeks and/or that a sufficient relationship has not developed between the puppy and its new home and family.

8.2.7 *The relationship between separation and interaction/social referencing, both post-homing*

The hypothesis tested was whether any relationship existed between the separation score obtained at one age, with the interaction/social referencing score obtained at the preceding age.

Multiple linear regression was used using separation score as the dependent variable and the preceding interaction/social referencing score as the independent variables. For significant results, cross-tabulations were constructed to determine exactly how the socialisation/social referencing score was affecting the subsequent separation score.

There were no significant effects of owner interaction on subsequent separation score, however the degree of social referencing at six and nine months was found to be related to the subsequent separation score (*Table 8.2*)

Table 8.2 Linear regression coefficients on separation score with preceding social referencing score. Values highlighted in bold are significant at the 0.05 level: the value asterisked is just outside of the accepted level of significance

Separation score	Social referencing score	ANOVA F value	Significance	t value
3m	Breeder	3.48	0.070*	1.866*
6m	3m	0.287	0.595	-0.536
9m	**6m**	**6.106**	**0.018**	**-2.471**
12m	**9m**	**5.343**	**0.026**	**-2.312**
18m	12m	0.147	0.704	-0.383

Utilisation of litter *average* scores for the level of social referencing provided by the breeder and the separation score at 3 months revealed no significant association, although the Beta value obtained was of the same sign [1].

[1] Whilst puppies are still housed as a litter, utilisation of average scores is more correct than using individual scores (i.e., for breeder social referencing scores); however, the analysis requires that comparative variables are also averaged (i.e., the post-homing separation score at three months) which automatically precludes the vast post-homing variation in circumstances. Arguments therefore exist for and against both types of analysis; individual scores *and* litter average scores are therefore presented.

On examination of the corresponding cross-tabulations, the following observations were made:

1 Breeder social referencing score/separation score at 3 months (*Table 8.3*):

There was an imbalance in the number of dogs receiving high levels of social referencing (3) and those obtaining a maximum separation score of 3; the majority of dogs scoring 3 for separation also scored 3 for social referencing.

Table 8.3 Crosstabulation of separation score at 3 months with breeder social referencing score for individual puppies

		Separation score (3 months)				
		0	**1**	**2**	**3**	**Total**
Breeder social referencing score	**0**	0	0	0	0	0
	1	7	1	0	0	8
	2	5	1	1	1	8
	3	14	2	1	7	24
Total		26	4	2	8	40

2 Social referencing at 3 months/separation score at 6 months (*Table 8.4*):

The incidence of separation scores of 2 and 3 had increased overall, dogs scoring 3 for separation had either scored 0 or 3 as a previous social referencing score

Table 8.4 Crosstabulation of separation score at 6 months with social referencing score at 3 months

		Separation score (6 months)				
		0	**1**	**2**	**3**	**Total**
Social referencing score (3m)	**0**	1	0	0	3	4
	1	3	0	1	0	4
	2	8	0	2	1	11
	3	12	1	0	8	21
Total		24	1	3	12	40

3 Social referencing at 6 months/separation score at 9 months (*Table 8.5*)

There was a positive bias towards those dogs well social referenced (3) receiving separation scores of 0

Table 8.5 Crosstabulation of separation score at 9 months with social referencing score at 6 months

		Separation score (9 months)				
		0	**1**	**2**	**3**	**Total**
Social referencing score (6m)	**0**	0	0	0	0	0
	1	2	1	3	2	8
	2	7	0	6	3	16
	3	12	2	0	2	16
Total		21	3	9	7	40

4 Social referencing at 9 months/separation score at 12 months (*Table 8.6*)

Many more dogs scored 2 for separation, most also scoring 2 for social referencing

Table 8.6 Crosstabulation of separation score at 12 months with social referencing score at 9 months

		Separation score (12 months)				
		0	**1**	**2**	**3**	**Total**
Social referencing score (9m)	**0**	0	0	0	0	0
	1	1	0	3	0	4
	2	8	1	11	4	24
	3	9	0	3	0	12
Total		18	1	17	4	40

5 Social referencing at 12 months/separation score at 18 months (*Table 8.7*)

All dogs now either displayed no separation behaviour (0), or scored 2 or 3. The trend was now for dogs receiving social referencing scores of 2 to display no separation behaviour

Table 8.7 Crosstabulation of separation score at 18 months with social referencing score at 12 months

		Separation score (18 months)				
		0	**1**	**2**	**3**	**Total**
Social referencing score (12m)	**0**	0	0	0	0	0
	1	4	0	1	2	7
	2	14	0	6	2	22
	3	5	0	4	0	9
Total		23	0	11	4	38

A more detailed analysis of the effect of owner interaction/social referencing on separation score was then made, taking into account *all* preceding variables at all preceding ages. For example, if the dependent variable under investigation was the separation score at 9 months, then a multiple linear regression of firstly: breeder interaction, interaction at 3 months and interaction at 6 months was examined followed by: breeder social referencing, social referencing at 3 months and social referencing at 6 months. Finally, a multiple linear regression of all interaction and all social referencing scores combined was performed (breeder interaction, breeder social referencing, interaction at 3 months, social referencing at 3 months, interaction at 6 months, social referencing at 6 months). If a significant result was obtained using all variables entered together, then a forward stepwise multiple regression was carried out to identify the specific variables driving this result.

Once again no significant results were found relating to the level of owner or breeder interaction but at most ages the separation score was affected by previous levels of social referencing (*Table 8.8*).

Table 8.8 Significant results obtained using forward stepwise multiple linear regression on separation score with all preceding interaction/social referencing scores. Values highlighted in bold are those found to be driving the association following forward stepwise analysis. Beta indicates the direction of the relationship, i.e. whether it is a positive or negative association

Separation score	Social referencing score	F value (ANOVA)	Significance (ANOVA)	Beta sign
3 months	Breeder	3.48	0.070	+
6 months	Breeder	4.428	0.019	+
9 months	Breeder **3 months**	4.988	0.005	+ -
18 months	3 months **6 months**	4.139	0.005	+ -

Using *averages* of breeder social referencing score and separation score at each age, the breeder social referencing score was only found to influence the separation score at 6 months (t=2.404, p=0.040), although all other results showed the same direction of association as the tests of individual puppy scores

Crosstabulations were generated for all significant results outlined in *Table 8.8*.

1. The same result as 1. above.

2. Breeder social referencing with separation score at 6 months (*Table 8.9*):
   Once again, those puppies receiving maximum social referencing by breeders were those acquiring a separation score of 3 at 6 months

Table 8.9 Crosstabulation of separation score at 6 months with breeder social referencing score for individual puppies

		Separation score (6 months)				
		0	**1**	**2**	**3**	**Total**
Breeder social referencing score	**0**	0	0	0	0	0
	1	7	1	0	0	8
	2	6	0	1	1	8
	3	11	0	2	11	24
Total		24	1	3	12	40

3. Breeder social referencing with separation score at 9 months (*Table 8.10*):

Again, the majority of dogs obtaining a separation score of 3 at nine months were those well socially referenced as puppies

*Table 8.*10 Crosstabulation of separation score at 9 months with breeder social referencing score

		Separation score (9 months)				
		0	**1**	**2**	**3**	**Total**
Breeder social referencing score	**0**	0	0	0	0	0
	1	7	0	1	0	8
	2	4	1	2	1	8
	3	10	2	6	6	24
Total		21	3	9	7	40

4. Social referencing at 3 months with separation score at 9 months (*Table 8.11*):

An inverse trend now became apparent, puppies well socialised at 3 months were less likely to score highly for separation behaviour at 9 months

Table 8.11 Crosstabulation of separation score at 9 months with social referencing score at 3 months

		Separation score (9 months)				
		0	**1**	**2**	**3**	**Total**
Social referencing score (3m)	**0**	0	1	1	2	4
	1	2	0	2	0	4
	2	4	0	4	3	11
	3	15	2	2	2	21
Total		21	3	9	7	40

5. Social referencing at 3 months with separation score at 18 months (*Table 8.12*):

Those dogs scoring 3 for separation behaviour at 18 months were adequately to excellently social referenced at 3 months

Tables 8.2 and *8.8* revealed slightly different results in the single linear regression tests of separation score/immediate preceding social referencing score and the multiple linear regression tests of separation score/all previous social referencing scores[2]. A relationship which was found to occur between the separation score at nine months and the social referencing score at six months in a single regression test was not found to occur in the multiple regression test (1). Similarly, the separation score at 12 months was found to be associated with the social referencing score at nine months in the single regression, but no relationship was revealed with any preceding social referencing score in the multiple regression test (2). In the first instance (1), the high correlation between the social referencing scores at three months and six months (Spearman's rho=0.578, $p<0.001$) was thought to have caused the discrepancy in the significant results obtained. When two highly correlated values are entered into a multiple regression analysis and both are associated with the dependent variable under investigation, the value most representative of the relationship is selected. Interestingly, when litter averages were entered into the multiple regression, the social referencing score at 6 months was once again revealed to be significantly associated with the separation score at 9 months. In the latter instance, no significant relationship was found with the separation score at 12 months and *any* previous social referencing score using a multiple linear regression test; however when forward selection was performed on the same data, a significant was obtained with respect to the social referencing score at 9 months (t=-2.312, p=0.026).

Table 8.12 Crosstabulation of separation score at 18 months with social referencing score at 3 months

		Separation score (18 months)				
		0	**1**	**2**	**3**	**Total**
Social referencing score (3m)	**0**	3	0	1	0	4
	1	2	0	2	0	4
	2	6	0	3	2	11
	3	12	0	5	2	19
Total		23	0	11	4	38

2 This was partly due to fundamental differences between the two statistical methods; the chances of obtaining a significant result in a multiple regression test decrease with the number of variables entered into the regression analysis as a guard against Type I errors.

6. Social referencing at 6 months with separation score at 18 months (*Table 8.13*):

Only those dogs receiving minimal social referencing at 6 months went on to obtain maximum separation scores at 18 months

Table 8.13 Crosstabulation of separation score at 18 months with social referencing score at 6 months

		Separation score (18 months)				
		0	**1**	**2**	**3**	**Total**
Social referencing score (6m)	**0**	0	0	0	0	0
	1	2	0	2	4	8
	2	10	0	5	0	15
	3	11	0	4	0	15
Total		23	0	11	4	38

It therefore seems that high levels of social referencing on the part of the breeder have a lasting effect on the behaviour of the puppies (up to 9 months of age) but that this effect is indeed the opposite to that anticipated in that it appears to *encourage* adverse reactions to subsequent separation[3]. That the actual amount of time spent with the puppies does *not* influence subsequent separation behaviour is interesting since one would have predicted that high levels of breeder interaction accompanied by poor social referencing would have generated the greatest response to social separation. This study has not only demonstrated this preconception to be inaccurate but that to some extent the converse is true: the amount of direct interaction has little effect on subsequent behaviour whereas high levels of social referencing positively influences the development of a subsequent separation reaction. Nevertheless, since all puppies in a litter were given the same social referencing score at that stage, the true number of degrees of freedom is not as high as the model used, therefore the result may not be reliable.

The significant results generated with respect to social referencing at 3 months are somewhat confused since there is an apparent negative influence on separation behaviour at 9 months but a positive effect on such behaviour at 18 months. An absence of social referencing at 6 months does however seem to encourage separation behaviour at 9 months and at 18 months.

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[3] It must be borne in mind when interpreting these results, that although several of the puppies received maximum separation scores of 3, these scores are arbitrary and in many cases represented relatively mild but ongoing separation behaviour.

It may therefore be concluded that the level of social interaction by either the breeder or the puppy owners does not significantly influence the development of separation behaviour with any degree of severity. In contrast, the level of social referencing an animal receives has a significant effect on the puppy's reaction to social isolation and that this effect is most marked when the puppy is up to 3 months old. Encouraging the puppy to meet new people, animals, and situations at such a young age apparently makes them less able to adapt to social isolation even up to the age of 18 months. Nevertheless, after 3 months of age high levels of social referencing become associated with *low* separation scores. If anything this confirms the time up to 3 months as a particularly sensitive period but suggests that the situation regarding the onset and development of separation behaviour is extremely complex.

8.2.8 How does the level of social referencing a puppy receives influence subsequent reactions to social situations?

Several questions within each questionnaire referred to the puppy's reaction to new social situations, e.g. "how does the dog react to strange dogs when out exercising?", "how does the dog react to strange people when out exercising?". In each instance, the response was scored from -2 to +2 according to whether the dog displayed aggression (-2), active avoidance (-1), hesitancy (-0.5), completely ignored the situation (0), or positive social reactions from 0.5 to 2.0 culminating in greeting enthusiastically (2). These scores were investigated using linear regression, taking the immediate preceding social referencing score as the dependent variable in each case.

Only one significant result was obtained: that the amount of social referencing a puppy receives at 3 months significantly influences its response to strange people at 6 months ($F=5.975$, $p=0.019$, $t=2.444$). Crosstabulations revealed that those dogs scoring 3 for social referencing at 3 months in general responded extremely well to new people, as did those scoring 2 (*Table 8.14*). Five of the 8 dogs reacting negatively at 6 months had received minimal or no social referencing at 3 months.

Table 8.14 Crosstabulation of social referencing score at 3 months with reaction to strange people at 6 months

		Reaction to a strange person (6m)									
		-2.0	**-1.5**	**-1.0**	**-0.5**	**0**	**0.5**	**1.0**	**1.5**	**2.0**	**Total**
Social referencing score (3m)	**0**	1	0	2	0	0	0	0	0	1	4
	1	0	0	1	0	0	0	1	0	1	3
	2	0	0	1	0	0	0	1	0	9	11
	3	1	0	1	1	1	1	0	1	15	21
Total		2	0	5	1	1	1	2	1	26	39

The inverse relationship was then explored taking reaction score as the independent variable with the subsequent socialisation score as the dependent variable. It was found that the dog's reaction to strange people and strange dogs did indeed affect the subsequent amount of social referencing the animal received, but only at 12 months (strange person, F=6.490, p=0.015, t=2.548, *Table 8.15*; strange dog, F=8.895, p=0.005, t=2.983, *Table 8.16*). Those dogs displaying the most positive responses at nine months went on to be adequately to well socially referenced at 12 months, whereas those displaying aggression received minimal social referencing.

