HUMAN CALMING OF DOG AROUSAL

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ABSTRACT

Humans, by their behaviour, may wittingly or unwittingly increase arousal that triggers attacks in dogs. Equally their behaviour may have a calming effect. Based on evidence in scientific literature, and from recommendations in other writings, the experimenter approached four dogs in one of three ways. (1) Head averted while crouching (Head Turn); (2) eye blinking while crouching (Eye Blink); and (3) direct stare while standing (Direct Stare). The effects of these approaches on arousal levels in the dogs were measured. Dog arousal (an indicator of how likely the dog is to aggress) was assessed from observations of six components of dog behaviour, using scales that measured submission and fear, through relaxation and calmness, to dominance. The presence of either submission or dominance can increase the likelihood of attack. The effect of the three approaches was tested using a small-N alternating treatments design, which involved an initial baseline phase, an alternating treatments phase, a preferred treatment phase, and reversal to baseline. A further three phases were run to assess the effect of approaches on the dogs behaviour by different experimenters. Head Turn was most effective in reducing either submissive or dominant arousal in the dogs, while Direct Stare elicited the most arousal. Eye Blink produced the most variable results but was found to have some calming effect on the dogs. Differences in individual experimenters were not found to have a large effect on dog arousal. Since the dogs displayed little dominance aggression, it is not known whether these treatments are appropriate for calming this type of behaviour. In addition to the traditional methods of analysis a prototype analysis tool (PAC) was employed as an exploratory technique. The findings from PAC showed its potential for improving analysis of behaviour and provided support for the data obtained from the more traditional analysis.

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CHAPTER 1: INTRODUCTION

1.1. Dog Attacks on Humans

Dogs are, and have been for a considerable time, a large aspect of human lives. They have shared human shelter, food and companionship possibly for tens of thousands of years (Fogle, 1995). The domestic dog (*Canis familiaris*) is one of the most widely kept household pets. Dog populations of almost all nations have increased in the past decade and today there are nearly 90 million dogs in Western Europe and the United States alone (Thorne, 1992). In New Zealand the dog population is in excess of 510 000, with one urban household in four estimated to have a dog (Redgrave, 1992).

Every year in New Zealand there are thousands of dog attacks requiring medical attention. It is estimated that for the entire country 5710 dog bites are treated per annum (Langley, 1992). There has been a steady increase in the number of incidents requiring inpatient treatment from 54 in 1979, 158 in 1988 to 182 in 1990 (Langley, 1992). These figures are representative of an international trend (Beck, 1975; Baxter, 1989; Redgrave, 1992; Wright, 1991).

A Queensland study (Podberscek, 1991) on 1150 postal delivery officers found that in four years 426 dog-related injuries were reported. Most of the injuries (70.7%) were dog bites and the rest were due to threats, which led to accidents and injuries incurred in defence. Postal delivery officers were bitten most often on the leg and foot (78.2% of cases) followed by hands and arms (20.7%) and trunk (3.1%). No facial bites were recorded.

There is a popular notion that most dog attacks are due to stray dogs making unprovoked attacks in parks or alleyways (Abrantes, 1997; Baxter, 1989; Beck, 1975). Stray dogs, however, account for only 10% of the attacks (Baxter, 1989). Baxter (1989) found that up to a quarter of all attacks are by the family pet against members of the household. Worse still, the family dog is responsible for almost half the attacks on children under 4 years of age, and half of all fatal attacks. Between 63 and 93% of all attacks are in or near the home of the dog's owner.

For thousands of people dogs have become members of the family, and it may be thought that of all animal species the dog should be the most understood. However, by becoming so close to dogs, humans have become guilty of anthropomorphism. Human characteristics and intentions are attributed to these pets and, in doing so, a more objective understanding of dog behaviour has been lost.

Many authors of popular literature (Nott, 1992; Hart, 1985; Rugaas, 1997) believe human behaviour can be a significant factor in eliciting dog arousal, which may lead to an attack. However, few controlled studies (Voith, 1981; Wright, 1991; Eltringham, 1995) have looked at aggression-provoking behaviour in humans. All have shown that human behaviour can profoundly affect dog behaviour. This study was conducted to further investigate human behaviour and the effect on arousal that can increase the likelihood of aggression in dogs.

1.2. Arousal

Arousal involves cognitive, physiological and behavioural components. These involve (1) a subjective conscious experience (the cognitive component), accompanied by (2) bodily arousal (the physiological component), and by (3) characteristic overt expressions (the behavioural component) (Weiten, 1992). At the behavioural level, arousal is expressed in body language or non-verbal behaviour, and it is in this context that this study will attempt to measure arousal. The word *arousal* is arbitrarily used to cover the domain in question - the social and psychological measures of dog behaviour. The writer's formulation of the problem agrees with that of J. R. Royce who uses the term 'emotionality' in a similar way. Royce (1955) states that emotionality "consists of a group of organic, experiential, and expressive reactions and denotes a general upset or excited condition of the animal". The term *arousal* is used rather than 'emotionality' due to the ambiguity surrounding the subjective nature of the latter term. The terms are merely convenient concepts for describing a complex of factors and does not imply that arousal is a unifying thing or substance.

1.3. Aggression

Aggression and fighting in animals can often be very destructive, and determining the circumstances in which an aroused animal will fight, or refrain from fighting, is important in gaining an understanding of this behaviour. The situations that elicit aggressive responding and the theories behind why animals display aggression exemplify the importance of both the causation and function as interconnected aspects of this behaviour.

Many theories exist surrounding the nature aggression. One of the most famous is that of Konrad Lorenz. Lorenz (1966) argued that the motivation for aggressive behaviour builds up over the time that has elapsed since its last occurrence. This drive accumulates until it is discharged by the act of fighting. However, this model seems inadequate in the light of evidence that suggests animals have a higher level of aggression following a period of fighting (Manning, 1995). It has also been shown that without the opportunity to fight the tendency to show aggression is decreased (Manning, 1995). From an evolutionary perspective this makes sense since, if there is no opponent, there is no advantage to be gained from being aggressive.

The theories of Lorenz, however, exclude other factors that can effect aggressiveness. Aggression can occur in many different contexts. Before any aggression occurs it must be preceded by some level of arousal. Although aggression may have a universal effect (controlling an individual) it may appear in forms ranging from overt fighting, to subtle postures where physical contact is limited. Dogs demonstrate this range of aggression particularly well. Aggression may be used in competition for food, territory, rank order and sexual partners or in defence of young (Manning, 1995).

Aggression in dogs can involve three types of responding. A dog may react aggressively due to an innate response to certain stimuli. This involves unconditional reflexes whereby an unconditional stimulus elicits an unconditional response. As an instinctive behaviour, aggression is important as a mechanism for animals to control one another. In these circumstances fighting is the only means an animal has to compete for and protect vital resources. Pain is often an elicitor of innate aggression. Particular breeds of dog, such as terriers, have been selectively bred for their predisposition to aggression.

As well as being an innate response, aggression may also be a learned behaviour, or a combination of the two. Training often heightens instinctive aggression. Learning through respondent conditioning involves learning through the pairing of a meaningless (neutral) stimulus that initially elicits no response and a meaningful (unconditional) stimulus that does elicit a response. After continued pairing of these stimuli, the neutral stimulus eventually becomes a conditional stimulus as it elicits a conditional response. Pain as a powerful stimulus for aggression is sometimes used purposely through respondent conditioning to induce aggression in dogs (Fogle, 1995).

The third type of responding involves operant conditioning. This is learning which occurs as a result of the consequences following a response. The process involves learning response-consequence (R-S^c) relations. Stimuli associated with this R-S^c contingency control the responding but do not elicit it. An association develops between (1) a preceding stimulus (S^D) and (2) a relationship between a response and a consequence, giving rise to a three term contingency S^D - R - S^c.

Aggression is a quantitative trait; no animal is totally aggressive and no animal is totally lacking in aggression. The intensity of aggression varies and is illustrated through facial and bodily expressions and vocalisations. The amount of aggression seen in an animal is a result of many factors all concerned with self-preservation. The individual that has the greatest chance of survival has the greatest chance to mate successfully (Fogle, 1995).

The dog, as a gregarious species, has a social organisation based on a hierarchy of dominance, similar to the wolf. In this context, aggression serves a function of achieving or protecting a dog's status within the group (Pulliainen, 1967; Rabb, 1967; Scott, 1950). The basis of the dog's social behaviour depends on signals of arousal, both dominant and submissive, in order to maintain a balance and harmony. A dog will generally respond to aggression from a conspecific with either dominance or submission. A review of the evolutionary background of Canidae is important in understanding arousal in the context of social behaviour and communication.

1.4. Social Behaviour in the Dog and Wolf

One of the things that distinguish different members of the family Canidae from each other is the differential development of social behaviour (Fox, 1967; Fox, 1970). Among the close relatives of the domestic dog, the most social species is the wolf (*Canis lupus*), and it is this characteristic, along with evidence from mitochondrial DNA research (Newby, 1997), which leads scientists to believe, with a good deal of certainty, that wolves are the closest common ancestor of the dog (Scott, 1967). Other possible ancestors of the dog are the jackal and the coyote. Wolves, however, are highly social animals, as are dogs, whereas jackals resemble coyotes - ordinarily forming groups no larger than a mated pair (Scott, 1967). Both dogs and wolves form social groups or packs, have elaborate greeting rituals, exhibit play behaviour, show exploratory behaviour, and seek out contact and interactions with conspecifics (Scott, 1967). Furthermore, primary communication patterns in both wolves and dogs involve body postures, facial expressions and vocalisations (Scott, 1950; Vines, 1981; Scott, 1967).

A closer look at species of non-domestic Canidae can reveal important information about the behaviour and communication of the domestic dog. Despite the diversity of morphology and ecology between members of the Canidae, social behaviour remains similar throughout the family. Some specialisations have occurred in highly gregarious species of wild Canid, such as the African Hunting dog (Estes, 1967) serving to maintain group cohesion and reduce intra-specific aggression (Kleiman, 1967). However, this is more a matter of degree than kind. The wolf, for example, has evolved more specialised agonistic postures that are used in the maintenance of a social rank hierarchy (Zimen, 1975) than other species of Canidae such as the coyote.

The wolf will be used as the main comparison to the dog due to its similarity in behaviour (although more exaggerated due to ecological differences). The wolf and domestic dog display a wider range of simultaneous combinations of various facial expressions than other Canids such as the fox (Fox, 1970). This may indicate an evolutionary advancement of visual signals in more social species.

The wolf, as a highly social species, has been studied in the wild (Mech, 1975; Zimen, 1975), under semi-natural conditions of confinement (Schenkel, 1947;

Schenkel, 1967; Fox, 1970; Fox, 1967; Fox, 1969; Rabb, 1967) and under conditions of domestication (Schenkel, 1947; Schenkel, 1967; Fox, 1970; Fox, 1967; Fox, 1969; Woolpy, 1967). These accounts of wolf behaviour provide strong evidence that most basic behaviour patterns found in dogs are also found in wolves.

In a study by Scott and Fuller (1950) some 90 behavioural patterns of the domestic dog were observed in the laboratory, nursery, and free situations. Scott and Fuller (1950) then examined the available descriptions of wolf behaviour and found all but 19 of the same patterns in dogs. Most of the missing behaviours were relatively minor patterns that were likely to have escaped observation. Pulliainen (1967) also reported most of the behaviour patterns identified by Scott and Fuller (1950) to be observed in dogs during his studies. The only major behaviour pattern of wolves that has not yet been reported in dogs is that of a dominant wolf pinning a subordinate to the ground by the neck (Woolpy, 1967).

That evidence suggests every basic behaviour pattern found in the wolf is also present in the dog means that, in spite of the centuries of artificial selection practised on dogs, the fundamental behaviour patterns of wolves still exist in the dog. Strangely enough, domestication does not seem to have produced anything new in dog behaviour. The behavioural patterns of dogs in human society are the same as those of wolves in wolf society (Fox, 1975). There is, of course, a large amount of variability of individual behaviour in dogs that may be produced by selection and training. It means however, that exaggeration or suppression of patterns of behaviour already present has produced this variability.

With regard to communication and motor capacities, dogs and wolves are similar (Scott, 1950). The ears may be held erect or depressed. The tail may be moved down or up and may be wagged from side to side. The facial muscles are capable of considerable movement during emotional expression (Fox, 1970), although not as much as humans. Wolves differ from dogs mainly in being much larger and more powerful in the jaws and legs than most dog breeds (Scott, 1950).

There are behaviour patterns of the wolf, however, that have been importantly modified in the dog. The most obvious is the selection of inherited anatomical abnormalities that make certain behaviour patterns difficult or impossible. Some domestic breeds of dog have such pendulous ears, bizarre facial markings, pendulous lips and excessive hair that little facial expression can be seen. For example, a Spaniel, with lop ears cannot lay them back or hold them erect. Extremely fluffy dogs, such as the Samoyed may evoke aggression in other dogs due to the threatening appearance of permanent piloerection (Goddard, 1985). Others, having been subjected to selective breeding and training, lack normal facial expressions under particular circumstances. Many breeds, particularly guard dogs like the Doberman, attack with little or no warning (Blackshaw, 1991). Certainly the wolf is more reliable in this respect.

In the present study these considerations of individual variation in dog breeds have important implications. In order to interpret body language accurately only dogs that are capable of utilising ears, lips, tail, body hair and voice similar to that of wolves were used as subjects.

It has been estimated that the domestication of the dog took place about 8000 BC (Scott, 1965). Early man probably tamed the young of most species of mammal in a haphazard sort of way, and kept them briefly in captivity (Clutton-Brock, 1992). They may have also kept the young of other carnivores, such as foxes and jackals, as young animals. But because these animals are inherently less social than wolves, the association would not have lasted into the animals' adult lives. As they matured, the animals would not have remained habituated to the human group (Clutton-Brock, 1992).

The process of domestication seems to have shifted the dog's primary social attachment from conspecifics to humans. This difference is highlighted in some important aspects of social behaviour. Behavioural changes such as increased subordinance, adaptability and increased infantile characteristics perpetuating into adulthood (neotony) are a direct result of domestication (Case, 1999). Arguably, the most modified aspect of social behaviour in the dog due to domestication is agonistic behaviour. For wolves, in order to survive, it is important to function effectively as a group. There must be minimal aggression and conflict for this to happen, since, given the power of their defence mechanisms, injury or death could occur as a result. To prevent aggression problems within the pack evolution produced a set of dominance and submissive displays along with a social rank hierarchy that allow for resolution of conflict without the danger of inflicting injury (Case, 1999; Zimen, 1975; Scott, 1967).

The dog has inherited most, if not all, of these agonistic body postures, facial expressions and vocalisations (Scott, 1950), however the process of domestication has modified them somewhat. During the domestication process the dog became more reliant upon humans as caretakers and no longer had the need to rely upon its skill and fitness in order to survive (Thorne, 1992). This meant that the natural selection pressure against aggression between pack members was unintentionally reduced in domesticated dogs. Being incorporated into humans lives meant the need to stay fit, function as a working unit, and avoid fights with conspecifics was no longer connected to survival. As a result increased intra-specific aggression can be seen (Case, 1999).

Selective breeding for guarding behaviour may also have contributed to this change. This type of selective breeding would have increased the intensity of the aggressive response and decreased the level of stimulus needed to trigger the aggressive behaviour. In contrast, some dogs would also have been selectively bred for infantile behaviours such as submissiveness with a resulting dog that is naturally more subordinate and less dominant than a wolf. However, when aggression is displayed it may be of higher intensity and elicited by a lower level of stimulus (Case, 1999).

1.5. Communication in Dogs

Dogs communicate not only by audition, vision and physical contact as humans do, but by olfactory signals as well (Nott, 1992) (Appendix 1). Visual communication is most apparent in the facial and body expressions. Facial expressions refer to all the animals' expressions of the head, including the eyes, ears, lips, tongue, forehead and muzzle. All facial expressions mirror a dog's motivation (Table 1). The combination of these elements can emphasise or diminish other signals, giving the dog's facial expressions many variations (Abrantes, 1997).

Table 1.

Facial Expressions with Corresponding Motivators

EXPRESSION	MOTIVATION	Aggression	Dominance	Friendly	Pacifying	Submission	Fear
Eyes	Big	X	X				
	Narrowed			X	X	X	X
	Averted gaze				X	X	X
	Staring	X	X				
	Blinking			X	X	X	X
Ears	Upright	X	X				
	Flattened			X	X	X	
	Totally flat					X	X
	Flickering				X	X	X
Mouth	Curled	X	X				
	Drawn back			X	X	X	
Forehead	Clear stop		X				
	Flat					X	
Lips	Raised	X					
	Normal			X	X		

Adapted from Abrantes, (1997).

1.5.1. Auditory

Dogs have a broad repertoire of vocal signals that are used in a variety of situations. Vocal communication is advantageous in that it can be used to communicate over long distances and in situations where vision is impaired. Common vocal communications of dogs are the bark, whine, howl and growl. Vocalisations vary enormously depending on motivational, and situational variables. Although there is considerable variation between breeds, dogs are generally more vocal than wolves - probably as a result of selective breeding by man (Abrantes, 1997). The most frequent vocal signal used by the dog is the bark, which is conspicuously absent from the vocal repertoire of the wolf. The bark may be used in defence, in play, as a call for attention, or as a greeting (Theberge, 1967). Growls are also used as a defence, warning, and threat signal, whilst whimpering, whining and yelping are used during submission, greeting and pain (Fox, 1967).

1.5.2. Olfactory

Dogs can smell some olfactants in concentrations of one to 0.001% that of the absolute threshold for humans. Olfactory communication might take the form of scent marking (urine and anal secretions) (Nott, 1992), and has an advantage over other systems of communication in that olfactory signals remain in the environment for long periods of time.

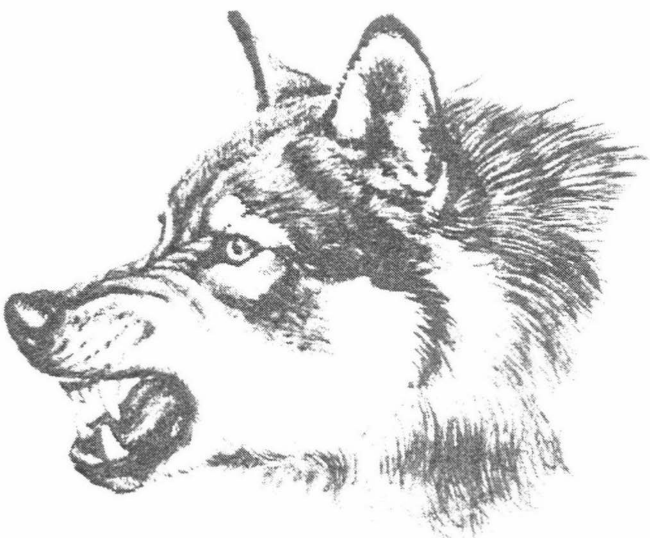


Figure 1. Aggressive stare with lip retracting snarl, erect ears and pilo-erection. *(From Abrantes, 1997).*

1.5.3. Visual

A dog's state of arousal can be determined by observation of the ears, mouth, facial expression, tail, the hair on its shoulders and rump (hackles), and its overall body position and posture (Rugaas, 1997; Fogle, 1995) (Appendix 1). The calm dog stands with ears and tail hanging down; when alert, tail and ears are pointed upward. As the dog becomes more aggressive, hair on the hackles and the rump rises and the lips are drawn back (Figure 1). The dominant dog maintains erect ears which, combined with high tail and head position, help to convey the impression of a larger and more powerful animal (Voith, 1982). The tail may or may not be slowly wagged from side to side (Schenkel, 1947).

The posture of the fearful-aggressive dog is one with tail and ears down and the body leaning away from the source of the fear. It may have raised hackles and lips retracted in a snarl (Rugaas, 1997). The fearful dog, in which fear is not mixed with aggression, crouches with its tail between its legs and its ears flattened. Submissive dogs may approach or greet a more dominant individual with a low general body posture with their head held below the level of the back (Schenkel, 1967). Although the head may be lowered, the dog's nose is often pointed upwards at the dominant human or dog. If the dog is abjectly submissive, it will lie on its side and lift its hind leg displaying the inguinal area (lateral recumbence) (Nott, 1992) (Figure 2). It may also make licking motions and it may urinate (Abrantes, 1997).

Figure 2. Active submission (left) and passive submission showing lateral recumbence (right). *(From Abrantes, 1997)*

The submissive or subordinate dog may nuzzle or lick the face of a more dominant animal (Nott, 1992). Rugaas (1997) states that dogs may also lick their lips and nose in situations that may potentially be stressful.

1.6. Calming Signals

Canine language, in general, consists of a large variety of signals utilising body, face, ears, tail, sounds and movement (Ryan, 1997). The wolf's ability to reduce aggression and resolve conflict in a conspecific is essential for survival. Wolves, as pack animals, have a language for communication with each other. The use of calming signals within the pack maintains the social rank hierarchy of the pack and ensures that aggression is minimised.

In studies on wolf packs (Fox, 1970; Kleiman, 1967; Schenkel, 1967) body language that reduces dominance aggression in a pack member has been described as a "cut-off" signal. Observers saw these signals as cutting off aggression in other wolves. Rugaas (1997) terms these signals as calming signals as they are used more to prevent rather than stop dominance aggression.

It has commonly been believed that although the wolf is the domestic dog's closest ancestor, our pet dogs do not have the same ability and social skills to avoid conflict by use of body language. However, it appears that perhaps the domestic dog does posses the wolf's ability to use calming signals though in more subtle ways. The domestic dog generally is not in the same position of danger as wolves, nor is it so reliant on its survival instincts. These factors may therefore reduce the intensity of its behaviour.

One extremely important feature of calming signals is submission. Both the domestic dog and wolf display signs of submission in similar situations. Submission, according to Schenkel (1967) functions as an appeal or a contribution to social integration, but it is effective only if it meets a corresponding attitude in a superior. According to Lorenz (1954) the function of submission is related to appeasing behaviour insofar as it does not elicit antagonistic behaviour or aggression. In addition, it acts as an innate automatism which blocks aggression. Later however, Lorenz (1963) describes submissive behaviour as "formalised or ritualised non-aggression where all possible intentional movements of aggression or of active defence are avoided. As in appeasing movements, the submissive animal turns its weapons away and does not stare or look at the opponent."

Schenkel (1967) has described expressions of submission in wolves, which act as calming signals, and which may serve to re-motivate the aggressor. He proposed that the dominant wolf may turn its head away from a subordinate during an agonistic encounter thus 'daring' the other to attack.

> The supposed submissive posture is in reality a posture of superiority. Continuous observations of the social life of groups of wolves in captivity and of domestic dogs over many years have led to the conclusion that it is always the *inferior* wolf who has his jaws near the neck of his opponent. He indeed shows a strong inclination to bite into the other's neck. But being the inferior he does not *dare* to bite! (Schenkel, 1967).