Table 8.15 Crosstabulation of social referencing score at 3 months with reaction to strange people at 6 months

		Reaction to a strange person (9m)									
		-2.0	**-1.5**	**-1.0**	**-0.5**	**0**	**0.5**	**1.0**	**1.5**	**2.0**	**Total**
Social referencing score (12m)	**0**	0	0	0	0	0	0	0	0	0	0
	1	2	0	0	1	0	0	2	0	1	6
	2	0	0	3	1	3	0	2	0	15	24
	3	0	0	0	1	0	0	1	0	7	9
Total		2	0	3	3	3	0	5	0	23	39

Table 8.16 Crosstabulation of social referencing score at 9 months with reaction to strange dogs at 12 months

		Reaction to strange dogs (9m)									
		-2.0	**-1.5**	**-1.0**	**-0.5**	**0**	**0.5**	**1.0**	**1.5**	**2.0**	**Total**
Social referencing score (12m)	**0**	0	0	0	0	0	0	0	0	0	0
	1	3	0	0	1	0	0	0	0	2	6
	2	0	0	3	1	0	0	2	0	18	24
	3	0	0	0	1	0	0	0	0	8	9
Total		3	0	3	3	0	0	2	0	28	39

8.2.9 Problems reported by puppy owners

By the time the puppies had reached eighteen months of age, a number of puppy owners said they were experiencing difficulty with one or more aspects of their dog's behaviour to the extent that it was becoming a "problem". Problems reported were:

1. Excessive jumping up (1)
2. Aggression towards strangers, including actual biting (1)
3. General "antisocial behaviour" to strange dogs and people, including actual biting (1)
4. House-soiling (1)
5. Intra-household aggression between male dogs (1)
6. Excessive barking, particularly whilst travelling (1)
7. Persistent antagonism of another bitch within the household (1)
8. Aggression towards owner (1)

Notably, four of the eight dogs were from the same litter (Border Collies), three of which were apparently showing dominance disputes with either another dog of the same sex within the household or the owner.

8.3 Discussion

The incidence and development of separation behaviour at various stages, as reported by puppy owners, revealed several interesting associations, and indeed absences of associations, with aspects of the puppies' social experiences. Firstly, no association was found to occur between the amount of time household members spent in direct interaction with the dog and the expression of separation behaviour, with degree of severity. This in itself was rather surprising since it has often been assumed that people who spend large amounts of time with their pets, indulging them in considerable one to one interaction, are encouraging strong attachments to form, with the development of inappropriate separation behaviour as a potential consequence. On the other hand, it is reasonable to suggest it is not only the quantity of time spent with the dog that is important but also the *quality* of interaction. Throughout the course of this study I came across several owners (mainly of working gundogs) who were of the opinion that brief periods of intense interaction encourage stronger attachments to develop than extended periods of less interactive social activity. If this is so, and I have no reason to believe it is not, then the variable pertaining to the duration of owner interaction may not be an effective predictor of attachment.

Secondly, the level of social referencing a puppy received, particularly up to 6 months of age, was shown to have a significant effect on the incidence of separation behaviour at several ages. Notably, the experience the puppies received whilst they were still with the breeder seems to be of importance, although in the opposite manner to that expected. The level of breeder social referencing *positively* influenced the expression of separation behaviour at 3 months, 6 months and 9 months (when individual scores were use in the analysis, at 6 months when litter average scores were used); in other words those puppies receiving considerable extra-litter experience were more likely to react to separation at least up to 6 months of age. This finding is somewhat unforeseen since although one would expect the social experiences occurring at seven weeks to have an effect on subsequent behaviour, one would not have anticipated this effect to be so drastic or longstanding. Interestingly, the degree of social referencing after 3 months appears to have an inverse effect on subsequent separation behaviour. Puppies adequately or well socially referenced at 6 months displayed lower levels of separation behaviour at 9 months and those inadequately socially referenced at 6 months displayed higher levels of separation behaviour at 18 months.

It therefore seems that puppies exposed to a highly socially stimulating environment at a young age may be less able to tolerate social isolation at a later age and that this effect perpetuates for a

considerable time. Nevertheless, once the puppy has reached a certain age, separation behaviour increases with an *absence* of extra-household stimulation. By logical inference, this tends to suggest that those individuals receiving lower levels of social referencing are not only missing out on external social contacts, but that they are necessarily spending greater amounts of time with a limited number of people, and potentially developing stronger attachments.

Is separation behaviour predictable? In a comparison of litter factor scores with separation score at each age, only one significant result was generated; that separation behaviour at 3 months is positively associated with Factors 4 (following, non-vocal separation behaviour and greeting behaviour - all directed towards the familiar person), 12 (greeting the unfamiliar person) and 6 (interacting with the unfamiliar person, non-vocal separation behaviour and greeting behaviour). Given the individual variables comprising each of these factors, it is not unexpected that they are predictive of separation behaviour at 3 months, although those factors specifically relating to vocal behaviour during separation were not found to show any significant association. None of the factors showed any relationship with separation behaviour after 3 months. Therefore, although the behaviour of puppies at 7 weeks bears some resemblance to subsequent behaviour, this relationship is no longer apparent by six months of age. After 3 months, (i.e. 6, 9, 12, and 18 months) separation scores taken at adjacent ages became well correlated, suggesting a reasonable level of reliability from 6 months onwards. This results bear some similarity to those of Goddard and Beilharz (1984, 1986), who found that the only behaviour predictive from early puppy tests was fearfulness, and that this predictability increased with age.

As regards the onset and development of separation behaviour, *Figure 8.3* illustrates that the number of individuals obtaining a separation score of 3 peaks at 6 months and declines thereafter, whereas those obtaining a score of 2 reaches a maximum at 12 months before declining. In either instance the incidence of notable separation behaviour has begun to decline by the time the puppy has reached 18 months of age, or presumed *social maturity* (Bradshaw & Brown, 1990; Overall, 1997). This finding supports the main hypothesis of this study in that behaviour displayed during separation is most frequent during the juvenile period and (usually) reduces thereafter.

The actual symptoms displayed during separation also provide some grounds for comment. At three months, vocal behaviour was the most frequently reported single symptom, considerably reducing by 6 months. Destructive behaviour, the second most frequent symptom of separation at 3 months, superseded vocalisation by 6 months and remained the outstanding separation behaviour thereafter. In accordance with previous findings, vocal and destructive behaviour rarely occurred together. On

examination of the breed incidence of symptoms, it became apparent that the Labradors were mainly responsible for the high level of vocal behaviour at 3 months and were largely responsible for the increase in destructive behaviour at 6 months. In general, Collies did not display symptoms of separation behaviour until they were somewhat older and tended to exhibit symptoms with less severity. Almost all of the puppies acquiring maximum separation scores of 3 up to and including 9 months of age were Labradors, with several members from the same litter in 3 instances. This apparent litter effect may go some way to explaining the results obtained following the previously discussed investigation of the level of breeder social referencing with subsequent separation score. Since all puppies in a litter were exposed to the same level of social referencing whilst with the breeder, they automatically received the same breeder social referencing score. With the 3 litters in question, all received maximum scores of 3 (incidentally all were Labradors housed in outdoor kennels) and several went on to obtain maximum separation scores up to 9 months of age. This might in fact not be due to breeder social referencing after all, but may be a genuine litter effect, i.e. there might be a genetic predisposition to exhibiting this kind of behaviour, or it may in part be due to the maternal environment. Unfortunately one of the limitations involved in a project whereby subjects are both related *and* share a common environment at a young age is that it is difficult to identify and isolate causative variables without performing complex rearing experiments including cross-fostering (Pfaffenberger *et al.*, 1976; Fält, 1984).

As I have already mentioned, the severity of the separation behaviour encountered throughout this study was in general extremely low. Only one individual displayed symptoms to a "problem" level whereby modifications in housing and routine were required. Additional video footage of this individual for a separation period of one hour indicated that howling began within a matter of a minutes and was accompanied by vomiting and pacing.

By the time the puppies were 18 months old, 8 owners viewed one or more aspects of their dogs behaviour to be a "problem", but none of these related to separation behaviour, not even the dog described above. In many instances of destructive behaviour, the owners (particularly of Labradors) were not at all concerned about this behaviour but regarded it merely as part of the "growing up" process. Those dogs housed in kennels proved especially difficult to assess for separation behaviour since it was often perceived as normal for the dog to chew its kennel. In such instances, careful questioning regarding the specific target of destruction in relation to the kennel layout, together with the latency of destructive behaviour and the overall level of destruction provided some enlightenment. How such dogs would have fared in a household situation is unknown, although my own impression is that equivalent behaviour would not be as evenly

tolerated and probably not viewed as "normal" under domestic circumstances.

The situation regarding working kennelled dogs is rather unique. In most cases, interaction time was less than the typical household pet, the remainder of the time being spent in kennels, frequently with one or more conspecifics. When interaction did occur, it was usually of a high level of intensity whereby the dog is expected to be have all attention directed towards "working" for the owner. This focusing of behaviour is intended to produce a highly motivated, obedient animal which often "works" for only one person. This is apparently a very successful regime and encourages the required bond to develop between dog and handler. These repetitions of intermittent intense social stimulation with minimal social contact in effect "tease" the animal and apparently generate maximum response to absence of the familiar person. Indeed this may be why so many kennel housed dogs *do* chew and vocalise although this is somehow viewed to be perfectly normal and as such acceptable.

8.5 Conclusions for Chapters 6, 7 and 8

Considerable differences in the behaviour of puppies at seven weeks of age were found both within litters and between unrelated litters. The puppies were able to discriminate and show a preference for either a familiar or unfamiliar person. Collies tended to be slightly more interactive with a familiar person during individual tests and more hesitant in their approach to an unfamiliar person. The incidence of separation behaviour was, as expected, much greater when conspecifics were not present, the frequency of vocal behaviour during littermate and human absence being sixteen times the rate per minute than when both were present. Labradors displayed higher levels of separation behaviour in general, particularly vocalisations. Labradors also displayed higher levels of conspecific interaction, although this was very litter specific and hence did not show up as a breed association with the litter factors. With respect to specific factor scores, no significant breed differences were found, although several sex differences were revealed. Females displayed higher levels of vocalisations during separation in the litter tests, and greeting the unfamiliar person after a period of separation. Males exhibited higher levels of following the unfamiliar person. Female Labradors displayed a tendency to score higher on the factor relating to apparent breeder attachment, whereas female Collies showed significantly *lower* instances of following the unfamiliar person. Nervous behaviour was very rarely encountered, the five individuals displaying such behaviours doing so at extremely low levels.

In the post-homing visits and corresponding observational studies from three to eighteen months, high levels of correlation were found between reliable variables measured at different ages. In particular, nervous behaviours (initial barking, urination and avoidance of the unfamiliar person) were very well correlated, suggesting that those individuals which were nervous at a young age, remained so at least until 18 months; this is in agreement with the studies of Goddard & Beilharz (1986). Nevertheless, the behaviour displayed by puppies at three months is apparently quite different to that displayed from six months onwards. In general, the behaviour exhibited by puppies after six months is more highly correlated than that at 3 months is with other ages. Border collies, in particular females, apparently display higher levels of submission and hesitancy towards an unfamiliar person, whereas Labradors were not outstanding in any instance of behaviour other than several variables relating to interactive behaviour with both the familiar and unfamiliar person. Throughout the observational study, it became apparent that behaviour during a brief denial of access to the familiar person (and subsequently the unfamiliar as well) was correlated with indicators of hesitancy and uncertainty towards the unfamiliar person. These apparently nervous individuals did not display any consequential increased interaction with the familiar person and as such were not therefore assumed to be seeking solace with an "attachment figure" (Gubernick, 1981). Conversely, several associations were found with behaviours towards the familiar person and a reaction to that person's departure but without active *avoidance* of the unfamiliar, suggesting an attachment relationship. Nevertheless it is possible that these puppies were not entirely at ease in the presence of the unfamiliar person and were remaining with the familiar person as a source of comfort. Unfortunately from the measurements taken and given the limited observational periods, it is impossible to identify the motivation for the increased level of familiar interaction.

The behaviour of the puppies during observations from 3 to 18 months was poorly predicted from the tests at seven weeks. Interaction with the familiar person was found to correlate with interaction with the *unfamiliar* person at seven weeks (littermates present) possibly indicating an early hesitancy in unfamiliar interaction, fully manifested by an increased interaction with a familiar and therefore "safe" person at a later age. An association was found with initial barking and vocalisation during separation in the litter tests. Although it is feasible that these individuals were simply vocal in general, I am of the belief that this initial barking was expressed in a *nervous* context and hence supports the nervous/separation association. Two of the factors relating to unfamiliar interaction at seven weeks were found to correlate with high levels of unfamiliar interaction up to 18 months. The puppy tests can be said to have generated some interesting if complex associations with later behaviour, although the behaviour of the puppies obviously changes so much so after the age of three months (not least as a result of removal from the dam,

littermates, familiar persons, and familiar environment to a new environment with new social contacts and new experiences at an exceptionally sensitive age) that long term predictions of behaviour are extremely difficult. In addition, the practicalities involved in conducting a study of pet behaviour in the home environment dictate that variation in circumstances is immense, such that environmental variability largely masks the underlying behavioural tendencies.

The questionnaire presented to puppy owners on each of the visits from three to eighteen months revealed only one severe ongoing case of separation behaviour. Many puppies displayed transitory separation behaviour, particularly between 6 and twelve months of age. Overall, Labradors displayed more separation behaviour than Collies, and at higher levels. Vocalisation was the most common separation behaviour at 3 months (largely as a result of Labrador vocalisation), this being superseded by destruction at six months of age, which remained the most common symptom thereafter. Vocal and destructive behaviour were rarely reported to occur together. Labrador separation behaviour was reported to reach a maximum at 9 months of age whereas Collie separation behaviour did not peak until 12 months. In either instance, the incidence of notable separation behaviour (i.e. scores of 2 or 3), had begun to decrease by 18 months.

In terms of the predictability of separation behaviour from the tests conducted at seven weeks, the only association found was that between three litter factors and the separation score obtained at three months. This once again confirms that behaviour after three months changes considerably, and suggests that behaviour at 7 weeks is reasonably predictive of behaviour at three months but not thereafter.