This interpretation is in direct opposition to the views held by Lorenz (1963) and Fox (1969). From their observations they hypothesise that it is the submissive wolf that twists its head to one side and exposes its most vulnerable part (the neck and jugular vein) as an act of submission, which inhibits further aggression (Figure 3). Fox (1969), in the same context as Schenkel, notes occasions where head turning has been observed but is of the opinion that such behaviour in the dominant wolf is a 'cut-off' gesture. He also points out that the behaviour is more frequently seen in subordinate Canids, where head turning and avoidance of eye contact act as appeasement and 'cut-off' gestures.

Figure 3. The subordinate dog (bottom) displays a sideways body posture with head turning and avoidance of eye contact in response to agonistic posture and direct stare of the dominant dog (top). *(Fox, 1969).*

A subordinate wolf will look away from the dominant conspecific during close social interaction and avoid eye contact (Fox, 1969). Turning the head in this way does expose the neck. The neck, however, is of low priority for focusing an attack by the dominant dog. Attacks are usually confined to the shoulder hackles, dorsal scruff of neck and face (Blackshaw, 1991). In the wolf pack, the subordinates are constantly looking towards the alpha individual, who frequently ignores them. When eye to eye contact is made even over a distance of some 20 yards, the subordinate looks away, flattens its ears back, occasionally lowers the entire body, lowers its tail and may whine (Fox, 1970). Sudden and exaggerated head-turning movements away from a conspecific are components of play soliciting gestures frequently seen in young dogs and wolves (Schenkel, 1967). In all Canids, a direct stare and exaggerated approach followed by sudden turning away or withdrawal has been observed during play and play soliciting between conspecifics.

Eye contact is also significant with the domestic dog. Fox (1970) has reported two reactions that have been evoked in dogs as a result of a direct stare. Submission, which can be either active or passive, or direct attack or threat in adult dogs on their own home territory. The concept of submission is intimately related to fear and is sometimes called inferiority. There are two main ways in which submissive behaviour can be displayed. Active submission, where the dog actively tries to pacify its adversary, for example, muzzle nudging and lip licking, and passive submission, where the dog lies down passively, with belly up, lateral recumbence and urination may also occur. These behaviours are illustrated in Figure 2. Rugaas (1997) theorises that dogs engage in lip licking behaviour as a calming signal to another individual, and may yawn during times of stress.

Another expression that is thought to mean submission or friendliness in Canids is eye blinking (Abrantes, 1997; Rugaas, 1997). Rugaas (1997) states that when a submissive wolf or dog greets the alpha animal, the dominant or alpha wolf may sometimes be seen to accept the submissive individuals greeting by blinking. This is thought to mean that it accepts the other's greeting and offers a calm response. In return the submissive dog may lick its lips and champ, indicating friendliness and submission (Abrantes, 1997). Sometimes dogs may blink at humans if, for example, they seem aggressive (Rugaas, 1997). Rugaas (1997) describes an occasion when eye blinking reduced aggressive behaviour:

> I had right in front of me a very aggressive Rottweiler who, by the sound of the deep growling, meant business [or] at least no interference in his privacy. The growling became deeper if I tried to move my head or something, so I had to stand still. I was certainly not going to back up, so all I could think of doing was blinking my eyes. After a while the growling ceased, and suddenly his tail started to wag a little. It took me very shortly [*sic*] to become his friend (Rugaas, 1997).

Narrowed or closed eyes have been identified (Fox, 1970) in all Canids when engaged in a variety of relaxing activities. Provided they are not disturbed by distracting stimuli, during eating, urination and when rolling and rubbing in a strange odour, the ears are partially flattened and the eyes either narrowed or completely closed (Figures 4 and 5).

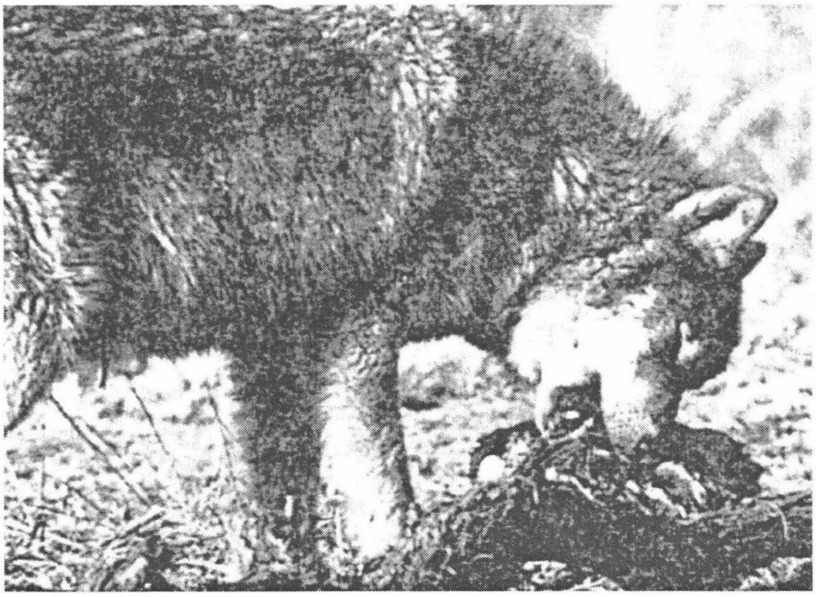


Figure 4. Consummatory face characterised by eye closure in the wolf while eating *(Fox, 1969).*

In dog-dog interactions the dominant and self-confident dog opens its eyes wide. As a dog becomes insecure and shows submissive behaviour the eyes become smaller and elongated. During pacifying displays, the eyes of the dog are narrowed. A dog engaged in extreme pacifying behaviour may even close its eyes (Abrantes, 1997).

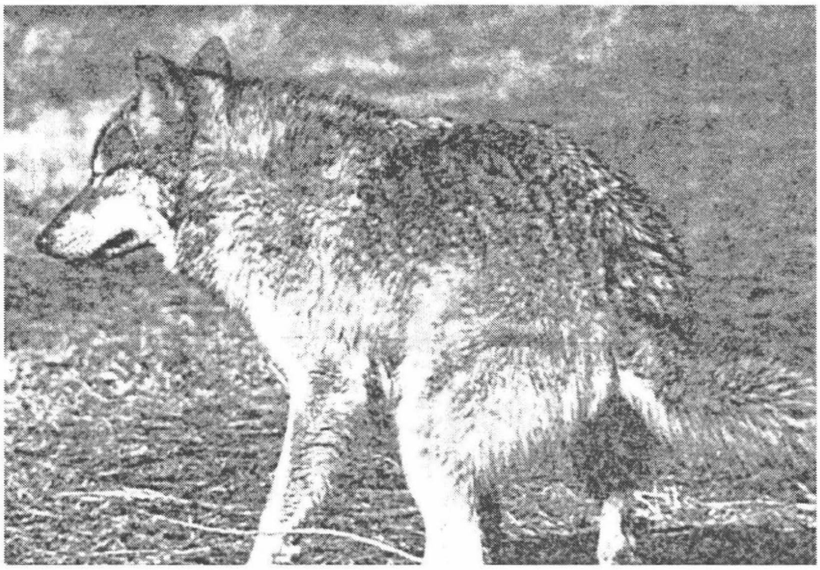


Figure 5. Consummatory face characterised by eye closure in the wolf while defecating *(Fox, 1969)*.

Observations of greeting ceremonies between wolves and between dogs can highlight the significance and importance of calming signals, in particular those of submission. Greeting is the behaviour seen when two individuals of the same species meet and assure each other of their peaceful intentions. When two aggressive animals meet, instead of engaging in fighting behaviour, they engage in greeting rituals (Abrantes, 1997). Greeting ceremonies comprise many modified behaviours, such as sexual and parental behaviour (Fox, 1975).

A ritualised greeting ceremony is illustrated in Figure 6. During this greeting one of the two assumes the position of the submissive animal while the other shows dominance. The submissive dog will flatten its ears, draw back its lips (but avoid showing teeth), make its eyes appear small and may muzzle nudge or lick the other around the lips. The dominant dog displays friendliness by closing its eyes a little, drawing its ears back slightly and by turning its head away. If one dog is particularly fearful or submissive it may display passive submission (Figure 2) by lying on its back, inviting the dominant dog to sniff its genitals. A few drops of urine may be produced to show total submission. This type of behaviour serves to calm the dominant dog through appealing to its sense of parental care by acting as if it was a puppy (Abrantes, 1997).

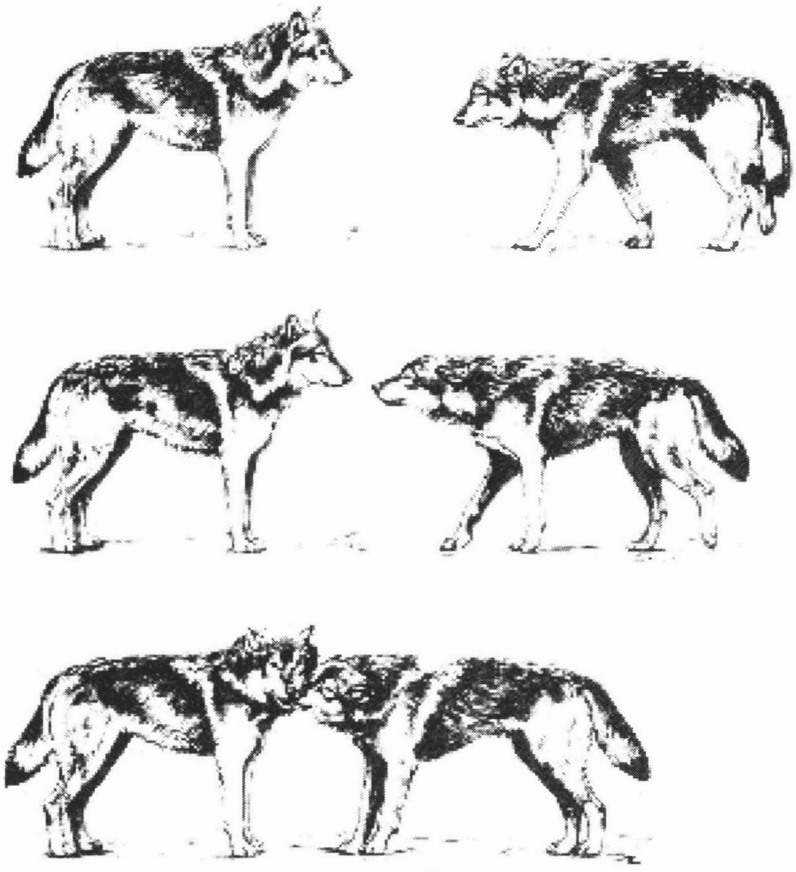


Figure 6. **Ritualised greeting behaviour found in wolves and dogs. The wolf to the right shows submissive and pacifying behaviour. The wolf to the left shows dominance and acceptance.** *(Abrantes, 1997).*

1.7. Human Behaviour and Dog/Wolf Behaviour

It has also been suggested (Scott, 1950) that a high degree of development of patterns of social behaviour, plus considerable similarity to those of human beings, is necessary for successful domestication. From studies by Schenkel (1947), Woolpy (1967) and Fox (1970) it has been shown how easily wolf cubs can be taken away from their parents and made into pets, and it is difficult to tell these animals from dogs. The comparison of human and dog-wolf behaviour patterns indicates that the reason for the easy and successful domestication of the wolf lies in the fact that it is a species with highly developed patterns of social behaviour. Furthermore, a large number of these patterns are sufficiently similar to human ones to permit mutual social adjustment between man and wolf. Wolves and dogs show sufficient similarity to human beings in their basic behaviour patterns for this to have occurred.

Some of the patterns of behaviour between humans are so similar to those between dogs that the meaning of dog behaviour can, in many cases, be readily recognised by people. For example, the behaviour of babies and puppies is strikingly similar. Whining and yelping in puppies is similar to crying in infants (Scott, 1950), while most agonistic behaviour, such as growling and teeth baring, is easily identified as such by humans (Schenkel, 1967). Certain behaviours such as tail wagging and hand licking are less familiar but have come to be identified as friendly behaviour.