The amount of time spent interacting with the puppy at any age (including whilst in the litter) did not reveal any association with separation score at any age. Conversely the level of social referencing the puppy received significantly influenced the separation score obtained at several ages. Puppies well socially referenced at 6 months obtained low separation scores at 9 months and those relatively poorly socially referenced at 12 months obtained high separation scores at 18 months. A surprising result was the apparently large effect of breeder social referencing on subsequent separation scores up to and including 9 months. Evidently those litters receiving maximum social referencing went on to obtain *high* separation scores at 3, 6, and 9 months of age. One possible reason for this effect is the *over-stimulation* of puppies at a young age generating a consequent inability to tolerate social isolation. Moreover, an alternative explanation is that the level of breeder social referencing and separation score is in fact a false correlation and that the real association is with the *litter* and the high separation scores, i.e. a litter predisposition to separation

behaviour. Three litters stood out as receiving high separation scores up to 9 months, all of which were Labradors.

As regards the apparent association between nervous behaviour and separation behaviour, 6 of the 8 puppies scoring 3 for separation behaviour at 3 months showed fearfulness under some circumstances, 9 out of 12 at 6 months, with a gradual reduction in the proportions thereafter.

It may therefore be concluded that testing of puppies at seven weeks reveals preferences for familiar unfamiliar or conspecific interaction, with corresponding reactions to social isolation from each. In general, the Factors obtained from such tests were not predictive of behaviour observed in the home from three to eighteen months of age although some associations were found. The reported incidence of notable separation behaviour in juvenile dogs was low, generally reaching a maximum at or before 12 months and reducing by 18 months. This separation behaviour was only predictable from puppy tests up to 3 months of age. There appears to be some association of nervous behaviour with behaviour during separation in some individuals but not in others displaying similar separation symptoms. Overall, separation behaviour was more frequently expressed in Labradors and with a higher degree of severity.

GENERAL DISCUSSION

9.1 *Discussion of methodologies used*

9.1.1 *Questionnaire studies*

The use of questionnaires in behavioural studies allows for the collection of factual information, and information on attitudes, particularly regarding circumstances outside the realms of feasible observational studies. In addition, they may be used either as a mode of surveying information (as in ***Chapter 2***), as a substitute for the impracticalities of collecting observational data (as in ***Chapter 5***) or as a complement to observational studies (as in ***Chapter 8***). The problems associated with the collection of observational data on companion animals in the home environment (***Chapter 7***) have, in this study at least, served to highlight the importance of information gathered from questionnaires. Although there can be no adequate substitute for good, reliable observational data, this is often difficult to attain and in the absence of rigorously controlled conditions, generating repeatable results, the questionnaire may suffice as the optimum mode of data collection.

Questionnaires were used as a means of data collection in several parts of this thesis (***Chapter 2***, ***Chapter 5***, ***Chapter 8***). In each instance, the questionnaires used were based on a similar line of questioning, mainly because the information required, although from discrete populations and with different hypotheses in mind, was of a like nature, but also to facilitate the scoring and analysis of responses. The template questionnaire used was that described in ***Chapter 2*** (see ***Appendix A***), whereby many questions were based on current opinions and beliefs in companion animal behaviour counselling and anecdotal evidence provided by the pet owning population. Unfortunately it was not possible to base questions on a more solid foundation; however, the somewhat pioneering nature of this study has served to provide a basis for the design and implementation of subsequent related questionnaires.

Many of the questions within the questionnaire were closed (fixed choice) response as opposed to open ended. Where fixed choice questionnaires are presented, respondents are asked to select an

answer from two or more alternatives. They have the advantage of making numerical comparisons comparatively easy whereas open ended questions may be difficult to code or quantify. Nevertheless, open ended questions do confer various advantages over fixed response questions (from Coolican, 1994):

1. They deliver richer information
2. The respondent is not constrained by a fixed choice answer
3. There is less chance of ambiguity as the respondent does not have to interpret a statement and then agree or disagree with it

Although the above statements are undoubtedly true with respect to open ended questions, these mainly apply to questionnaires where the respondent is responsible for completion of the questionnaire. As regards the questionnaires presented in this thesis, in all instances questions were delivered in the form of an interview (either in person by a behaviour counsellor as in ***Chapter 2***, by myself via telephone in ***Chapter 5***, or by myself in person in ***Chapter 8***). The questions were therefore delivered in the form of open ended questions, but the responses were recorded within suitable preselected categories. One of the problems associated with preselected fixed categories is the anticipation of the distribution of response. For example, where the question "how long is the dog routinely left alone for during the day" (***Question 18, Appendix A***) is concerned, some prior knowledge of the length of owner absence might have permitted the definition of response categories that more accurately reflected the information given verbally by the owners. In practice, however, this did not result in any substantial loss of data, since the response categories used generally reflected those volunteered by the owners

9.1.2 *Observational studies*

Specific problems associated with the collection of data have already been outlined within the appropriate chapters (see ***Chapter 4***, ***Chapter 7***). Apart from the obvious restrictions in the facilities available within rescue centres, one of the major obstacles to the implementation of a test of potential separation behaviour (with known diagnostic specificity and sensitivity) is the necessary time constraint imposed on centre staff. Although the test described in ***Chapter 4*** predicted separation behaviour in the home with 60% accuracy, this relied on considerable amounts of attention paid to individual animals during testing, not least their behaviour during separation.

Nevertheless, given that in general the dogs responded to a five minute period of social isolation following only 20-25 minutes of interaction with a previously unknown tester, it is possible that a similar reaction to a brief period of separation may elicit a similar, if not greater, separation response during isolation from a *known* handler *without* the preceding period of social interaction. Given that two distinct factors pertaining only to behaviour during separation were isolated in the analysis of temperament test data, other behavioural measures, although interesting, are apparently superfluous to the identification and prediction of separation behaviour. Investigations could therefore be made into the efficacy of recording behavioural measures during brief separation from a familiar handler. It is suggested that widely available (and relatively inexpensive) closed circuit television cameras could be used to observe the animal's behaviour during the period of separation, for the purpose of routine testing.

As regards the observational studies in ***Chapters 6*** and *7*, the immense variation in circumstances contributed towards the generation of largely disappointing results. Although some interesting results regarding the stability of nervous behaviour, the overall absence of predictability of adult behaviour from puppy tests and possible differences in the motivation of dogs reacting to a period of complete and incomplete social separation were obtained, given the inconsistencies of the test situations, much more rigorous control is required before these observations may be regarded as conclusive. The home environment is not conducive to reliable behavioural testing, although removal from the home environment introduces alternative, perhaps even greater practical difficulties.

9.1.3 *Design of longitudinal studies*

In the longitudinal study described in ***Part III***, only one individual went on to develop problematical separation behaviour. It could therefore be suggested that the sample size was insufficient for a full examination of the ontogenetical process of separation behaviour. Unfortunately, there are no available statistics relating to the incidence of clinical separation behaviour in the pet dog population (as opposed to in the population of dogs referred for behaviour counselling, or those in animal rescue centres). It was therefore not possible to ascertain in advance a sample size that would allow the effect (i.e., clinical separation behaviour) to be detected. The selection of twelve litters for study was therefore somewhat arbitrary and given the nature of the study, the maximum possible in the given time. Having completed this pioneering investigation, it is

now apparent that a considerably larger sample size would be required to identify a significant number of clinical cases. As discussed earlier, the inherent unreliability of behavioural data collected over a short period of time indicates that either considerable modification of observational techniques, or indeed the complete abandonment of this method of study, is required. The most reliable and informative part of the longitudinal study, i.e., the questionnaires, may therefore provide the greatest scope for further research. An increased litter sample size, together with more regular, detailed personal interviewing of pet dog owners is suggested as an improvement to the current study.

9.2 *Discussion of experimental findings*

9.2.1 *The exhibition of separation behaviour as a result of variable motivational states*

In agreement with the hypothesis for *Part I*, the symptomatology of clinically diagnosed separation behaviour cases (*Chapter 2*) suggests several underlying motivational states. Although many of the behaviours exhibited during separation are apparently identical, further examination of the dog's behaviour outside of social separation reveals possible differences in the animal's general emotional state. Using arbitrary indices of presumed attachment behaviour, there apparently exist categories of clinical cases which can be said to be over-attached, and those which are not. This is in agreement with Overall (1997), who comments that there are over-attached and not over-attached individuals within this population, although in my sample at least, individuals experiencing an over-attached relationship *are* over-represented. Similarly, there appear to be several sub-categories of dog which are apparently hyper-attentive to the movements of household members and who exhibit fearful responses to one or more stimuli, behaviours which are potentially analogous to a state of "anxiety". These individuals do not necessarily display behaviour indicative of a highly attached relationship, rather they appear to use one or more persons as a figure of security, the absence of this person triggering a severe behavioural response, often including physiological reactions. In an examination of variables within the subjective assessment of behaviour by APBC members (*Section 3*), attachment, or over-attachment, to the owners was found to have no correlation with the level of fearfulness displayed by the dog. Furthermore, fearfulness was found to be positively correlated with a susceptibility to the level of (emotional) disruption within the human household. This observation tends to support the fearful/attached hypotheses as alternative motivational states for the excessive separation reaction.

The longitudinal study of behavioural development in twelve litters of pedigree puppies (*Chapter 7*) provided further evidence for the existence of at least two behavioural types. Observations of puppies up to 18 months of age indicated that in the presence of an unfamiliar person, a period of brief social separation from the familiar person induced a (usually vocal) response in puppies displaying high levels of behaviour towards the familiar person, and also in those displaying submissive behaviour towards and avoidance of the unfamiliar person. The former were assumed to be attached to the familiar person and the latter not particularly attached, rather they were uncertain or "anxious" in the presence of a strange person. Unfortunately, the experimental method not permit a distinction between those animals displaying high levels of interaction with the familiar person as an indirect avoidance of the unfamiliar person (i.e., by using the familiar person as a secure base) and those exhibiting preferential interaction as a result of a strong attachment (Gubernick, 1981).

Unfortunately the literature regarding the behaviour of the domestic dog is often limited, frequently anecdotal or based on opinion rather than carefully controlled studies. It is therefore necessary to turn to studies of other mammalian species for enlightenment regarding the possible roles of attachment and fearfulness in the behavioural manifestation of the separation reaction.

9.2.1.1 *Function of attachment*

Why do animals develop attachments? The majority of experimental studies and discussions on attachment have focussed on infant-maternal attachment. The major function of filial attachment has in the past been assumed to be that of protection from predation through attachment behaviours which promote and maintain proximity between the parent(s) and its young. This hypothesis is based on three types of observation (Gubernick, 1981 from Bowlby, 1969):

1 Isolated animals are more likely to seized by a predator
2 Attachment behaviour is easily and intensely elicited in those particularly vulnerable to predators
3 Attachment behaviour is elicited at high intensity in situations of alarm such as in the presence of a predator.

Nevertheless, it cannot be assumed that proximity between parents and offspring arose simply as a result of the need for protection from predation. Other factors, including resources obtainable from

caregivers (such as food, warmth, shelter and stimulation), have other important benefits which presumably contributed to the evolution of such behaviour in many mammals.

The dog (*Canis familiaris*) is a highly social animal descended from the wolf (*Canis lupus*). Many canid species have evolved behavioural mechanisms promoting sociality[1], whereby social groups are comprised of related individuals with varying degrees of relatedness. It is therefore likely that various types of social behaviour evolved via kin selection and/or reciprocity. Where there is marked sociality, as in these particular canid species, there exists stability in associations and partners for interaction. In such a system, the phenomenon of attachment (other than parental attachment) is intrinsically involved in the perpetuation of social relationships. Why should animals live in highly developed social systems; what are the benefits (and costs) of group living?

Hypotheses for the evolution of group living, particularly in carnivores include (Gittleman, 1989):

1. Anti-predator defence

   Animals competing with other species for food may benefit from group vigilance whereby encroachers are detected more effectively. Grouping may also minimise a predator's effect on the group: if by clustering together the members of a group cause a predator to catch only one individual while the rest are able to escape, gregariousness may evolve. Group defence is expected to be more common in smaller species that are not able individually to ward off larger species, and in species living in open habitats (*e.g.*, grassland plains).

2. Feeding success

   Group living may also be more advantageous for locating food resources, improving chances of finding and catching prey, and competing successfully for food. Predators hunting in groups may be more successful at taking down prey. Concerted cooperative hunting effort permits a wider selection of prey in terms of amount, diversity, and size (of particular importance in a fluctuating environment). In addition, group living may carry advantages in defending kills or other food resources from neighbouring predators or other groups.

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Sociality:
"*where interactions are differentiated and structured on the basis of the attributes of participants such as sex, age, or power (physical size, strength, skill and motivation) are repeated over time between the same participants, and themselves have some content (are aggressive, affiliative, nurturing, or sexual), then relationships result and sociality is present*" (Lee, 1994).

3. Reproductive access to members of the opposite sex (including synchronisation of reproductive cycles)

4. Facilitation of learning

5. Teaching young to hunt

6. Collective resistance against harsh environments (including thermoregulation)

Inevitably, there are also costs to group living:

1 Increases the chance of being detected by potential predators

2 Decreases the amount of food available to individuals

3 Increases transmission of disease or parasites

4 Increases the possibility of aggression or injury, although in species such as the wolf complex communication systems involving agonistic signalling are used as aggression reducing systems

It is assumed that in the domestic situation, once the puppy is no longer part of its natal group, relationships, including attachment relationships, are transferred to the human family (substitute care-givers). Separation in this situation thereby induces a reaction comparative to one of involuntary absence from individuals to whom the animal is in a stable situation with respect to the stability of associations and interactions.

9.2.1.2 *The implication of fearfulness in the separation reaction*

None of the observational studies described in this thesis implemented an actual test of fearfulness, rather fearful behaviours were recorded as and when they occurred within the assessment of other behavioural measures. One of the most widely adopted tests of fearfulness is the **open-field test** which broadly speaking is the introduction of an animal into a pen whereby it is separated from

conspecifics and familiar sites. This experimental situation provides a number of threatening factors such as novelty, absence of shelter and landmarks, and bright lighting. Traditionally, the open-field test has been adopted for use with rodents and domestic fowl because of its methodological facility, i.e., ease of use, rapidity, automization, standardization and repeatability; however more recently it has been adapted for use with domestic mammals, particularly cattle, pigs and sheep. The environmental situations occurring in companion animal studies, not least those taking place in the home setting, make the use of open-field tests unfeasible and impractical. Nevertheless, since fearfulness or nervousness appears to be intrinsically linked to the separation reaction in domestic dogs, it is suggested that a specific test of such behaviour may elucidate the situation further by providing some scale of the degree of fearfulness present. Unfortunately, behavioural data alone may be insufficient in this aspect and there may be a requirement for complementary physiological measures such as plasma catecholamine levels, HPA axis reactions, and plasma level of corticosteroids, although as Boissy (1995) notes, behavioural reactivity and endocrine characteristics are not always related.