Bolwig (1964) describes the variation in facial expressions under different social situations in primates and has emphasised the similarity of facial expression between primates and the domestic dog. Expressions of threat found in primates (Bolwig, 1962), particularly the direct stare, rounded eyes, occasionally snarl and frown, which may be combined with elements of submission closely resemble those displayed by Canidae. The animal may be seen to raise and lower its head, raise and lower its ears, and direct its gaze alternately toward and away from the stimulus. When highly aroused, the aggressive expression of higher primates is an open mouth grimace, in which the teeth are bared. This expression is also found in Canidae (Figure 1).

In feeding the young, the accompanying epimeletic behaviour (the giving of care or attention) is similar to that in human beings, and, like humans, there is a long period of dependency with regard to food (Scott, 1950). The presence of Allelomimetic behaviour (the tendency to copy what another animal is doing) makes the integration of the dog into the human household easier (Scott, 1950).

There are, of course, patterns of behaviour that are strikingly different from typical human behaviour, such as female sexual behaviour (which may partly account for the unpopularity of female dogs as pets) and eliminative behaviour (Voith, 1981).

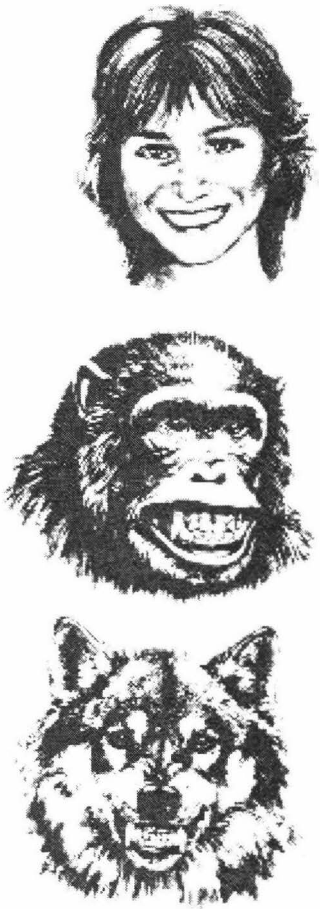
1.8. Dog-Human Communication

Many conflicts between humans and dogs arise from misunderstandings of each other's signals. Behaviour by one species may be interpreted in particular ways by the other species. These behaviours may be correctly interpreted because of the similarities between the two, or because the other learns the true meaning of the behaviour. They can also be incorrectly read because the behaviour has importantly different meanings for the two species, or learning has not occurred, hence a misinterpretation arises with aggression a possible consequence.

As well as there being patterns of social behaviour in dogs that are highly recognisable by humans, there are other signals that are more subtle and less appropriate to human patterns of social behaviour. The domestic dog will often treat humans in a similar manner to which it treats other dogs. As puppies, dogs lick their mothers' faces to beg for regurgitated food (Fox, 1969). Although wild Canids frequently regurgitate food for their pups (Kleiman, 1967), domestic dogs do not do so very often. Nevertheless, the begging behaviour is shown by domestic puppies (Abrantes, 1997). This behaviour persists in the adult dog who either licks the owner or makes licking intention movements. Mouthing of the owners hand is another greeting that is a submissive gesture (Fogle, 1995).

Dogs also communicate with humans the need for play. They do this by bowing with the forequarters lowered and the hindquarters raised and topped by a rapidly wagging tail. Often one paw is waved or rubbed at the dogs own muzzle (Schenkel, 1947). The dog may pretend to attack its opponent. It positions the front part of its body as if lying down, with its back end in the air, waits a moment and then jumps playfully at its playmate (Abrantes, 1997). The play bow is also seen during courtship behaviour, used by both the male and female (Scott, 1967).

The primary stimuli between the two species are similar enough that appropriate and recognisable social behaviour is usually evoked. There are of course exceptions to this as human behaviour is far more complex than dog behaviour. When different animals use similar expressions that mean different things misunderstandings are liable to occur. The human smile is one behaviour that may result in confusion. A lip retracting, teeth baring grimace, that to humans may be recognised as a sign of happiness, may appear threatening to a dog, and may elicit fear in a chimpanzee (Figure 7). There is some evidence to suggest that this behaviour may be responsible for some dog attacks (Fogle, 1995).



<u>Figure 7.</u> Similarities in facial expressions of different animals. *(Abrantes, 1997).*

Within the scientific literature there are few controlled studies offering guidance on interpreting body language of dogs (Bekoff, 1977; Bolwig, 1962; Eltringham, 1995; Fox, 1970; Lore, 1985; Schenkel, 1947; Schenkel, 1967; Scott, 1967). For this reason it was necessary to also look to popular literature written by people who interact with dogs. From both popular and scientific literature and studies on wild Canids some general conclusions can be reached regarding body language and, in particular, calming signals.

Human communication with dogs comprises movement and sound and dogs behave according to the way people act, not what people say (Campbell, 1992). The dog's efforts to communicate with people through movement and sound are often ignored or misinterpreted, creating a frustrating communications gap. When this happens humans may inadvertently fall victim to dog aggression. Although there may be many different causes of aggression, our behaviour may help avoid an attack irrespective of the initial cause. Wright (1991) believes that the tendency for dogs to aggress will also be affected by heredity, training and socialisation, medical and behavioural health, and finally victim behaviour.

One study on the human triggers of dog aggression (Eltringham, 1995) showed clearly that dogs interpret some human body language signals in ways consistent with intra-species communications. Varying eye contact, body position and movement of four experimenters saw a marked effect on dog attitude. This study showed that presenting a reduced profile, avoiding direct eye contact and remaining still when encountering a dog elicits less arousal in the dog than presenting a high profile, making direct eye contact and moving.

1.9. Development of Socialisation

Various factors in the dog-human relationship that may affect the behaviour of the dog have been suggested in the literature. Particular breeds of dog seem more likely to display aggression than others (Hart, 1985). This may be due to a greater tendency for the dog to aggress if aroused, a lower threshold of arousal, or a mixture of both. This increased likelihood of aggression could be due to either phylogenic contingencies, explaining variations among breeds, or ontogenic contingencies where there is variation amongst individuals or, again, a mixture of both.

One of the most important ontogenic contingencies is socialisation - early experiences, and the effect they have on the development of a dog's social relationships with other dogs and humans (Fox, 1967; Jagoe, 1996; Young, 1982; Wright, 1991). Studies have shown that restricting socialisation of dogs with either their own species or humans affects later social behaviour toward humans (Freedman, 1961; Fox, 1967). Freedman *et al.* (1961) have shown that dogs denied human contact during the critical socialisation period (3-12 weeks) show strong avoidance of humans. Both fear and dominance towards humans were seen, both of which increase the likelihood of attack. Fox and Stelzner (1967) looked at the reverse of the Freedman *et al* (1961) study and restricted dogs from contact with their own species. These dogs showed a considerable lack of interest in playing with other dogs and also tended to display aggression.

However, regardless of the degree to which a dog is socialised, it is the behaviour of either the conspecific or the human that induces arousal. While the effects of malsocialisation may increase the likelihood of an attack in some dogs (since a lower level stimulus may be required to elicit aggression) it is still the behaviour of others that influences a dog attack.

1.10. Victim Behaviour and Characteristics

The behaviour of victims (intentional or otherwise) has been found to increase the likelihood of being bitten. Behaviours found to precede both dominant and submissive forms of aggression include punishing a dog either verbally or physically (Wright, 1991), disturbing a resting dog (Beck, 1975; Wright, 1991) or continuing to approach a dog that is displaying threatening signals (Hart, 1985). Threatening signals consist of visual displays indicating the dog's propensity to either control its victim or to protect itself. In dominance arousal, which is characterised by exaggerated approach behaviours toward the victim, the dog may exhibit dominant postures such as standing over an object, staring, rigidity, erect ears and tail, teeth baring, snapping, biting and growling (Fogle, 1995). In submissive arousal, signals are characterised by initial attempts to avoid or escape from the person who constitutes an aversive stimulus (Wright, 1991). An attack is generally elicited when the communicative behaviours are misinterpreted or ignored and the individual fails to change its behaviour in relation to the dog (Rugaas, 1997; Figure 8).

There are other circumstances that are associated with the onset and escalation of aggression. A dog may attack to avoid pain or punishment, or out of fear. However, threatening an animals' dominance is one of the most common causes of dog attack (Borchelt, 1983). This includes bending over or leaning on a dog, reaching for or taking away an object, and petting, hugging, or pushing a dog (Figure 9; Wright, 1991). Baxter (1989) has also shown that an interaction between dog and victim preceded 60% of all attacks in his study. These interactions included petting, playing, feeding, abusing or teasing the dog. These behaviours are consistent with the notion that victims behave in similar

Figure 8. A potentially dangerous situation where the boy is increasing his proximity to the fearful dog, which is trying to decrease the proximity. *(From Abrantes, 1997).*

ways to dogs that elicit aggression in other conspecifics. Often a dog will give clear signals of arousal, and if the human responds appropriately, as another dog would, aggression may be avoided.

Another factor in affecting the onset of aggression is the established relationship between the dog and the human. Sometimes a behaviour performed by one person (especially the owner) may produce little arousal in the dog, while the same behaviour performed by another person may result in aggression. One study on canine aggression toward humans (Wright, 1991) found that the person's age may influence aggressive encounters. Children were bitten more often than adults and disproportionately to their representation in the population, and younger children more often than older children. For example, Wright (1991) found that children ten years and younger received 42.1% of all bites but made up only 26.4% of the population. In another study, children aged five to nine received 27.4% of the reported dog bites but represented only 8% of the population (Beck, 1975). Fogle (1995) states that the most common cause of dog bites in children is fear aggression. He suggests four possible variables as the cause. Insufficient socialisation of dogs towards children, and the different smell of pre-pubertal children along with their smaller stature and jerkier movements.

Figure 9. An expression of affection in humans that may be misinterpreted as dominance by the dog. *(From Abrantes, 1997).*

Victims of dog bites can also be characterised by gender. Among kennel owners and veterinarians it is generally acknowledged that females elicit less avoidance from dogs than do males (Lore, 1985). Both bite frequency and bite rate are higher for male than for female victims (Beck, 1975; Wright, 1991). Wright (1991) found that in eight of nine studies involving large samples of bite reports, men and boys accounted for 60% to 69.5% of all bites. This difference may be explained by males' tendency to come into contact with dogs more frequently. Victims of severe and fatal bites were also typically boys and men with a range of 56.4-63.6% of all bites (Pickney, 1982). Podberscek and Blackshaw (1991) also report that bite rates differ for males and females. Significantly higher proportions of male postal delivery officers (65%) were attacked compared with female officers (35%). New Zealand findings by Langley (1992) are also consistent with these results. He found that overall, males, children and Maori had higher rates than female, adults, and non-Maori, respectively.

It has also been assumed that domestic dogs behave differently toward familiar and unfamiliar humans (Lore, 1985; Rappolt, 1979; Wright, 1991; Voith, 1982; Borchelt, 1983). These popular notions have been partially supported by Lore and Eisenberg's (1985) study on avoidance reactions of domestic dogs to unfamiliar males and females. Their results showed that male dogs reared as pets are far less likely to approach and physically contact an unfamiliar human male, compared to an unfamiliar female. Female dogs, however, readily sought proximity and body contact with the human experimenter regardless of gender. Rappolt's (1979) study also supported the assumption that dogs direct affiliative behaviour patterns towards familiar persons and patters of aggression towards unfamiliar persons. Significant differences were found between dogs' responses to their owners and their responses to strangers. However, these studies only looked at readiness to approach an unfamiliar person. Of more interest might be determining if active physical contact with dogs is influenced by caretaker gender.