With respect to the inferred multiple motivation for excessive separation, studies of separation in relation to human infants may provide some enlightenment. Bowlby described two types of attachment existing in human infants. One such type, which became known as *anxious attachment*, is described as a syndrome existing whereby an infant has no confidence that his or her attachment figure will remain available and accessible and hence tends to maintain close proximity in order to ensure continued access. The second, known as *secure attachment*, whereby no such constant apprehension about separation exists, appears to be important because securely attached infants have generally spent more time away from their mothers and as a result may have more experience of forming social relationships prior to separation. These attachments may have some relevance regarding the effect of social experience on later separation behaviour in infant canids. Hypothetically, it would be expected that those puppies experiencing higher levels of socialisation and social referencing would display lower levels of distress behaviour during separation. The results of ***Chapter 8***, this thesis, indicate that this is not the case but that high levels of social experience outside of the infant-maternal relationship at a young age (up to seven weeks) appear to increase the likelihood of later separation behaviour. Interestingly, this effect is reversed once the puppies are more than six months old, those experiencing lower extra-household social interaction displaying higher levels of separation behaviour.

9.2.2 *The symptomatology of separation behaviour*

In diagnosed cases of *problem* separation behaviour, vocalisation (including barking and howling) was significantly likely *not* to occur with destructive behaviour (***Chapter 2***). This lack of association was not found in any of the other studies; however this may simply reflect differences in the populations from which the subjects were derived. Furthermore, it is possible that vocal behaviour was under-represented in the dogs referred for behavioural counselling, since this behaviour is not as objectionable from the human perspective as elimination or destruction (in terms of damage and cost), does not leave any visual evidence, and may therefore be under-reported.

Although the symptoms exhibited by puppies throughout the observational and questionnaire components of the longitudinal study were not subject to full statistical analysis, the exhibition of symptoms with respect to the age of the puppies revealed interesting differences. Notably, destructive behaviour was exhibited at low levels in puppies of three months of age but increased up to twelve months. The pattern of vocal behaviour was somewhat more complex; reported vocal behaviour was prevalent amongst three month old puppies (particularly Labradors), although none approaching problematical levels. Very few individuals exhibited both vocal and destructive behaviour.

With reference to the primate literature, the symptoms of separation in monkeys are known to change with age . Separation from or loss of the primary care-giver can have profound effects on the young leading to a debilitation in species-appropriate social, maternal, sexual, aggressive and exploratory behaviour (Harlow & Harlow, 1965; Hinde & Spencer Booth, 1971; Seay *et al.*, 1962). The biphasic response to separation in many (but not all) infant primates (of less than a year old) including humans has been characterised as one of initial high agitation and distress or "protest" (hyperactivity, increased vocalisation) normally lasting a few days, followed by dejection or "despair" (substantial inactivity, reduction in the level of play behaviour, withdrawal from social interactions, increase in self-directed behaviour such as thumb-sucking and self-rocking)[2]. Notably, the despair phase of the separation response does not occur in older (3 year old) individuals (McKinney *et al.*, 1972), moreover protest behaviour may be exhibited cyclically, alternating with

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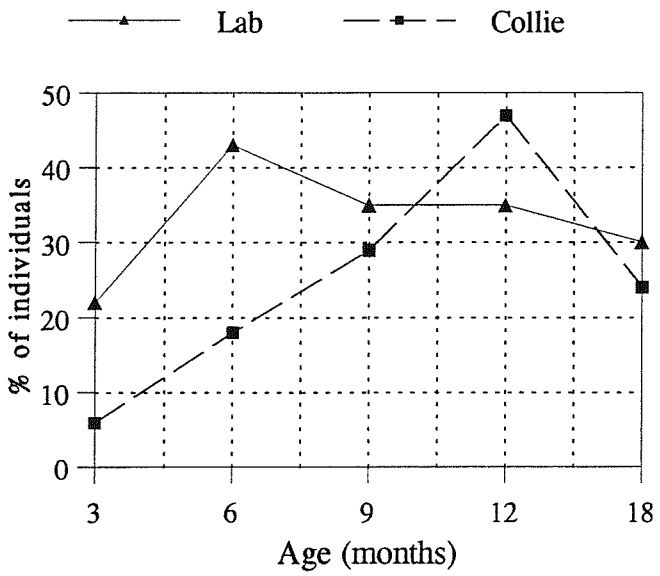
It is also known that separation has an effect on the physiological and hormonal systems, increased levels of plasma cortisol being obtained following separation, even in the absence of any significant correlation with the behavioural reactions of the monkeys (Levine *et al.*, 1977).

periods of despair.

Taken together, the dissociation of vocal and destructive behaviour in problem behaviour cases with the early incidence of vocal behaviour in young (Labrador) puppies, tends to suggest that the motivation for each behaviour is different. It is postulated that vocal behaviour in dogs is infantile, as whining and barking are in wolves (Coppinger & Fernstein, 1991), a possibility supported by the reference Dehasse (1997) makes to "infantile" vocalisations in separation behaviour cases and the retention of other indicators of juvenile dependency. Vocalisation represents the "helpless" infantile response to isolation through attempting to re-establish contact with absent social contacts by the expression of et-epimeletic behaviour. The observation that during testing of puppies aged seven weeks, relatively few individuals made contact with the exit through which the tester most recently departed, but almost all vocalised in response to the departure of the tester, tends to support the "helpless puppy" hypothesis. Accordingly, the *active* response of attempting to escape or the expression of overt destructive behaviour, particularly targeted at entrances and exits, apparently develops somewhat later (*Figure 9.1*).

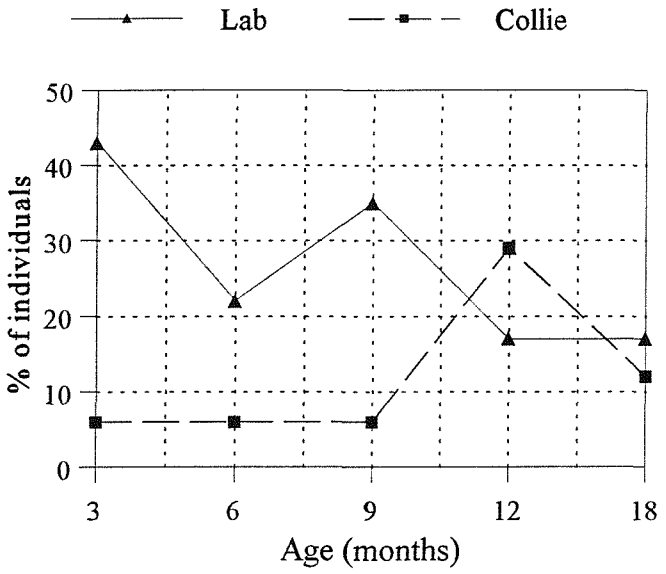
The pattern of destructive behaviour with respect to age revealed interesting differences between the two breeds, Collies showing a higher degree of latency with regard to the onset of destructive symptoms.

Figure 9.1 The distribution of destructive behaviour in Labradors and Border collies



Examination of the incidence of vocal behaviour in puppies older than 3 months of age revealed a complex interaction of age and vocalisation which cannot easily be explained. Considerable differences were apparent between the two breeds. The incidence of vocal separation behaviour in collies reached a maximum at 12 months before declining (as in the exhibition of destructive separation behaviour), but the incidence of vocal behaviour in Labradors declined with age (*Figure 9.2*). The ontogeny of vocal responses to separation therefore appears to be breed specific. The development of vocalisations in general (not necessarily as a response to separation) in puppies aged up to four weeks is known to differ between breeds (Scott & Fuller, 1965). Similarly, minor breed differences, including variation in activity levels and the frequency of vocalisations, have been found to occur in adult dogs during periods of social separation (Pettijohn *et al.*, 1977).

Figure 9.2 The incidence of vocal behaviour in Labradors and Border collies



9.2.3 The effect of age in the manifestation of separation behaviour

Part I indicated a high incidence of separation behaviour in dogs of less than two years of age. Although there are no comparative statistics of the age distribution of dogs throughout the population as a whole (although it is known that the majority of canines admitted to rescue centres are less than two years old), it is likely that this reflects a heightened incidence of this behaviour in

juveniles[3]. In addition, has been estimated that the most age for *destructive* dogs to be given up for adoption is six to nine months (Bailey, 1991).

Investigations into the behaviour of dogs housed in rescue kennels (***Part II***), revealed that young adults (i.e., dogs of up to 25 months) were significantly more likely than adults to react to a five minute period of separation in two separate studies (Factor 4, ***Chapter 3***; measure 9, ***Chapter 4***). In addition, a revised and restructured version of the general temperament assessment test (***Chapter 3***) applied to rescue dogs in Denmark signified an elevated incidence of whining and scratching in young adult dogs during 5 minutes of social isolation (Kristensen, 1997).

In a detailed examination of the onset of separation behaviour in the ontogenic study (***Chapter 8***), it became apparent that up to 55% of subjects displayed some reaction to social isolation between three and eighteen months of age. This reaction reached a maximum (in terms of incidence, not necessarily severity) at twelve months of age and began to decline thereafter. It would have been extremely valuable to have prolonged this study in order to obtain information regarding the dogs' behaviour after 18 months of age; unfortunately this was not possible due to the time constraints imposed. Similarly, in a study of guide dogs by Scott and Beilfelt (1976), an "exaggerated" separation response was manifested by 20% of home-reared puppies in their first year; it was estimated that 20% exhibited vocal behaviour during separation and that 22 % were destructive. Given that so many individuals overtly responded to the departure of one or more familiar persons throughout the juvenile period, it seams feasible to suggest that this is not an "abnormal" reaction, more that it is part of a developmental process. In my sample only one individual exhibited symptoms indicative of a severe separation reaction, a response which could have been viewed as "problematical" and as such psychologically and physically maladaptive; this behaviour was not treated and had not alleviated by the time the individual concerned was 18 months old.

The reduction in separation behaviour of any severity by 18 months of age (***Chapter 8***) tends to suggest that the increased incidence of behaviour during the juvenile period of development may in fact display a natural decline in most instances (possibly on attainment of "social" maturity). Indeed, in the diagnosed cases described in ***Chapter 2***, a drastic reduction in the number of individuals displaying separation behaviour beyond 25 months of age was found to occur. Nevertheless, anecdotal reports from several workers suggest that separation behaviour once again

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[3] Dehasse (1997) remarks that many dogs displaying symptoms of separation behaviour are less than one year old

becomes prevalent amongst elderly individuals. In a paper by Chapman and Voith (1990), separation related behaviour was found to be the most common source of behavioural problems in dogs of more than 10 years of age. Indeed the data obtained in this study (***Chapter 2***) revealed that 12% of cases referred to behaviour counsellors were more than eight years old. The exhibition of such behaviour in previously "normal" dogs has been attributed to the onset of cognitive dysfunction (Ruehl *et al.*, 1994), although it is also likely that older dogs exhibit increasing dependency on their human-caregivers. If one considers the age distribution and relative dependency of individuals within a related social group, it seems appropriate that the young and old gain most benefit from (and are therefore most dependent on) the maintenance of sociality. The advantages of elderly individuals remaining in the social group may be summarised are as low-risk, low energy expenditure associated with familiar surroundings. This includes:

1. Familiarity with the local physical and social setting
2. Reduced levels of aggression through familiarity with relatives and neighbours
3. Increased access to food resources through co-operative hunting

In summary, it appears that there is a period between the ages of 6 months and (up to) 18 months, variable depending on breed, when behavioural changes occur in response to social separation in the companion domestic dog. The reason for these changes requires further investigation although this may reflect, as hypothesized by Scott and Marston (1950), the third sensitive period attained around the time of sexual maturity. Given that there is a considerable temporal discrepancy between the onset of sexual maturity and the attainment of social maturity in the domestic dog, unlike related wild canid species (Fox, 1978; Bradshaw & Brown, 1990; Overall, 1997), this apparently juvenile response may reflect a behavioural paedomorphosis[4]. It appears that the excessive response to social separation frequently subsides after approximately two years, suggesting a distinct behavioural phase. In individuals where this response does not subside but persists over a considerable time, there may be compounding factors such as a pathological over-attachment to one or more persons or a persistent anxiety-like state, which prevent the normal decline in behaviour. It is suggested that those dogs displaying symptoms for the first time after 25 months of age represent a different category of separation behaviour case, e.g., those which have experienced an environmental "trigger" such as a traumatic rehoming. So far, little evidence exists

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[4] The tendency for some dogs to react strongly to separation from the primary human care-giver has been interpreted by some as a side-effect of unconscious (or conscious) selection for increasingly affectionate, socially dependent, and infantalised pets (Fox, 1978; Serpell, 1983; Mugford, 1985) or those exhibiting *behavioural paedomorphosis.*

to substantiate these postulations, although it is anticipated that a large scale ontogenic study might perhaps provide enlightenment.

9.2.4 Common features of dogs exhibiting separation behaviour

In line with numerous other studies of inappropriate separation behaviour in the domestic dog, those experiencing a process of "rescuing" appear to be over-represented; up to a third of those dogs referred to in the APBC survey (***Chapter 2***) had been through at least one cycle of rehoming by a rescue centre.

Although cross-breed animals were highly represented in the survey of diagnosed cases (48.7%, ***Chapter 2***) and in the assessment of rescue dogs (***Chapter 5***), it is not clear whether this in fact signifies an over-representation with respect to the canine population as a whole. Gundogs and working dogs appear to be particularly prevalent in the sample examined in ***Chapter 2***, the shepherd/collie breeds and retriever/spaniel breeds both presenting frequently, a finding which is in agreement of that of Mugford (1983) and Landsberg (1991). With respect to the two breeds investigated in the longitudinal study, Labrador retrievers were found to display incipient separation behaviour more often and with greater intensity than Border collies, although some litter effects were apparent. Furthermore, the onset of the separation behaviour appeared to differ between the two breeds, occurring earlier in the Labradors (***Chapter 8***).