1.11. Outline of Hypotheses

This study aims to investigate the response of dogs to human approximations of dog calming signals. Types of dog arousal that may lead to attack, such as dominance and fearful submission, may potentially be reduced and controlled by utilising the language and signals that dogs use with each other. By manipulating experimenter body height and eye contact this study aims to show that these elements play a critical role in understanding dog behaviour.

A variety of literature supports the notion that human behaviour can alter dog behaviour. If one is interested in reducing dog aggression and arousal towards humans it is important to understand components of Canidae behaviour and the signals that affect them. Variables such as human body position, height, movement and eye contact may crucially affect dog behaviour. From this, the following hypotheses were generated:

1. The body language and behaviour of a person will critically affect the response of a dog towards a human.
2. If signals by dogs produce characteristic responses in other dogs, humans displaying similar signals will also produce these characteristic responses. In particular, a direct stare is likely to produce the most arousal, eye blinking less and head turning with eye aversion the least.

1.12. Research Design

A small-N (single-case) research design was considered most appropriate for this study. The unique feature of this design is the capacity to conduct valid experimental investigations with one subject. Although the term "single-case" design implies that only one subject is included in the investigation, this is usually not the case. In some "single-case" designs thousands of subjects have been included (Kazdin, 1982). What is a critical feature of these designs, is that the methodology requires repeated measures of performance of the same subject over time (Kazdin, 1982).

It has been argued that a more complete and accurate picture of individual behaviour can be obtained from a small-N design than from a large-N design that tests the same hypothesis. Gathering baseline data, applying the experimental manipulation, and then returning to the baseline condition obtains a very clear idea of the impact of the independent variable on that behaviour.

The principle of the small-N design is that each subject acts as its own control, by a process of repeated measurement of behaviour, providing internal validity (Cooper, 1987). The effect of different treatments on the behaviour of each subject is compared across conditions (Cooper, 1987). Data sets are organised by replicates, but replicates need not be multiple persons; they can equally be multiple occasions, multiple variables, or multiple experimental interventions (Franklin, 1996). This is important as it allows for valid inferences to be made about the behaviour of other individuals and other situations, thereby providing external validity.

In the present study each dog will be exposed individually to three approach behaviours adopted by the experimenters to allow treatment comparison. Small-N design is particularly appropriate for this study, as each dog will have an individual phylogenic and ontogenic history. This individual conditioning history could mean that unique triggers of behavioural arousal and behavioural patterns are observed in a subject.

An alternating treatments design was chosen for this study as it provides both an experimentally sound and efficient method for comparing the effects of three treatments being investigated. Alternating treatments designs are characterised by the rapid alternation of two or more treatments while their differential effects on a single target behaviour are measured (Cooper, 1987). The effect produced by the different variables is determined by the amount of vertical distance between the respective data paths, while experimental control is demonstrated when the data paths show little or no overlap (Cooper, 1987).

1.13. PAC Analysis

A prototype software programme called Preparation Analysis Conclusion, or PAC (Heinrich, 1999), was utilised as an extension of the data analysis. The use of PAC was exploratory in nature, with its main purpose being to examine how a more sophisticated analysis might provide a more detailed and perhaps more accurate analysis of behaviour compared to traditional methods of analysis. The use of PAC as an analysis tool involves digitising video sequences and developing a coding language to allow a more detailed analysis of behaviour than is possible, or feasible, with traditional techniques. It involves an observer developing an appropriate coded language and then viewing the digitised video sequences and labelling the various behaviours with the coded language. Later, any of the coded behaviours can be extracted and viewed either individually or rapidly in succession and graphed. It was thought that this study would be a useful examination of the PAC system as large quantities of videotaped data were generated and analysed. Only a small sample of the trials were analysed using PAC as the main aims were to ascertain if the two forms of analysis complement each other and to discern what additional advantages PAC provides. A more detailed description of PAC is provided at the end of Chapter 2 and the results from this method of analysis are presented at the end of Chapter 3.

1.14. Summary

Dogs, likes wolves, communicate important signals to one another within the pack. The literature on wild and domestic Canid social behaviour and communication provides evidence that dogs have characteristic signals for both producing and reducing arousal in conspecifics. A domestic dog raised within the human household may include humans as members of their pack (Fox, 1975; Fogle, 1995; Abrantes, 1997). If this does occur, information exchanges between the two species may evoke important changes in the behaviour of each of them. If humans emit similar signals to those used by dogs, either deliberately or inadvertently, they may affect the likelihood of arousal and hence aggression. Equally if they display submissive behaviour, this may reduce arousal or aggression when it occurs.

CHAPTER 2: METHOD

2.1. Participants

Four dogs served as subjects. People who, prior to the study, were not known to the experimenter voluntarily donated them. Dogs were chosen for "readability" of their physical attributes and expressiveness in their behaviour and because they could be handled without difficulty. Also, while they were not known to have attacked or bitten a human in the past they displayed a moderate amount of territorial aggression. Territoriality was determined by whether or not the dogs would bark at a stranger entering their owner's property.

The dogs, which varied in size and breed, comprised a Staffordshire Terrier Ridgeback cross (George), an English Springer Spaniel Setter cross (Max), a Great Dane Rottweiler Bull Mastiff cross (Houston) and a pure-bred German Shepherd (Diva). The ages of the dogs ranged from 12 months to 9 years old. Three of the dogs were female, one spayed (Diva), the other two entire (Houston and George) and the fourth dog was a neutered male (Max).

All four dogs were in good health, received regular exercise, and were reasonably well socialised towards both humans and other dogs. Max and George were raised together, as were Diva and Houston. Each of these pairs was housed together at the time of the experiment.

At the beginning of each day preceding the experimental trials, the dogs were collected from their homes and taken to the experimental centre. At the end of the day all dogs were returned to their homes where the owners maintained their normal exercise, feeding and handling regimes. Ethical approval for the use of the animals in this experiment was obtained from the Massey University Animal Ethics Committee.

2.2. Setting

The experimental area was a 5m x 5m room within a large animal housing area (Figure 10). The walls were approximately 6m high and did not reach the ceiling. This caused slight exposure to external stimuli, such as noise. A wire dog cage was placed in one corner of the room opposite the entrance that enabled visibility of the experimenter upon entering the room. A video camera was placed in the diagonally opposite corner to the cage with red paint markers on the floor to ensure correct alignment for every session. The position of the camera ensured that both the dog and the experimenter would be in full view throughout the session. Every session was videotaped.

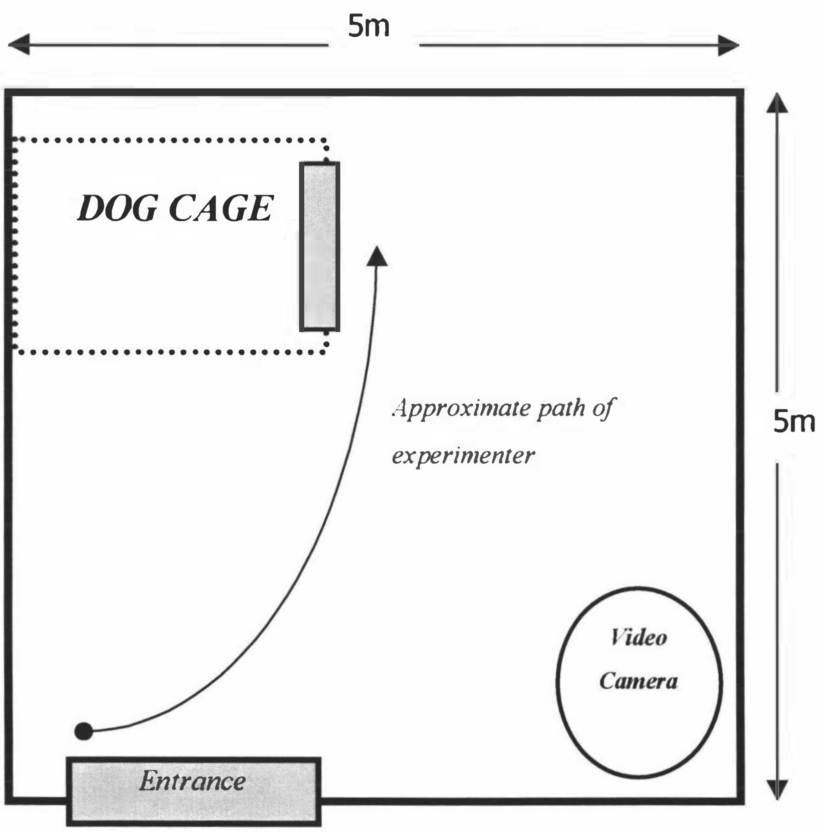


Figure 10. Set up of experimental area.

Lighting was provided by four hanging fluorescent tubes situated above the room and daylight through large open doors just outside the experimental area. Both the walls and floor were concrete, which allowed for easy hosing of the cage if a dog urinated or defecated. This was important, as any excrement may have distracted the other dogs. The door, which was mostly solid wood, had bars at the top that enabled easy monitoring of experimenter safety.

2.3. Independent Variables

Three human experimenters were used in the study. The primary experimenter was the author, a 22-year-old Caucasian female of small build with experience in dog handling. The other two experimenters were of medium build, with limited experience in handling dogs. One was a 22-year old Caucasian female and the other was a 22-year-old Caucasian male. All experimenters were previously unknown to the dogs. A 22-year-old male also assisted with the handling of the dogs. Ethical approval was obtained from the Massey University Human Ethics Committee, and human participants were given a consent form to sign (Appendix 2).

Three different approach behaviours by an experimenter were manipulated in the study. These were operationally defined as follows.

2.3.1. Head Turn

Walk calmly to the front of the dog cage keeping head turned away from the dog. Crouch down side-on to the cage and turn head 180° from the dog and do not look at the dog. Remain still throughout the trial.

2.3.2. Eye Blinking

Walk calmly to the front of the dog cage whilst looking in the direction of the dog and blinking eyes rapidly. Crouch down side-on to the cage but keep head turned towards the dog and maintain eye blinking and remain still.

2.3.3. Direct Stare

Walk calmly to the front of the cage square on at full body height with eyes open wide, making direct eye contact with the dog. Maintain this throughout the trial. Lean towards the dog keeping eyes large and maintain eye contact. Keep hands behind back and remain still.

2.4. Dependent Variables

The dog's level of arousal was assessed from postural attitudes, movements and vocalisations. This comprised six component behaviours: Tail Position, Head Position, Ear Position, Vocalisations, Yawning and Lip Licking.

A rating scale for each of the behaviours was developed from Fogles' (1995) body and facial posture flow chart. Figure 11 shows the body language of a dog changing from submissive to calm and alert to aggressive. The dog's behaviour was evaluated from the video recordings using a ten-second time sampling

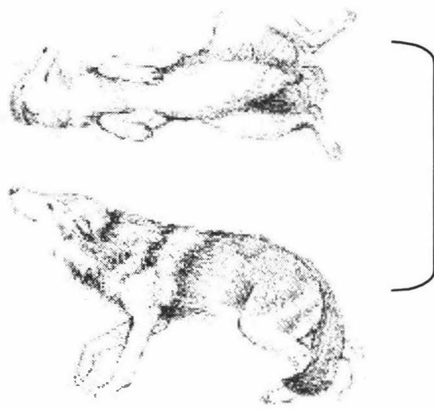
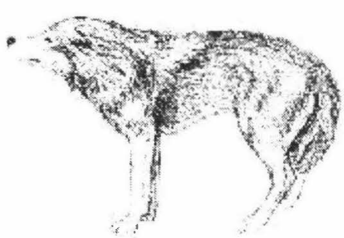
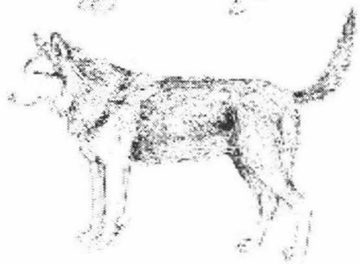
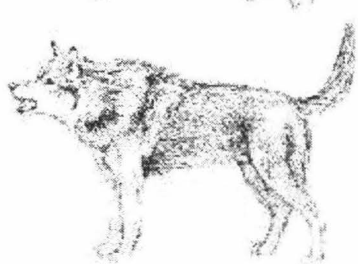
Body Position	Code	
	1	Extreme submission, showing lateral recumbance (top) and lowered ears and tail (bottom). The nose is raised and will often include lip licking.
	2	Submission with hunched back and lowered tail and ears.
	3	Calm and relaxed posture
	4	Increasing alertness and aggression. Tail and ears are raised.
	5	Extreme Aggression with bared teeth, raised hackles and forward posture.