As discussed in ***Chapter 1***, several studies have highlighted the importance of experiences aquired during the socialisation period. Although there were no controlled studies of the socialisation period in this thesis, the results obtained in ***Chapter 8*** suggest that early exposure to multiple social contacts may predispose young canines to exhibiting separation behaviour later in life. Very little is known about the effects of experience prior to the socialisation period in dogs, although studies of other mammalian species have shown that neonatal and even prenatal experience may influence later behaviour. It is well established that short periods of daily handling, as well as a variety of other strong or noxious stimuli, can have marked long-term effects on the behavioural and physical development of neonates including puppies. These effects include accelerated maturation of the nervous system, more rapid hair growth and weight gain, enhanced development of motor and problem solving skills, and earlier opening of the eyes. Canine neonates exposed to varied stimulation from birth to five weeks of age were found to be more confident, exploratory and

socially dominant when tested later in strange situations than unstimulated controls (Fox, 1978). Levine (1967) suggests that early handling and stress produce an adaptive change in the animal's pituitary-adrenocortical system that enables it to cope more effectively with stressful situations later in life. Anecdotally, the adoption of early handling programmes by breeders including the US Army Veterinary Corps achieved improvements in stress-resistance, emotional stability and learning capacity (Fox, 1978). In addition, Fox (1971) and Zimen (1987) report that wolves hand-reared from birth or soon after are more reliable and friendlier towards humans than those hand-reared from 15 days.

Regarding pre-natal experience, studies of rodents indicate that transplacental maternal influences may affect the subsequent behaviour of the offspring. Females subjected to stressful experiences during pregnancy tend to produce offspring more emotional or reactive in test situations and more emotional females apparently give birth to more emotional offspring independent of genetic influences (Denenberg and Morton, 1962). The immature state of the foetal nervous system in altricial species makes it unlikely that significant prenatal effects are due to learning but that changes in emotionality are probably caused by direct effects of maternal corticosteroid hormones on the development of the foetus's subsequent physiological responsiveness to stress (Hinde, 1970).

With respect to the environment of the dogs, several relationships were found with regard to the exhibition or otherwise of separation behaviour. The amount of social referencing the dog receives was found to influence whether or not it overtly reacted to separation (***Chapter 8***), lower levels of social referencing after the age of six months apparently encouraging the separation response. It is postulated that the restriction in the number of social contacts encountered provides the potential for the development of strong attachments to a few people. Interestingly, high levels of social referencing at a very young age seem to produce puppies that display an elevated separation response, although it is difficult to distinguish the influence the behaviour of the breeder has on subsequent behaviour from the inherent tendencies of the litter (i.e., possible genetic effects), or indeed the influence of the post-parturition maternal environment. This effect is evident up to nine months of age in some dogs, although the effect is most pronounced at six months. It is not clear why *high* levels of social referencing in puppies up to seven weeks old should apparently predispose these puppies to separation behaviour later in life, although it is possible that the early experience of multiple social contacts may prime the puppy to form strong human attachments.

The assumption that traumatic experiences in infancy must have deleterious effects in later life is

not clearly consonant with many laboratory studies of rodents. Indeed several experiments apparently contradict this classical assumption and suggest that stimulation administered between birth and weaning[5] brings about a reduction in emotional reactivity. Furthermore, the greater the stimulation in infancy, the less emotional the subject will be in adulthood. For example, Denenberg and Morton (1962) found that rats handled daily between birth and weaning were significantly more active and had a significantly smaller defecation rate than non-handled controls in an open-field test; similar results were also obtained for rats handled for the first 10 or 20 days of life (Denenberg *et al.*, 1962). In open-field tests of consummatory behaviour, (Levine, 1957; 1958) rats were either handled, shocked, or left as controls between birth and weaning before being deprived of water for 18 hours. When given the opportunity to drink, both the rats which had been handled and those which had been shocked consumed significantly more water than nondisturbed controls. Stimulus input in infancy has been varied by number of days of handling (0, 10, 20) (Denenberg *et al.*, 1962), number of days of shock (0, 10, 20) (Lindholm, 1962), and form of stimulation (nondisturbed controls, handled, shocked) (Denenberg & Smith, 1963; Levine, 1957). In each instance the greater amount of stimulus input in infancy, the less was the level of the subject's emotional reactivity (as measured in open-field tests, or consummatory behaviour) in adulthood. In each instance, the greatest change in behaviour occurred between the control group and the group receiving the intermediate amount of stimulation[6].

The behaviour of animals can therefore be said to arise as a result of various inter-related factors (both genetic and experiential), which have variable effect depending on the intensity of the stimulus (or experience) provided, the species to which the individual belongs, and the social organisation of the species. These influences on behaviour include: genetics, pre-natal, neonatal and subsequent socialisation, juvenile and adult experience, the post-parturition maternal environment.

The early social environment of young mammals includes their mother, and in many species other classes of close kin: namely, littermates, older siblings, and possibly their father. Indeed some species, including *Canis lupus*, the social environment consists of a varying number of related

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used as a criterion point because senses are functional by this time and because it is only after weaning that there is any evidence of long term retention of a learned fear response

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Most of the stimuli administered in experiments of infantile stimulation contain a noxious element (e.g., avoidance, under-water swimming, thirst, starvation). It would therefore be expected that the subject's level of emotionality will have a significant effect on performance in tasks and that there will be an optimal level of emotionality for efficient performance, also dependent on the level of task difficulty.

individuals. Animal behaviourists and psychologists have traditionally focussed on the maternal-infant relationship and, to a lesser extent, the parental investment provided by the father. The contribution of siblings to the behavioural development of mammalian young has, in contrast, received relatively little attention.

The number of social contacts the dog has within the household does not seem to affect the expression or otherwise of excessive separation behaviour. Of the dogs presented to behaviour counsellors, 23% resided in homes with one or more child and 31% lived with a conspecific; of those exhibiting symptoms in the Blue Cross study (***Chapter 5***), 40% lived in homes with children and 18 % in homes with another dog - this compares with those *not* exhibiting symptoms (in the same study) of 45 % with children and 15% with another dog; in the longitudinal study (in which notable separation behaviour was uncommon), 43% of households had one or more child and 63% of households had another dog. Interestingly, in an ethological study of interactions between people and their pets (Smith, 1981), it was found that childless households interacted more frequently and with more complexity than households with children; in return, the dogs in childless households spent relatively more time within three feet of a person. It may therefore have been expected that dogs in childless households would have expressed higher levels of separation behaviour than households with children. Indeed in clinically diagnosed cases of problematical separation behaviour (***Chapter 2***) there were fewer children than in any of the other studies, although it is not clear whether this reflects a true causal relationship, or is simply a reflection of behaviour counsellor clientele. Notably, differences in the symptomatology of the behaviour exhibited by these dogs were found to exist in houses with one or more children.

No sex predilection towards separation behaviour was found in any of the studies, although males were slightly more common than females in cases presented to counsellors (***Chapter 2***). Interestingly, it has been suggested that in studies of social separation in primates under one year of age, minor sex differences in behaviour were found although males seem to be slightly more adversely affected than females (Hinde and Spencer-Booth, 1971). Similarly, sex differences in response to separation in humans reveal greater effects on male subjects (Bowlby, 1973).

9.2.5 The predictability of behaviour

Separation behaviour up to 18 months of age was not found to be predictable from tests of temperament performed at 7 weeks of age (***Part III***). Behavioural similarities were found to exist between the ages of 7 weeks and 3 months but did not perpetuate thereafter. Correlations of behaviour after 6 months of age were found to be greater than those before 6 months. Measures of nervousness in particular were found to correlate well between ages (including 3 months) although the number of individuals displaying this behaviour was very small. These findings are in agreement with those of Goddard & Beilharz (1986) who found that fearfulness was the only predictable measure from puppy tests and that this became more reliable with age. Although Beaudet *et al.* (1994) found limited association between the behaviour of puppies at seven weeks with that at sixteen weeks, it is anticipated that this would become negligible if repeated at a more advanced age. It therefore appears that considerable changes take place in the behaviour of puppies after the age of approximately 3 months, not least as result of the vast variation in environmental stimuli presented throughout the socialisation and social referencing processes.

That nervousness exhibits some level of stability implies that it has some aspect of heritability, and indeed this has been demonstrated experimentally in several studies (e.g., Murphree, 1973). That nervousness or fearfulness is an easily selectable trait, suggests that it has an important biological function. In the natural (wild) environment, a level of inherent nervousness would necessarily confer a survival advantage on those possessing such a trait, particularly in a changing environment, where strong selection pressures may apply. Boissy (1995), in a review of fear and fearfulness in animals states that

" *Fearfulness*[7] *could be considered a basic feature of the temperament of each individual, one that predisposes it to respond similarly to a variety of potentially alarming challenges, but is nevertheless continually modulated during development by the interaction of genetic traits of reactivity with environmental factors, particularly in the juvenile period*"

Several other studies of domestic animals whereby the same individuals were examined over a long period of time have revealed a consistency of the fear reaction. Goats (Lyons *et al.*, 1988) show a

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where "*fearfulness is considered as a personality or temperament trait defining the general susceptibility of an individual to react to a variety of potentially threatening situations*"

high stability in their reactivity towards humans when tested at several ages, in heifers the flight response to a standardised approach of a human remained relatively constant up to seven months of age (Kerr and Wood-Gush, 1987), and in poultry individuals are consistent in their tonic immobility response over time (Jones, 1988).

In addition to the known genetic aspects of fearfulness, it appears that neonatal (and possibly prenatal) environment and experience may influence puppies' subsequent reactions to stressful or frightening situations through their direct effects on the development of the pituitary-adrenocortical responsiveness (Levine, 1962; Denenberg, 1968; Fox, 1978). It is known that in rodents, females stressed during pregnancy produce offspring that are more emotionally reactive. Although no experimental evidence exists for a similar scenario in canids, these results suggest that the puppies of bitches stressed during pregnancy may be more susceptible to nervousness. In contrast, exposing puppies to handling or other mild stressors during the neonatal period tends to produce more phlegmatic and less easily stressed or frightened individuals (Fox and Stelzner, 1966; Fox, 1978). However, other such effects usually have multiple causes; Boissy (1995) comments that the psychobiological responses to environmental challenges depend on the genetic background and early or previous experiences of the individual and that a complex interaction of these factors is responsible for the large range of variation in fear-related or anxiety related responses.

In terms of specifically predicting separation behaviour in juveniles and adults, the test of potential separation behaviour in kennelled rescue dogs revealed correlations of vocal and destructive behaviour whilst in the shelter (measure 9, ***Chapter 4***) with similar behaviour in the new home. Dogs scoring highly on a composite measure of vocal separation behaviour in the shelter (measure 10, ***Chapter 4***) were likely to display vocal behaviour in the new home or, slightly less likely, to be destructive in the home (***Chapter 5***). Dogs scoring highly on the composite measure of destructive during separation (whilst in the shelter) were likely to display either destructive or vocal behaviour in the new home. In either instance, the severity of the separation behaviour could not be predicted, merely the presence or absence of a separation reaction (with 60% accuracy).

9.3 Further work

The results of these studies have provided some insight into the development and symptomatology of the separation reaction in the domestic dog; however if anything, they have illustrated that the situation is extremely complex. It appears that the juvenile period of development is, as has previously been suggested, of great importance in the process and requires considerable further investigation. In addition, the symptoms elicited by the separation response are not random and appear to be subject to developmental changes. Furthermore, although the attachment process seems to have an intrinsic involvement in the separation reaction, not all individuals displaying excessive responses to social isolation are necessarily over-attached. There appears to be a distinct category of animals exhibiting similar separation reactions which, according to the application of basic attachment criteria, are not over-attached but apparently in a state of generalised "anxiety"[8], the full manifestation of symptoms becoming apparent in the absence of social contact.

The question therefore arises as to whether a specific attachment relationship is actually a causative factor in the exhibition of separation behaviour, or whether the apparent association between highly attached animals and excessive separation behaviour is merely coincidental. In the assessment of potential separation behaviour in kennelled dogs (***Chapter 4***), a reaction to a brief period of social isolation was induced in the majority of subjects after only a limited duration of interaction with a previously unfamiliar handler. It would seem inappropriate to call the relationship developing as a result of this interaction "attachment" since it arose over such a restricted time period, nevertheless, the reaction of some dogs to the departure of this figure was in some instances extreme. It is therefore hypothesised that the dogs were reacting to an absence of social contact rather than the denial of access to a specific person, i.e., the separation reaction does not require a specific attachment relationship. In cases of clinical separation behaviour whereby the dog is apparently hyper-attached, it is postulated that this may simply be an additive factor to an alternative motivational state.

In line with the hypothesis for ***Part III*** that differences in social experience during the socialisation and juvenile periods predispose some dogs more than others to exhibit separation behaviour, one of the most interesting findings of this study was the apparent influence that high levels of socialisation have on the subsequent development of this behaviour. It is suggested that introducing

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[8] The use of the word anxiety has been discussed in ***Chapter 1***, and despite the conclusion that it is inappropriate terminology, the behavioural state is most aptly described as anxiety-like.

puppies to considerable amounts of (multiple) human interaction may condition them to human social contact and to subsequently form particularly strong attachments with the adoptive family, although further investigation is required to validate this hypothesis.

The longitudinal study of behavioural development indicates that although the separation reaction reaches a maximum at 12 months, this response declines by 18 months. It would be interesting to see whether this decline persists with time by extending the collection of information over a longer period, perhaps up to 36 months.

In order to examine the response to social separation fully, information other than behavioural observations is required. It would be extremely useful to obtain physiological information regarding the separation response, not least because those individuals displaying an absence of response are assumed to be non-reactive. Given that up to 55% of individuals in a control study reportedly display overt vocalisation or destruction during separation (***Chapter 8***), it is anticipated that many others do respond, although not in such an obtrusive manner. The use of hormonal measures may elucidate the situation further and confirm that, as anticipated, most individuals react in some way to the departure of a familiar person(s). Physiological measures would also provide confirmation or otherwise of the relative severity of the reaction and assist with the motivational diagnosis.

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Appendices

Appendix A

APBC Questionnaire

Justine McPherson
Anthrozoology Institute
Biodiversity and Ecology Division
University of Southampton
Bassett Crescent East
Southampton
SO16 7PX

Tel: (01703) 594254

SEPARATION RELATED PROBLEMS

Instructions

For sections 1 and 2, please tick whichever response you feel is most appropriate. For some questions you may need to tick more than one response.

The final section, which is for your personal assessment of the dog, consists of a number of scaled responses. Please circle the category which is most applicable to the dog concerned.

If you feel there are any other factors contributing to the dog's behaviour I would be grateful if you could provide this information at the end of the questionnaire.

Once you are nearing the end of your supply of questionnaires, please mark the circle at the back of the booklet and I shall be glad to issue you with some more.

SEPARATION PROBLEMS QUESTIONNAIRE

The full scoring system is indicated in red text

SECTION 1

Counsellor name: .....

Family Information

Owner name:

Number of adults in household:

1	◯ one
2	◯ two
3	◯ three
n	◯ more than three

Number of children:

0	◯ none
1	◯ one
2	◯ two
3	◯ three
n	◯ more than three

Ages of children:

Any other pets:
(please only include animals which the dog is in direct contact with)

0	◯ none
n	◯ dog(s)
0 / 1	◯ cat(s)
0 / 1	◯ other

If there are other dogs in the household, please give further details:

Age	Sex	Breed
1. older 1 / 0	same sex 1 / 0	
2. younger 1 / 0	different sex 1 / 0	
3. same age 1 / 0		
4.		

Has the dog with the separation problems always had a canine companion?
(Please state which of the above)

10 ◯ yes, the dogs were acquired at the same time
11 ◯ no, the S.P. dog was acquired first
12 ◯ no, we had the other dog(s) first
13 ◯ the dog used to have a different companion

SECTION 2

Dog's Information

1. Name:

2. Age: (months)

3. Breed:

4. Sex:

10 ◯ entire male
11 ◯ neutered male
12 ◯ entire female
13 ◯ neutered female

5. Age when obtained:

1 ◯ 2 months or younger
2 ◯ 2-3 months
3 ◯ 3-6 months
4 ◯ 6-12 months
5 ◯ 1-2 years
6 ◯ more than 2 years

6. Where was the dog obtained from?

◯ bred by current owner
10 ◯ direct from breeder
11 ◯ rescue centre
◯ pet shop
12 ◯ other (please state)

7. Age when neutered:

1 ◯ 6 months or younger
2 ◯ 6-12 months
3 ◯ 1-2 years
4 ◯ more than 2 years

8. Number of previous homes (not including the initial few weeks when the pup was with it's mother)

0	◯ none (go to question 10)
1	◯ one
2	◯ two
3	◯ three
4	◯ four
n	◯ more than four
	◯ not known

9. At what age(s) was the dog rehomed (after original homing by breeder)?

◯ 2-4 months
◯ 4-6 months
◯ 6-8 months
◯ 8-10 months
◯ 10-12 months
◯ 1-2 years
◯ older (please state)

10. Did the dog have a canine companion in the first year of its life (apart from its littermates prior to initial homing by breeder)?

1	◯ yes
0	◯ no

11. Has the dog ever been in rescue kennels?

1	◯ yes, once
3	◯ yes, more than once
0	◯ no
	◯ not known
2	◯ at least once

12. Has the dog ever been in boarding kennels?

3	◯ frequently
2	◯ occasionally (1-2 times per year)
1	◯ rarely (once or twice)
0	◯ never
	◯ not known

13. What was the dog's reaction to being kennelled?

2	◯ very distressed
1	◯ mildly distressed
0	◯ did not mind
	◯ not known

14. What are the symptoms the dog is showing when it is left alone?
(Tick as many responses as may apply)

1 / 0	◯ barking
1 / 0	◯ howling
1 / 0	◯ destruction
1 / 0	◯ eliminating
	◯ self-mutilating
1 / 0	◯ other (please state)

15. How long after the dog was obtained did symptoms begin?

1	◯ immediately
2	◯ within days
3	◯ within weeks
4	◯ after a few months
5	◯ after a considerable time (more than 6 months)

16. Do you believe that a particular event triggered the onset of the behaviour?

◯ yes (please describe)

.....
.....
.....
.....

◯ no

17. How soon after the dog is left do symptoms begin?

1	◯ start before it is left
2	◯ immediately
3	◯ after a few minutes
4	◯ up to half an hour
5	◯ more than half an hour

18. How long is the dog **routinely** left alone during the day?

0	◯ not at all
1	◯ less than an hour
2	◯ 1-2 hours
3	◯ 2-4 hours
4	◯ 4-6 hours
5	◯ 6-8 hours
6	◯ more than 8 hours

19. How long is the dog **routinely** left in the evening?

0	◯ not at all
1	◯ less than 1 hour
2	◯ 1-2 hours
3	◯ 2-4 hours
4	◯ more than 4 hours

20. Does the behaviour occur if the dog is left unexpectedly, e.g. during an occasional night out?

2	◯ yes, always
1	◯ sometimes
0	◯ no

21. Where is the dog left?

12	◯ it has the run of the house
11	◯ downstairs only
	◯ hall and stairs
	◯ kitchen
13	◯ bedroom
14	◯ outside
	◯ indoor kennel
	◯ other (please specify)
15	◯ indoors & outdoors
10	◯ restricted

22. If the dog is destructive, what items are targeted?

1 / 0	◯ exit/entry points
	◯ owner's belongings
	◯ random objects
1 / 0	◯ other (please state)

23. Does the separation behaviour occur when people are present?

10	◯ never
11	◯ yes, but to a lesser extent
12	◯ yes, but only when a particular person leaves
13	◯ only when left with unfamiliar people

24. How does the dog behave when left alone in a car?

2	◯ shows the same separation symptoms
3	◯ separation behaviour is worse
1	◯ slightly less distressed
0	◯ reacts well
	◯ other

25. What is the owner's behaviour towards the dog on leaving?

12	◯ intense goodbye
11	◯ brief interaction
10	◯ completely ignore the dog
13	◯ inconsistent
13	◯ tried several of the above

26. How is the dog greeted on the owner's return?

12	◯ exaggerated greeting
11	◯ brief 'hello'
10	◯ ignore the dog
13	◯ inconsistent
13	◯ tried several of the above

27. If the dog has soiled or destroyed something, what is the owner's reaction?

1 / 0	◯ physical punishment
1 / 0	◯ verbal scolding
1 / 0	◯ behave in an annoyed manner
1 / 0	◯ ignore the dog
1 / 0	◯ greet as normal
1 / 0	◯ inconsistent
1 / 0	◯ tried several of the above

28. Does the dog have any other fears and if so to what?

◯ none
◯ other dogs
◯ strange people
◯ loud noises
◯ other (please specify)

Does the dog have any fears? 1 / 0

29. How long was the dog left alone when first obtained?

0	◯ never
	◯ only during the night
1	◯ as it is now
-1	◯ less than now
2	◯ more than now

30. How was the dog trained to be left alone when a puppy?

0	◯ no special training
1	◯ using an indoor kennel
2	◯ gradually leaving for longer periods
	◯ not known
3 (1 + 2)	

31. Where does the dog sleep?

13	◯ bedroom
	◯ kitchen
	◯ hallway
12	◯ where it chooses
10	◯ restricted
11	◯ downstairs
14	◯ outside

32. Where did the dog sleep when first obtained?

1	◯ as now
	◯ bedroom
	◯ kitchen
	◯ hallway
2	◯ other

33. Does the dog stay in a room alone voluntarily during the day?

1	◯ yes
0	◯ no
and at night?	◯ yes
	◯ no

34. Does the dog follow the owners from room to room?

2	◯ yes, always
1	◯ sometimes
0	◯ no, never

35. If the dog follows, who is it that the behaviour is directed at?

2	◯ one particular person
1	◯ anyone

36. How does the dog react to a door being shut between it and people?

1 / 0	◯ vocalises
1 / 0	◯ scratches at the door
1 / 0	◯ digs at the floor
1 / 0	◯ sits and waits at the door
	◯ doesn't mind

37. Is the dog affectionate?

4	◯ extremely
3	◯ yes, in general
2	◯ only with specific people
1	◯ not particularly
0	◯ not at all

38. Does the dog get affection freely?

1	◯ yes
0	◯ no

39. Does the dog demand affection?

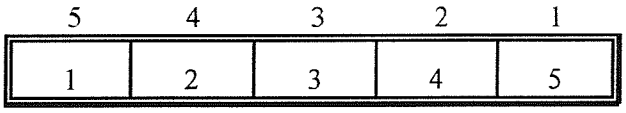
2	◯ yes, frequently
1	◯ sometimes
0	◯ no

SECTION 3

Counsellor's Own Assessment

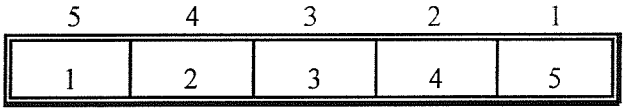
Please circle whichever number you feel is most appropriate.

40. Is the dog submissive or dominant in character?



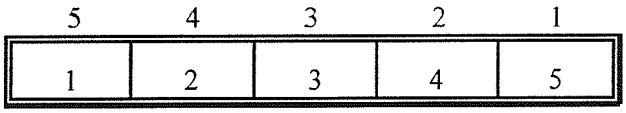
Extremely Submissive — Extremely Dominant

41. Is the dog basically fearful or confident?



Extremely Fearful — Extremely Confident

42. Is the dog likely to react to stressful family circumstances?

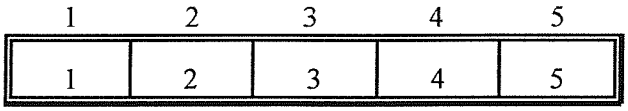


Highly Likely — Very Unlikely

43. Is the dog over-attached to anyone in particular? 1 / 0

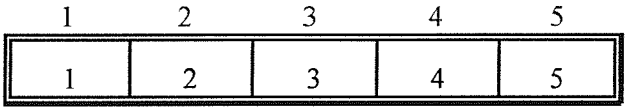
- ◯ no-one
- ◯ female owner
- ◯ male owner
- ◯ child(ren)
- 1 / 0 ◯ more than one person

44. How attached would you say the dog is to its owner(s)?



Not Attached — Extremely Attached

45. In your opinion, how serious is this case?



Mild — Severe

46. Do you feel that the dog is a straightforward separation related problem case or are there other contributing factors?

0 ◯ pure S.P.
1 ◯ more complex (please describe)

Please feel free to add any other comments which you think may be of importance.

Please issue me with a further supply of questionnaires ◯

Counsellor name: .....

Appendix B

Temperament assessment test (I)

1: Testing the temperament of dogs arriving at rescue shelters

Dogs must be kennelled separately and have arrived at the shelter more than 48 hours previously. The dogs must also be older than six moths.

Identification:

Tester: i / s

Reference no: Kennel block and no: Name:
Breed: Age: ya / a Sex: m / f

Test one: kennel test

To be conducted within the kennel in which the dog is normally housed.

1	2	3
Approach	Unreactive	Retreat

a) How does the dog respond when its kennel is approached:

a) Squat down by kennel. Do not make eye contact with the dog (30 seconds)
b) Make casual eye contact with the dog whilst squatting (30 seconds)
c) Put tips of fingers through cage. Move fingers (30 seconds). Then move fingers along cage and away from dog.

Behaviour:	1. Squat	2. Eye contact	3. Fingers
Approach	1 / 0	1 / 0	1 / 0
Barking	1 / 0	1 / 0	1 / 0
Whine	1 / 0	1 / 0	1 / 0
Growl	1 / 0	1 / 0	1 / 0
Retreat	1 / 0	1 / 0	1 / 0
Pawing	1 / 0	1 / 0	1 / 0
Jumping	1 / 0	1 / 0	1 / 0
Stand over (on hind legs)	1 / 0	1 / 0	1 / 0
Cringe	1 / 0	1 / 0	1 / 0
Shivering	1 / 0	1 / 0	1 / 0
Raise hackles	1 / 0	1 / 0	1 / 0
Unreactive	1 / 0	1 / 0	1 / 0
Lick lips	1 / 0	1 / 0	1 / 0
Yawn	1 / 0	1 / 0	1 / 0

Behaviour:	1. Squat	2. Eye contact	3. Fingers
Most frequent ear position - Forward / back	1 / 0	1 / 0	1 / 0
Position of tail - Up/ Tucked /relaxed	1 / 3 / 2	1 / 3 / 2	1 / 3 / 2
Movement of tail - Wagging / Still	1 / 0	1 / 0	1 / 0

Avoids eye contact (2 only)	**1 / 0**		
Allows touch (3 only)	1 / 0		
Bite / sniff / lick / fingers (3)	1 / 0	1 / 0	1 / 0
Leans into hands (3)	1 / 0		
Presents rear end (3)	1 / 0		
Follows and maintains interest in fingers when moved (3)			1 / 0

Test two: Walk test

Conducted whilst taking the dog from kennel to room (dog must go outside)

	1 / 0	1 / 0	1 / 0	no.
Marking / Elimination:	Urination	Defecation	Scent-mark (freq)	

	1 / 0	1 / 0
When leaving kennel does the dog	push past / lag behind	

When being walked on lead does it mainly:

pull at lead	1 / 0
lag behind	1 / 0
bite the lead	1 / 0
bark excitedly	1 / 0
jump at the handler	1 / 0

Test three: Room test

Room should contain a chair, table, a blanket and a toy.

Enter room with dog on lead. Sit quietly on chair in middle of the room. Take the dog off the lead.

Allow the dog to investigate the room for five minutes.

a) Marking / Elimination:

1 / 0	1 / 0	1 / 0	no.
Urination	Defecation	Scent-mark (freq)	

b) Is the dog settled?:

1 / 0				Total mins
1st min	2nd min	3rd min	4th min	5th min

c) Where does it settle?:

1	2	3	4	5
Door	Person	Table	Corner	Blanket

After five minutes, the handler moves on to the second part of the test.

d) Handler calls the dog: "name, come here" (max 3 times). Does the dog respond?

On command number 3 / 2 / 1 1 / 2 / 3 not at all 0

e) Handler gives the command "sit" (2 times max), whilst making upward movement with the hand. Does the dog sit?

no 0 1st command 2 2nd command 1

f) Handler gives the dog a food treat. How does the dog take the treat?

not at all 0 carefully 1 snatch 2

Handler now pets head and neck for 10 seconds.
Handler talks to the dog quietly for the remainder of the test.

g) Try to groom dog with soft brush, starting at head. Does the dog object?

1 / 0
yes / no

If the dog objects, return to petting for 30 seconds. Otherwise continue to groom dog. Groom from head to tail, and then chest (30 seconds).

h) How does the dog respond to grooming?:

Shake	Growl	Mouth brush	Mouth person	Wag tail	Paw handler	Walks away	Unreactive
1 / 0	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0

Feed dog titbit. Get up and switch on camcorder before leaving room. Pat dog on head as leaving room. Pretend to leave area by opening and closing another door. Stand quietly far away from room. Dog will now be left alone for 5 minutes. Record all auditory cues.

i) Do noises occur 1 / 0

j) For how many of the 5 minutes? (no. 0-5)

k) Is the dog vocalising? 1 / 0

l) Is the dog:

1 / 0	1 / 0	1 / 0	1 / 0
Barking	Growling	Howling	Whining

Jumping at the door 1 / 0
Scratching / scrabbling 1 / 0

m) Does the dog greet you on your return? 1 / 0

n) When you re-enter, are there any signs of disturbance?