Figure 11. Measures of dog arousal. *(Adapted from Abrantes, 1997).*

technique (Cooper, 1987). This consisted of stopping the video record at the end of each ten-second period and evaluating the subject's level of arousal on four of the dependent variables and recording this on a check sheet (Appendix 3). Level of arousal was rated according to which of the pictures in Figure 11 the dog most closely resembled. For the remaining two component behaviours, yawning and lip licking, a different scoring system was employed. A simple tally of occurrences throughout each trial was used with an increase in occurrences indicating an increase in arousal.

The component behaviours rated using the pictures in Figure 11 were Tail Position, Head Position and Ear Position. Picture 3 indicates a calm and relaxed dog. Pictures 4 to 5 depict increasing aggressiveness, with pictures 2 to 1 increasing submission. All pictures, except for 3, represent arousal whether it is dominance or submissive arousal and all may result in biting or attack. It was possible for a dog to have different ratings for the different component behaviours. For example, ears may attain a rating of 3 while head is scored as 2, and tail at 4. A similar scoring system of 1 to 5 was used for the Vocalisations measure (Table 2).

Table 2.

<u>Arousal Scores for Vocalisations Measure.</u>

Score 1 – The dog is continuously whimpering or yelping during the sampled period.

Score 2 – The dog is occasionally whining or whimpering during the sampled period.

Score 3 – The dog exhibits no vocalisations at all during the sampled period.

Score 4 – The dog exhibits some barking during the sampled period.

Score 5 – The dog barks continuously or growls at some time during the sampled period.

The level of dog arousal was calculated by adding over the whole two and a half minutes (or 15 ten-second intervals) of each trial the rating given in each of the ten-second intervals for the six behaviours. For example, if a dog's tail position is rated as calm (score of 3) for the entire trial, 3 x 15 ten second intervals gives an arousal score of 45. A score of 45 indicates that the dog is completely calm, or not aroused in any way. It was possible for a dog to achieve an overall rating of 45 for a trial when it had not remained completely calm throughout. For example, if it had scored a 1 in seven of the intervals, a 3 in one interval and a 5 in seven of the intervals it would still achieve a supposedly calm score of 45. Although this was potentially possible, it must be noted that this situation never occurred and so created no problem. Potentially the lowest score a dog could obtain on either tail, head, ear or vocalisations ratings is 15, that is if it scored 1 in every ten-second interval. Conversely, the highest level of arousal a dog could score is 75, that is if it scored the maximum of 5 for every ten-second interval. For the Yawning and Lip Licking measures the minimum a dog could score is zero, indicating no occurrences of the behaviours were recorded, while there was no limit on the maximum a dog could score.

2.5. Experimental Design and Procedure

An alternating treatments design with initial baseline phase and final "best treatment" phase (Cooper, 1987) was used to assess stimulus control over the dogs' behaviour by the primary experimenter. This was followed by additional phases to evaluate stimulus control by other experimenters. The alternating treatments design was used as it allowed a direct comparison between the alternating approaches (treatments) and further investigation of the treatment having the most effect on reducing dog arousal.

The study involved each dog in three to four trials per day during the baseline and alternating treatments phases and one or two trials during the other phases. Trials were run on most days. For each trial the assistant led the dog into the experimental room where it was left to become accustomed to the surroundings for two minutes (five minutes during the first week). The experimenter then entered the room marking the beginning of the trial, which lasted two and a half minutes. A bell was sounded at the end of the trial and the experimenter then left the room and the assistant removed the dog.

The initial baseline phase started concurrently for all subjects, however, the alternating treatments and preferred treatments phases were staggered. All phases lasted at least four trials and more if the dog's behaviour was unstable or showed an upward or downward trend. This was assessed for each dog and for each component behaviour individually.

2.5.1. Baseline 1 (B1)

The primary experimenter made a Direct Stare approach in all trials. This phase continued for a minimum of ten trials or more if necessary to ensure stability was maintained over time.

2.5.2. Alternating Treatments (AT)

The alternating treatments phase directly followed Baseline 1. The alternating treatments phase was similar to the baseline except that each of the three approaches was applied on different trials in a random but counterbalanced order. This phase lasted a minimum of eight trials.

2.5.3. Preferred Treatment 1 (PT1)

Following the alternating treatment phase, the most effective of the three approaches, across all dogs, was singled out. This phase involved using only the Head Turn approach for a minimum of four trials.

2.5.4. Baseline 2 (B2)

Following PT1 baseline conditions (Direct Stare) were reinstated for a minimum of four trials.

2.5.5. Preferred Treatment 2 (Across Experimenters) (PT2)

Following B2, secondary experimenters (one male, one female) were introduced to the study. The two secondary experimenters were instructed to follow the same procedure as that used by the primary experimenter in PT1. Each secondary experimenter had four trials with each dog. The order of secondary experimenters was randomised and counterbalanced across trials.

2.5.6. Baseline 3 (Replication of Effects across Experimenters) (B3)

Baseline conditions were then reintroduced for all dogs, with each of the two secondary experimenters on a randomly assigned trial. This involved each experimenter in four trials with each dog,

2.5.7. Preferred Treatment 3 (Across Experimenters) (PT3)

Following B3, Preferred Treatment conditions (Head Turn) were reinstated for the secondary experimenters in four trials with each dog.

2.6. Inter-Observer Reliability

Two observers (the primary experimenter and the dog-handling assistant) were trained to evaluate the videotape data using the dog behavioural definitions and pictures of dog attitudes.

Inter-observer agreement of the dependent variable was computed using the interval-by-interval method (Cooper, 1987) which involved dividing the number of agreement intervals by the total number of agreement intervals plus disagreement intervals and multiplying by 100. If two observers scored all the dogs postures (DV) as the same, an agreement was scored; otherwise a disagreement was scored.

Inter-observer agreement checks were carried out on 25% of the trials, randomly chosen across phases and subjects. An overall agreement percentage of 92% was achieved with a range from 83% to 100%. Inter-observer agreement scores with agreements, disagreements and overall scores are presented for each subject and phase in Appendix 4. These inter-observer agreement scores were considered more than adequate for this type of data (Cooper, 1987). Only the data obtained by the primary observer for each trial are included in the study.

2.7. Intra-Observer Reliability

Intra-observer reliability measures the extent to which a single observer obtains consistent results when measuring the same behaviour on different occasions (Martin, 1995). Since the primary observer was involved in rating much of the data over time, intra-observer reliability checks were carried out on 5% of the trials rated by the primary experimenter (Appendix 5). An overall agreement percentage of 93% was achieved with a range from 88% to 97%.

2.8. Treatment Integrity

The experimenter's behaviour was also checked for consistency and correctness in approach on 25% of all trials. This is to ensure that the independent variables (the experimenter's approach behaviours) were applied exactly as planned and that no other unplanned variables were inadvertently administered along with the planned treatment.

In order to assess the treatment integrity, Direct Stare, Head Turn and Eye Blink were evaluated from the videotapes using ten second time sampling on a check sheet (Appendix 3). A tick mark was recorded if the observer agreed the experimenter complied with the behavioural definition for the appropriate treatment and a cross if the observer disagreed. Treatment integrity was determined by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Agreement was scored 91% of the time.

2.9. PAC Analysis

The idea of the PAC software is to support a study from the beginning to the end, from preparation through analysis to conclusion. PAC consists of 10 modules, which are grouped, according to their function, into Preparation, Analysis, and Conclusion (Figure 10).

2.9.1. Study Files

Thirteen video sequences, or trials, were digitised using the subject Max across the various phases. These sequences made up what were identified by PAC as the study files – behavioural recordings, either video, text, audio and/or images. In this study they were video clips with sound.

2.9.2. Vocabulary

PAC's major advantage was its ability to form a detailed analysis. This analysis takes the form of questions regarding the behaviour being displayed on the video, in this case the interactions between the dog and the human. In order for the software to interpret the question, a special vocabulary, or Coding Language, had to be developed and entered into the computer. This simply involved listing all the words needed to describe the behavioural events or concepts likely to be found

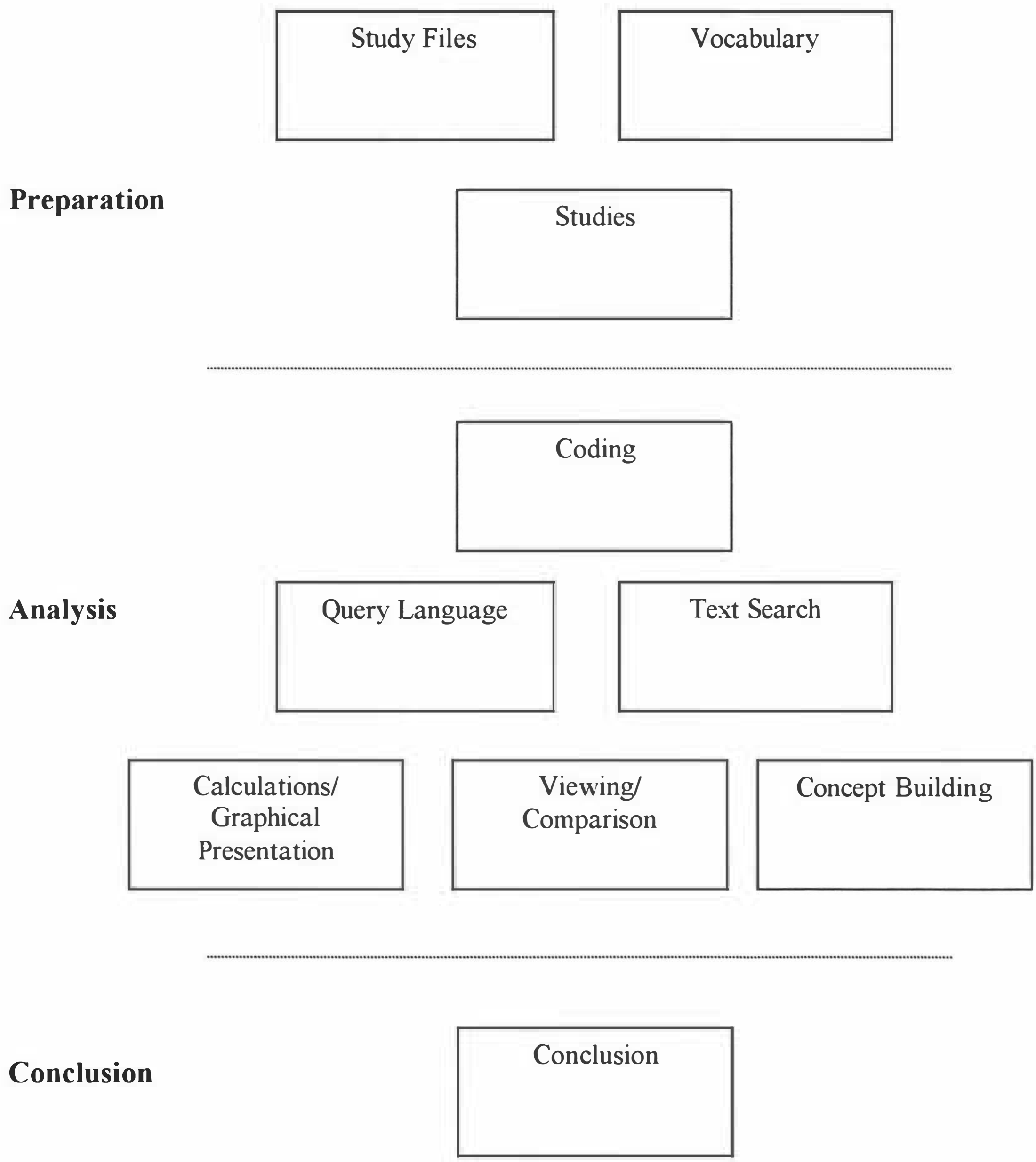


Figure 12. The PAC Modules *(adapted from Heinrich, 1999).*

in the study (Table 3). This process required precise thought about what was being described. There were many instances where the same behaviour could be described by several different sentences, each with a slightly different emphasis. For example, 'dog has upright head-position,' 'dog has upright head,' and 'dog holding up head.' It was important that each behaviour only had one definition in order to aid later querying.