Have objects been moved? 1 / 0

	1 / 0	1 / 0	1 / 0
Which ones?:	Blanket	Chair	Toy

	1	1	1	0
Signs of elimination:	Urination	Defecation	Vomit	None

Test four: Reaction to conspecifics

When returning the dog to its kennel, assess the reaction of the dog to unfamiliar dogs (in another part of the run).
Stand for 15 seconds with the dog on the lead. Ensure that dog is surrounded by occupied kennels.

a) What behaviours does the dog display in reponse to other dogs?

- Bark	1 / 0
- Whine	1 / 0
- Growl	1 / 0
- Lunge	1 / 0
- Approach	1 / 0
- Cringe	1 / 0
- Retreat / move away	1 / 0
- Stand alert	1 / 0
- Unreactive	1 / 0

Position of tail - Up/ Tucked /relaxed	1 / 3 / 2	1 / 3 / 2	1 / 3 / 2
Movement of tail - Wagging / Still	1 / 0	1 / 0	1 / 0

Test five: Reaction to now familiar hndler when threatened

Return dog to kennel, removing lead. Squat down outside kennel. Stick fingers through kennel. Talk to dog. Remove fingers after 10 seconds. Make and hold direct eye contact (10 seconds). Stand up abruptly and shout at dog.

b) After initial startle respons, how does the dog react?

	1	2	3
Movement	Approach	Unreactive	Retreat
	1 / 0	1 / 0	1 / 0
Vocalisation	Bark	Growl	Whine
Position of tail - Up/ Tucked /relaxed	1 / 3 / 2	1 / 3 / 2	1 / 3 / 2
Movement of tail - Wagging / Still	1 / 0	1 / 0	1 / 0

Appendix C

Temperament assessment test (II)

Temperament Assessment Test

Dogs must be kennelled separately and have arrived at the shelter more than 48 hours previously.

Date: Day: 1 / 2

Dog's identification:

Reference no: Kennel block and no: Name:

Breed: Age: Sex:

Part one: kennel test

To be conducted within the kennel in which the dog is normally housed.

1. The tester approaches the kennel sideways on, squats alongside the kennel and avoids making eye contact with the dog for 30 seconds

2. Casual eye contact is made with the dog for a period of 30 seconds

Test part:	1. Squat	2. Eye contact
Approach	1 / 0	1 / 0
Barking	Freq.	Freq.
Whining	Freq.	Freq.
Pawing	Freq.	Freq.
Tail position (up/relax/tuck)	1 / 2 / 3 u / r / t	1 / 2 / 3 u / r / t
Time interacting with tester	Time (s)	Time (s)

Time taken for initial approach: Time (s)

Part two: removal from the kennel to an unfamiliar area

The tester enters the kennel and quietly leashes the dog.
The dog is then taken on a standardised route to an unfamiliar room.
On entering the kennel:

Tail position (up/relax/tuck) 1 / 2 / 3
u / r / t

Frequency of scent marking between kennel and room: Freq.

Room test

1. The dog is unleashed and allowed to explore the room for five minutes.

2. The tester introduces the dog to a ragger and encourages play interaction for a three minute period.

Time spent in active play: Time (s)

Time spent interacting with the tester: Time (s)

Time spent behaving independently: Time (s)

3. A further five minutes is spent in friendly interaction with the dog.

Time spent interacting with the tester: Time (s)

Time spent behaving independently: Time (s)

4. The tester slowly stands up and walks around the room for 30 seconds.

Time spent maintaining social contact: Time (s)

5. The dog is offered a small titbit

Does the dog accept the food? y / n
1 / 0

Temperament Assessment Test

Dogs must be kennelled separately and have arrived at the shelter more than 48 hours previously.

Date: Day: 1 / 2

Dog's identification:

Reference no: Kennel block and no: Name:

Breed: Age: Sex:

Room test (cont'd)

6. Several audio and visual cues are given to indicate that the tester is about to depart the room before leaving the dog alone for five minutes

Test part:	1. Prior to departure	2. Following departure
Whine	1 / 0	Freq.
Bark	1 / 0	Freq.
Howl	1 / 0	Freq.
Destruction	1 / 0	1 / 0
Jumping on furniture	1 / 0	1 / 0
Escape attempts	1 / 0	Freq.
Scent marking	1 / 0	1 / 0
Drinking	1 / 0	1 / 0

Temperament Assessment Test

Dogs must be kennelled separately and have arrived at the shelter more than 48 hours previously.

Date: Day: 1 / 2

Dog's identification:

Reference no: Kennel block and no: Name:

Breed: Age: Sex:

Room test (cont'd)

Return of the tester

The tester re-enters the room and quietly greets the dog.

Time taken for approach: Time (s)

Vocalisations: y / n
1 / 0

Pawing: y / n
1 / 0

	1 / 2 / 3	1 / 2 / 3
Tail position (up/relax/tuck)	u / r / t	u / r / t

The dog is then leashed and returned to the kennel block via the same route.

---

1 / 0

Aggressive behaviour during any test part: y / n

Description .....

Appendix D

Post-adoption questionnaire

Justine McPherson
Anthrozoology Institute
Department of Biology
University of Southampton
Bassett Crescent East
Southampton
SO16 3DD

Tel: (01703) 594254

BLUE CROSS QUESTIONNAIRE

The following is a telephone questionnaire for the owners of Blue Cross rescue dogs. It is to conducted when the dog has been in its new home for 4 to 8 weeks, thereby giving the dog sufficient time to have settled in.

Some of the questions apply only to dogs exhibiting separation related problems. If your dog does not vocalise, show destructive behaviour or soil the house when you are out, please do not answer these questions. The numbers of the questions concerned are - 2, 3, 4, 5, 6, 11 & 18.

Please tick whichever response you feel is most appropriate; for some questions you may wish to tick more than one response.

The owner's name and address will not be stored on computer and will not be used for any reason other than to identify where the dog has been rehomed to and subsequently to contact the owners regarding this questionnaire.

Thank you very much for your assistance.

Blue Cross Questionnaire

SECTION 1

Background information

Date of interview:		
OWNER DETAILS		
Name	**Address**	**Telephone No.**
DOG'S DETAILS		
Blue Cross Reference No:		
Description (including breed/breed type):		
Age:		
Sex:		

SECTION 2

Questions to the new owner

How many adults are there in the household?

1	◯ one
2	◯ two
3	◯ three
n	◯ more than three

How many children are there in the household?

0	◯ none
1	◯ one
2	◯ two
3	◯ three
n	◯ more than three
1/0	presence/absence of children

What are the ages of each of the children? .....

Do you have any other pets?
(only include those with which the dog is in direct contact i.e. not caged animals or fish)

1 ◯ yes
0 ◯ no

If yes, please describe them:
(give details of age, sex and breed) .....
.....
.....
.....

SECTION 3

Questions relating to separation problems

1) Does the dog exhibit any of the following behaviours when it is left alone:

1/0 ◯ barking, whining, or howling
1/0 ◯ chewing, digging or general destructive behaviour
1/0 ◯ urination, defecation
1/0 ◯ any other unusual behaviours
◯ none of the above (go to question 7)

2) If the dog is destructive, what items are targeted?

entrances/exits	1/0
belongings	1/0
random objects	1/0

3) Does the dog exhibit any of these behaviours when there are people in the house?

10 ◯ never
11 ◯ yes, but to lesser extent
12 ◯ yes, to the same extent
13 ◯ yes, worse than when it is alone
14 ◯ only when left with people other than those it lives with

4) Does this appear to be only when a particular person leaves?

1 ◯ yes (please give details)
0 ◯ no

5) Which of the above behaviours does it perform when there are people present?

1/0	◯	barking, whining, or howling
1/0	◯	chewing, digging or general destructive behaviour
1/0	◯	urination, defecation
1/0	◯	any other unusual behaviours
	◯	none of the above

6) How long after you obtained the dog did the problem behaviour begin?

1	◯	immediately
2	◯	after a few days
3	◯	after a week or so
4	◯	after a few weeks

7) How long is the dog left before this behaviour begins?

1	◯	begins before the owner leaves
2	◯	as soon as it is left
3	◯	after a few minutes
4	◯	up to half an hour
5	◯	more than half an hour

8) How long is the dog regularly left during the day?

0	◯	not at all
1	◯	less than an hour
2	◯	1 - 2 hours
3	◯	2 - 4 hours
4	◯	4 - 6 hours
5	◯	6 - 8 hours
6	◯	more than 8 hours

9) How long is the dog regularly left in the evening?

0	◯	not at all
1	◯	less than an hour
2	◯	1 - 2 hours
3	◯	2 - 4 hours
4	◯	more than 4 hours

10) How long is it left at weekends?

0	◯ the same as during the week
-1	◯ less than on a weekday
1	◯ more than on a weekday
	◯ only at night
	◯ only during the day

11) How long was the dog left for when you first obtained it?

0	◯ the same as now
1	◯ more than now
-1	◯ less than now

12) Does the problem behaviour occur if the dog is left unexpectedly, e.g. on an occasional night out?

2	◯ yes, always
1	◯ sometimes
0	◯ no, never

13) Where do you leave the dog when you go out?

1/0	◯ restricted
1/0	◯ free access
1/0	◯ outside

14) Is it left with a canine companion?

1	◯ yes
0	◯ no

15) When you first obtained the dog where did you leave it?

1	◯ the same as now
2	◯ elsewhere (please describe)

16) Where does the dog sleep?

1/0	◯ restricted
1/0	◯ free access
1/0	◯ bedroom

17) Does it sleep with a canine companion?

1	◯ yes
0	◯ no

18) Where did the dog sleep when you first acquired it?

1	◯ the same as now
2	◯ elsewhere (please describe)

19) How do you behave towards the dog when you leave it?

12	◯ intense goodbye
11	◯ brief interaction
10	◯ completely ignore the dog
13	◯ inconsistently

20) How do you behave towards it when you return?

12	◯ exaggerated greeting
11	◯ brief 'hello'
10	◯ ignore the dog
13	◯ inconsistently

21) If the dog has soiled or destroyed something how do you react?

1/0	◯ physical punishment
1/0	◯ verbal scolding
1/0	◯ behave in an annoyed manner
1/0	◯ ignore the dog
1/0	◯ greet the dog as normal
1/0	◯ inconsistently

22) How does the dog behave when left alone in a car?

2	◯ shows the same separation symptoms
3	◯ separation behaviour is worse
1	◯ slightly less distressed
0	◯ reacts well

23) Does the dog stay in a room alone voluntarily?

1	◯ yes
0	◯ no

24) How does it react to a door being shut between you and him?

1/0	◯ vocalises
1/0	◯ scratches at the door
1/0	◯ sits and waits at the door
1/0	◯ doesn't mind

25) Does the dog follow you or any other member of the family around persistently?

2	◯ yes, always
1	◯ sometimes
0	◯ no

26) If yes, who does it follow?

1	◯ one particular person
2	◯ more than one person
3	◯ anyone

27) Is the dog affectionate?

4	◯ extremely
3	◯ yes, in general
2	◯ only with particular people
1	◯ not really
0	◯ not at all

28) Does it demand attention at all?

3	◯ yes, frequently
2	◯ yes, occasionally
1	◯ not usually
0	◯ no, never

29) How attached to you would you say the dog was?

3	◯ extremely
2	◯ no more than any other dog
1	◯ not particularly
0	◯ not at all

30) Is the dog particularly attached to any one member of the family?

1	◯ yes (please describe)
0	◯ no

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Separation score	◯ 0 ◯ 1 ◯ 2 ◯ 3
Has the dog seen a behaviour counsellor?	1/0
If so, was this for separation related problems?	1/0

Any other comments:

Appendix E

Questionnaire for Breeders

QUESTIONNAIRE FOR BREEDERS

BREEDER NAME	BREEDER ADDRESS	BREEDER TEL.
PUPPIES' DAM		
PUPPIES' SIRE		
PUPPIES' D.O.B.		
NO. PUPPIES		
DESCRIPTION OF PUPPIES		

OWNER NAME	OWNER ADDRESS	OWNER TEL.
1.		
2.		
3.		
4.		
5.		

INFORMATION ABOUT THE PUPPIES

The dam

1) How old is the dam?

2) How many litters has she had?

3) Is she in your opinion a good mother?

Homing

1) How old will they be when they are homed?

2) What is/are the date(s) of homing?

Socialisation

1) Where are the puppies housed?

2) How much time do you spend with the puppies (per day)?

3) Do they have regular contact with people outside your own family?

How much contact?

4) Do they meet strangers regularly?

5) Do they have regular contact with children?

6) Have they met children at all?

7) How would you describe the litter as a whole in comparison with other litters?

1	2	3	4	5

Not at all friendly — Extremely friendly

1	2	3	4	5

Extremely Fearful — Extremely confident

8) How would you describe each puppy within the litter?