Although some of the terms made no sense behaviourally, they did logically. This could be seen especially with the concept of vocalisations. Since it is behaviourally just as important to know when the dog is silent, as when it is whining or barking, a continuous description of the dog's vocalisation status was implemented. It was necessary to indicate that at a given point of time no vocalisations occurred, in other words the non-occurrence of behaviour. From this the 'word' NonVocalisations was added into the vocabulary.

2.9.3. Studies

Parallel to the development of the vocabulary, digitised video recordings were introduced into PAC. Defining the studies, giving them a name, description and identifying which words of the vocabulary to use in the study followed this.

2.9.4. Coding

The next stage involved the coding. This was where a coding sentence, formulated from the developed vocabulary, was connected with an exact location in a study file. The codes could be stored in different "sets" to allow for separate description by different observers, for description in different phases. For the present study this involved playing through each digitised sequence and separately coding for Ear Position, Tail Position, Head Position and Vocalisations. Yawning and Lip Licking were excluded due to their lack of significance found using more traditional methods of analysis. However, another category called "external noise" was coded for, and simply involved recording the specific time and duration of any external noise that may have caused interference or behavioural changes in the dogs. The coding sentences contained the following information:

- The start and end time of the behaviour described within 1/100 of a second
- The phase the trial belonged to, i.e. Baseline, alternating treatments, preferred treatment etc.
- The treatment performed, i.e. Direct Stare, Eye Blink or Head Turn
- The experimenter performing the treatment, i.e. experimenter 1, experimenter 2 or experimenter 3
- The observer conducting the coding, i.e. observer 1 or observer 2
- The name of the dog, Max
- A description of the behaviour being observed

Table 3. Vocabulary used to Develop Coding Language

Person/Thing

- Dogs
  - Max
  - Diva
- Experimenter
  - experimenter 1
  - experimenter 2
  - experimenter 3
- Observer
  - observer 1
- dog
  - head
  - ears
  - leg
  - tail
- cage
- ground

Action

- Vocalisation
  - NonVocalisation
  - RealVocalisation
    - Barking
    - growling
    - yelping
    - whining
- General-Action
  - has
- Action
  - Wagging
  - turning
  - looking
  - looking-around

Concept

- External Noise
  - Noise human
  - Noise dogs
  - Noise other animals
  - Noise other
- Position
  - head-position
  - tail-position
- Intervention
  - directStare
  - headTurn
  - eyeBlink
- Phases
  - baseline1
  - alternatingTreatments
  - preferredTreatment1
  - baseline2
  - preferredTreatment2

Conjunction

- and
- while

Preposition

- between
- at

Descriptor

- Pace
  - slowly
  - quickly
- Desc(Position)
  - frontal
  - relaxed
  - raised
  - sideways
  - upright
  - lowered
  - turned-away
- Desc(Height)
  - high
  - medium-high
  - medium-low
  - low
  - unclear

Each behaviour was coded separately and provided a continuous description of the behaviour across the whole 2½ minutes of video footage. Examples of coded sentences are presented in Table 4.

Table 4.

Examples of Coded Sentences for Behaviour Descriptions from Several Trials.

594	1294	B1 DS exper1 obs1 while Max has raised ears
859	1209	PT1 HT experl obs1 while Max has lowered tail-position and quickly wagging tail
94	255	AT HT exper1 obs1 while noise OtherAnimals
9795	9960	B1 DS exper1 obs1 while Max NonVocalisation
9960	10836	B1 DS exper1 obs1 while Max whining
0	561	AT HT exper1 obs1 while Max has unclear ears

2.9.5. Query Language

Following the coding, the query language could then be used. The query language was based on the coding language but offered a number of options to identify specific coding sentences. This language enabled the user to ask the programme specific questions pertaining to the coded sequences. For example, 'show me all instances when Max has his ears raised and is barking?' or 'show me the next five recorded events.' The query results are coding sentences relating to a specific position in a specific study file (video clip).

2.9.6. Text Search

The Text Search enabled the user to search for any text strings in the coding. It could be defined which coding set the search was to apply to, and the results could be used to count or view specific sequences.

2.9.7. Graphical Presentation/ Viewing/ Comparison/ Concept Building

Based on these results, frequencies and duration of behaviours could be calculated and presented in graph form to allow comparisons, to see developments of a specific behaviour or to check inter-observer reliability. Some selected sequences in the behaviour recordings could be viewed in slow or fast motion or parallel to other sequences. During the study, relationships between concepts seemed apparent. For example, it may be that when the dog's ears were flattened or lowered it also expressed submissive whining. These relationships between concepts could be recorded and presented in graphical form. These results can be either counted as the basis for quantitative calculations or comparisons, or they could be used to view the specific sequences in the study files. The query results were interpreted and additional queries were applied to the existing code instances, which meant a repetitive process of coding, querying and interpretation ensued.

2.9.8. Conclusion

The conclusion is all the elements from the analysis steps combined to form a presentation of the study findings. The primary use of the PAC system in the present study was as an exploratory measure of the accuracy and validity of the traditional methods of analysis. It also served as an analysis of the component behaviours used to measure the dependent variables.

The general aim was to get a more detailed and accurate description of the dogs' behaviours, less prone to subjective bias. There is evidence to suggest that even trained observers can be influenced by expected outcomes (Cooper, 1987). By rating more specific behaviours and sub-behaviours it was expected that this observer bias should be reduced. It should also be possible to more readily investigate the individual components being responded to by observers. This should lead to more accurate defining of behaviours and subsequent checks on these definitions should be easier since all examples of any behaviour can be viewed rapidly in sequence or even in parallel. It should also allow for checking of any changes in accuracy over time and better assist calibration of observers.

While, in principle, all of these tasks can be done with conventional video clips, the task would be considerably harder, especially because of the time taken to move to different parts of the videotape. Coding and rating behaviours is still a considerable task even with digitised images, but it is quicker than with video clips. Typically the task involves going repeatedly over some sequences. A shorter total time spent doing this will allow more sequences to be measured and in greater detail if necessary. Further, being able to move quickly between sequences will reduce errors of fatigue and also errors due to memory lapses when moving between different behavioural sequences.

Since the main emphasis of this study was to explore new ways to investigate these research questions, it became obvious that in the given time it would not be possible to cover all the questions, analyse a substantial amount of data and establish plausible answers to the questions posed. However, a small percentage of the behavioural recordings were analysed with the results being presented at the end of Chapter 3.

CHAPTER 3: RESULTS

The responding of each dog on each of the arousal measures across all phases is presented in graphical form in Figures 13-36. Responding by Max, George, Diva and Houston, respectively, is shown for Tail Position (Figs 13-16), Head Position (Figs 17-20), Ear Position (Figs 21-24), Vocalisations (Figs 25-28), Yawning (Figs 29-32), and Lip Licking (Figs 33-36). For the first four measures (Figs 13-28) a score of 45 indicates a state of calmness in the dog while anything above 45 indicates dominance, and anything below 45 indicates submission. The last two measures (Figs 29-36) show the rate of occurrence of Yawning and Lip Licking for the subjects over each trial. For all graphs each data point represents one trial. For the Alternating Treatments (AT) phase, a block of three trials is shown above each point on the x-axis, one for each of the three treatments. Similarly, the second Preferred Treatment (PT2), third Baseline (B3) and third Preferred Treatment (PT3) phases show a block of two trials above each point, one for each of the secondary experimenters. For the remaining treatments, one data point is shown above each point on the x-axis.

Since the Yawning and Lip Licking measures were found to be less consistent, the first part of this chapter concentrates on the first four measures of arousal, that is, the Tail, Head and Ear positions, and Vocalisations. In the latter part of this chapter the Yawning and Lip Licking measures are briefly addressed followed by a brief summary of the behaviour of the dogs across all trials and phases. Finally, results from the PAC analysis are presented.

3.1. Baseline 1 Phase (B1)

In the B1 phase, with the Direct Stare treatment in effect, the Tail Position of all dogs was around 44. Across the phase, however, the levels showed a slight upward trend with Max and Diva and a slight downward trend with George and Houston. All dogs had a Head Position around 43, although for George this occurred after initial levels, which began at 41. Ear Position was around 42-43 on most occasions although Houston's responding showed considerable variation across the phase. Vocalisations varied between dogs but were reasonably stable around 42-44 except for Max whose level was usually around 37.