Puppy:

1	2	3	4	5

Not at all friendly — Extremely friendly

1	2	3	4	5

Extremely Fearful — Extremely confident

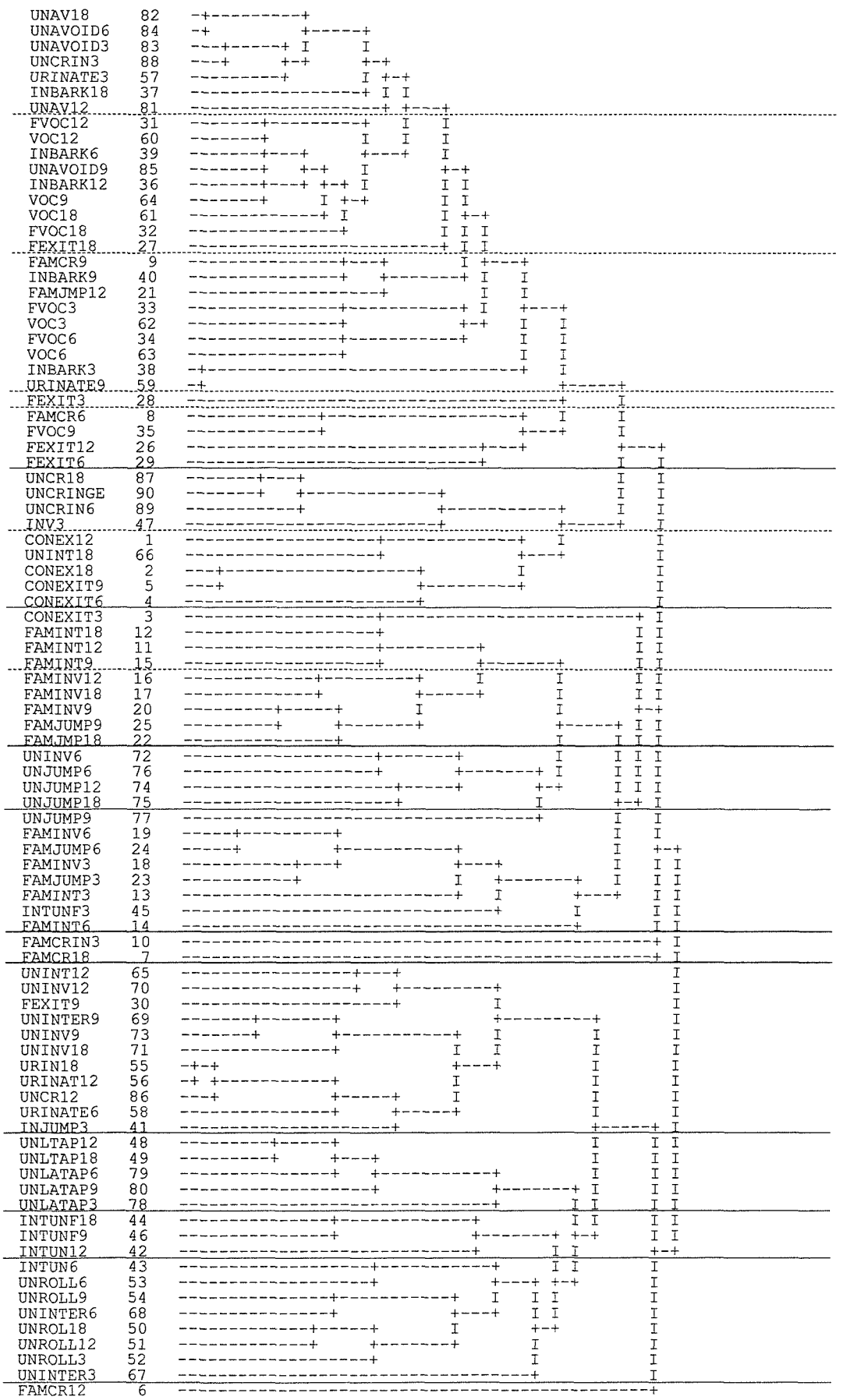
1	2	3	4	5

Extremely Submissive — Extremely Dominant

Appendix F

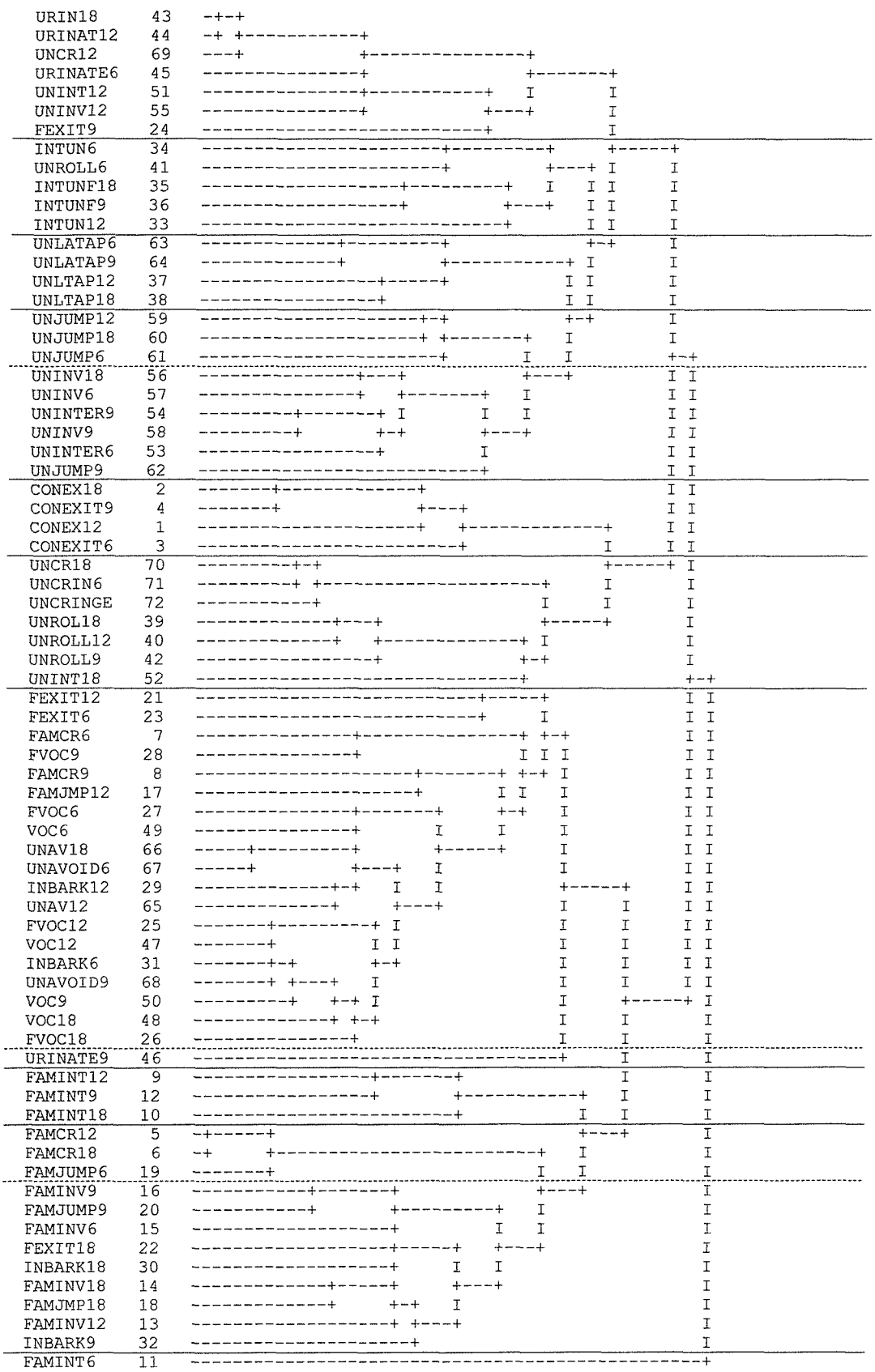
Dendrograms obtained using
Hierarchical Cluster Analysis
on Longitudinal Follow-up Variables

1. Dendrogram obtained using hierarchical cluster analysis on each of the *18 variables at all 5 ages*
Major cluster divisions are indicated by solid red lines and minor divisions by dotted blue lines



2. Dendrogram obtained using hierarchical cluster analysis on each of the *18 variables at 6, 9, 12, and 18 months* of age

Major cluster divisions are indicated by solid red lines and minor divisions by dotted blue lines



Appendix G

Questionnaire presented to puppy owners at 18 months

QUESTIONNAIRE FOR PUPPY OWNERS TO BE CONDUCTED AT EIGHTEEN MONTHS

Owner name:	
Owner address: **Tel no:**	
Dog's name:	
Description of dog:	
Breeder:	
Dog's date of birth	
Date acquired:	

SECTION 1

General Questions

1. Have any family circumstances changed since the last visit, e.g. family members left home, deceased, additional family members, new babies?

1 yes (please describe)

0 no

2. If the answer to the above is yes, have you noticed any changes in the dogs behaviour since this alteration in circumstances?

1 yes (please describe)

0 no

SECTION 2

Information about the dog

Background

3. Where is the dog housed during the day?

10	outdoor kennel
11	indoors

4. Where does it sleep?

it has the run of the house
downstairs only
hall & stairs
kitchen
bedroom
outside
indoor kennel
other (please specify)

5. Have you changed where the dog sleeps since the last visit?

1	yes
0	no

6. Where did it used to sleep?

it has the run of the house
downstairs only
hall & stairs
kitchen
bedroom
outside
indoor kennel
other (please specify)

7. How long is the dog routinely left alone during the day?

0	not at all
1	less than an hour
2	1-2 hours
3	2-4 hours
4	4-6 hours
5	6-8 hours
6	more than 8 hours

8. How long do you leave the dog on a typical evening?

0	not at all
1	less than 1 hour
2	1-2 hours
3	2-4 hours
4	more than 4 hours

9. Is the dog left completely alone or does it have a canine companion?

0	alone
1	with canine company

10. Where do you leave the dog when you go out?

	it has the run of the house
	downstairs only
	hall & stairs
	kitchen
	bedroom
	outside
	indoor kennel
	other (please specify)

11. How does the dog react to being left?

1/0	responds well
1/0	vocalises
1/0	eliminates
1/0	behaves destructively
1/0	other

12. If the dog is destructive, what items are targeted?

1/0	exit/entry points
1/0	owner's belongings
1/0	random objects
1/0	other

13. If the dog shows any of the following behaviours when it is left, i.e. vocalising, elimination, destructiveness when exactly does the behaviour begin?

1	before the puppy is left
2	immediately
3	after a few minutes
4	up to half an hour
5	more than half an hour

14. Do any of these behaviours occur when people are present?

3	yes, even more than when it is left alone
2	yes to the same extent
1	yes to a lesser extent
0	no

15. Please indicate which of these behaviours are exhibited in the presence of people

1/0	vocalising
1/0	eliminating
1/0	destructiveness

16. Is this only when a particular person has recently left the room/house?

1	yes (please specify)
0	no

17. How do you behave towards the dog when you leave it?

12	intense goodbye
11	brief interaction
10	completely ignore the puppy
13	tried several of the above; depends on the circumstances

18. How do you greet it when you return?

12	exaggerated greeting
11	brief 'hello'
10	ignore the puppy
13	tried several of the above; depends on the circumstances

Socialisation

19. How much contact do you have with the dog in an average day?

1	less than 1 hour
2	1-2 hours
3	2-4 hours
4	4-6 hours
5	6-8 hours
6	more than 8 hours

20. How much of this time do you spend directly interacting with the dog, e.g. playing with it, taking it out, training it?

1	less than half an hour
2	half to 1 hour
3	1-2 hours
4	2-4 hours
5	more than 4 hours

21. Does the dog regularly meet people outside of the family?

1	yes
0	no

22. How does the dog react to these people?

2	greets them enthusiastically
1	greets them briefly
0	ignores them
-1	reacts nervously
-2	displays aggression towards them

23. Does the dog meet strangers often?

1	yes
0	no

24. Does the dog ever come into contact with children?

3	yes, frequently
2	yes, on occasions
1	rarely
0	never

25. Are these your own children or other children?

1	own children only
2	other children only
3	both

26. Does the dog regularly receive off-territory exercise?

1	yes
0	no

27. How often?

4	several times a week
3	weekly
2	once every few weeks
1	rarely
0	never

28. Is the dog undergoing any kind of training?

1/0	basic obedience
1/0	show dog
1/0	high level obedience
/10	agility
1/0	gundog
	none of the above

29. Do you attend training/socialisation classes?

1	yes
0	no

30. Have you ever attended the above or a similar establishment?

1	yes
0	no

31. Do you compete with your dog at all?

1	yes
0	no

32. How does the dog react to strange people on its own territory?

2	greets them enthusiastically
1	greets them briefly
0	ignores them
-1	avoids them
-2	other

33. How does the dog react to strange people when off-territory?

2	greets them enthusiastically
1	greets them briefly
0	ignores them
-1	avoids them
-2	other

34. How does the dog react to strange dogs when off territory?

2	greets them enthusiastically
1	greets them briefly
0	ignores them
-1	avoids them
-2	other

35. How does the dog react to strange dogs when on its own territory?

2	greets them enthusiastically
1	greets them briefly
0	ignores them
-1	avoids them
-2	other

36. Do you encourage your dog to interact with strange dogs and strange people?

yes, both
yes, for people
yes, for dogs
no

37. Do you prevent it from interacting with strange dogs/people?

1	yes
0	no

SECTION 3

Owner's opinion of the dog's temperament

38. How friendly is the dog towards people it is familiar with?

1	2	3	4	5

Not at all friendly — Extremely friendly

39. How friendly is the dog towards people it has never met before?

1	2	3	4	5

Not at all friendly — Extremely friendly

40. How affectionate would you say the dog is?

1	2	3	4	5

Not at all affectionate — Extremely affectionate

41. Does the dog demand attention?

2	yes frequently
1	sometimes
0	no

42. Is the dog frightened of anything or anyone that you are aware of?

1	yes (please describe below)
0	no

43. How attached is the dog to you and the other family members?

1	2	3	4	5

Not at all attached — Extremely attached

44. Is the dog particularly attached to any one person?

	no
1/0	female owner
1/0	male owner
	child(ren)
1/0	more than one person

45. How strongly would you rate this attachment?

1	2	3	4	5

Not at all attached — Extremely attached

46. Are there any aspects of the dog's behaviour which you are not happy with?

1	yes (please describe below)
0	no

47. Are there any aspects of the dog's behaviour which you would call a "problem"?

1	yes (please describe below)
0	no

48. Have you noticed any changes in the dog's temperament over the last few months and if so, when did this begin to happen?

1	yes (please describe below)
0	no

For female animals only (49-51)

49. Has the bitch been in season?

1	yes
0	no

50. When was her first season?

1	< 6m
2	6-8m
3	9-11m
4	12-14m
5	15+m

51. How many seasons has she had?

0	0
1	1
2	2
3	> 2

52. Have you had the dog neutered?

1	yes
0	no

53. At what age was the dog spayed/castrated?

1	< 6m
2	6-8m
3	9-11m
4	12-14m
5	15+m

54. Are you planning to have the dog neutered?

1	yes
0	no

55. Have you noticed any changes in the dog's behaviour following neutering?

1	yes
0	no

56. Has the dog had any illnesses in the last three months?

1	yes (please describe)
0	no

57. Did this require hospitalisation or long term treatment?

1	yes
0	no

58. When was the dog last fed?

1	< 1 hour ago
2	1-2 hours ago
3	3-4 hours ago
4	5-6 hours ago
5	> 6 hours ago

59. When was the dog last exercised?

1	< 1 hour ago
2	1-2 hours ago
3	3-4 hours ago
4	5-6 hours ago
5	> 6 hours ago