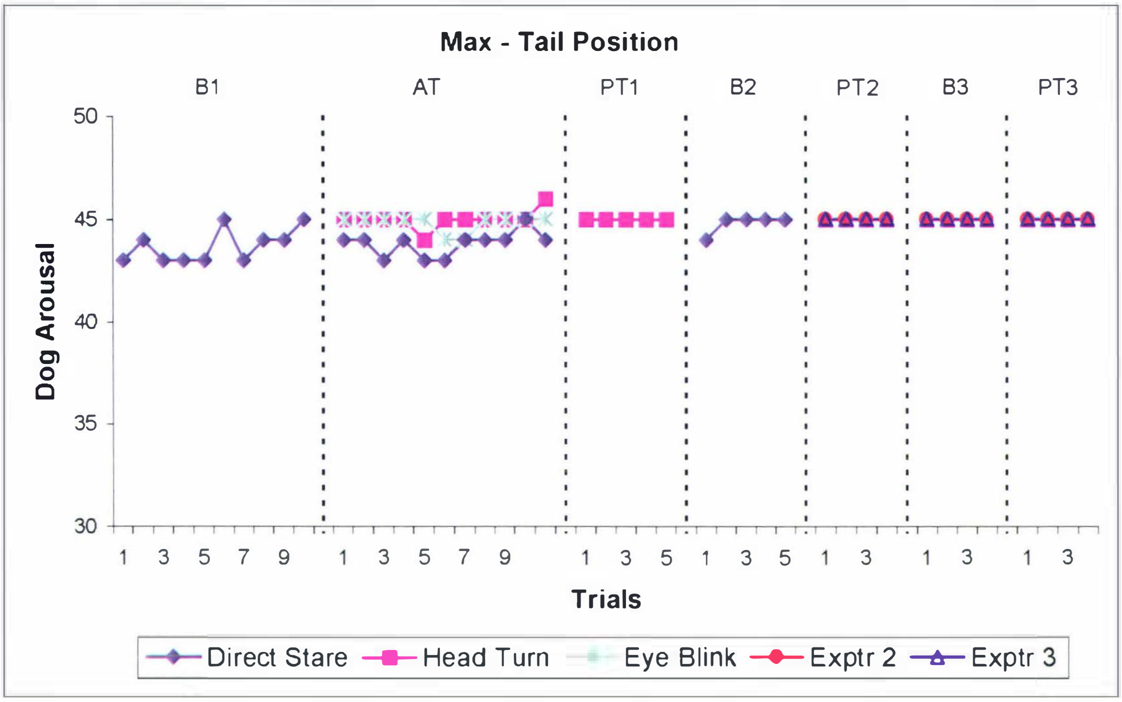


Figure 13. Arousal scores for Max as measured by Tail Position

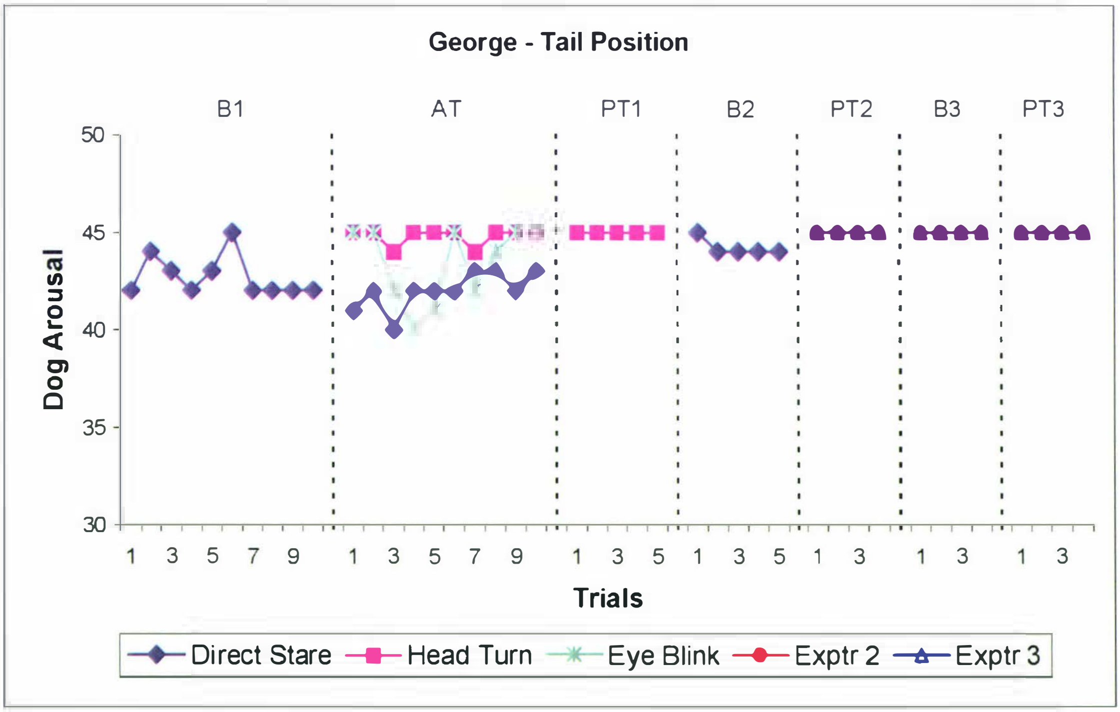


Figure 14. Arousal scores for George as measured by Tail Position

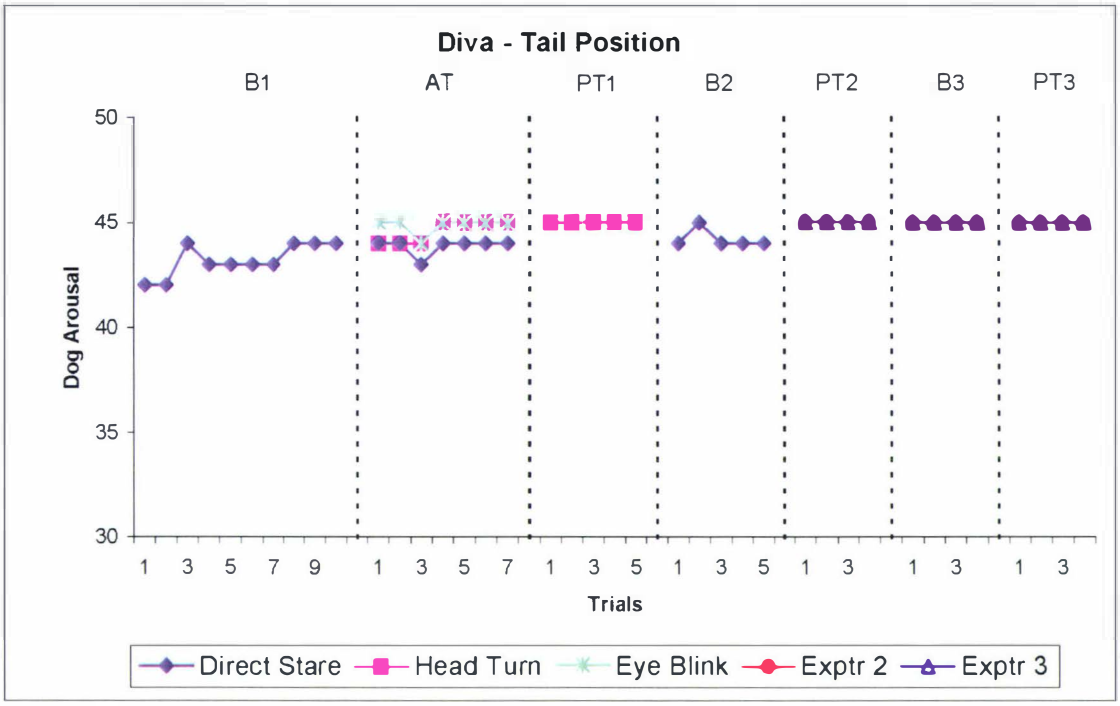


Figure 15. **Arousal scores for Diva as measured by Tail Position**

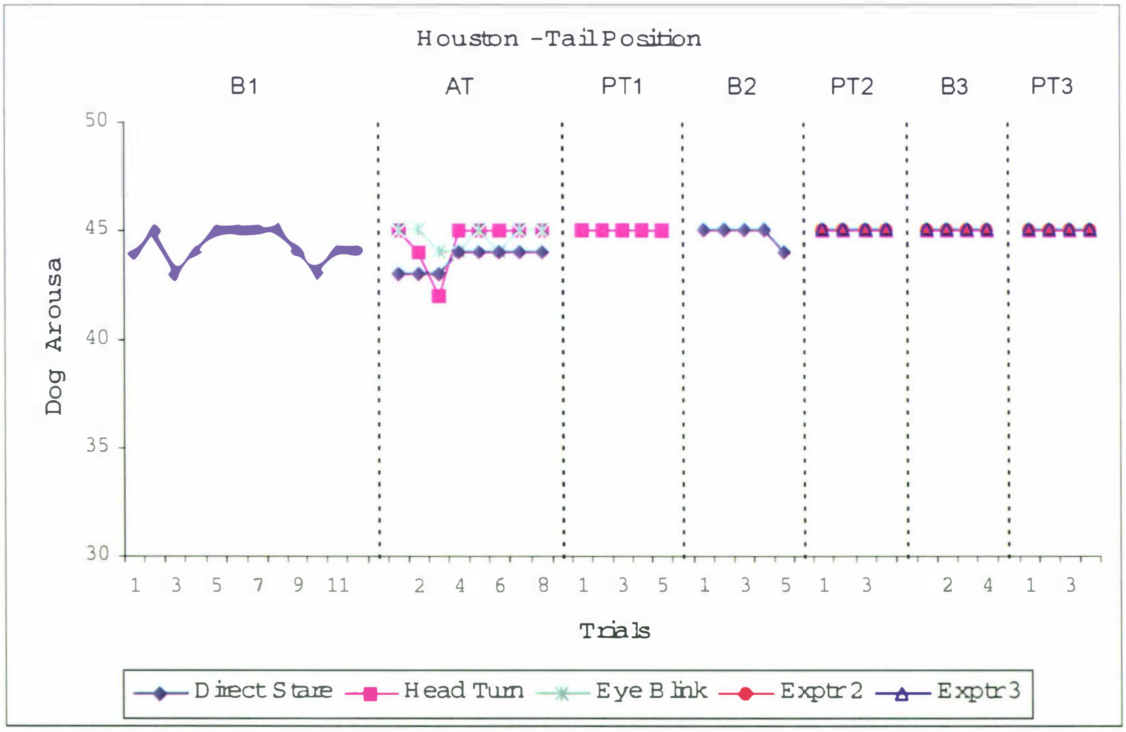


Figure 16. **Arousal scores for Houston as measured by Tail Position**

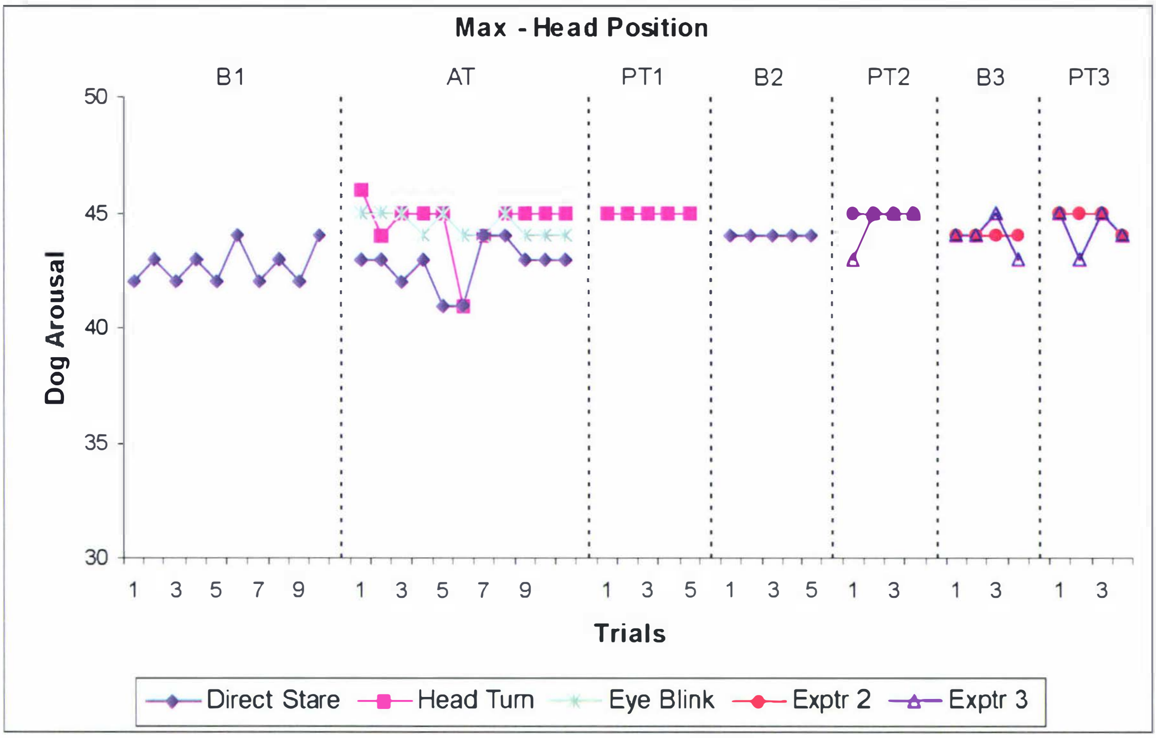


Figure 17. **Arousal scores for Max as measured by Head Position**

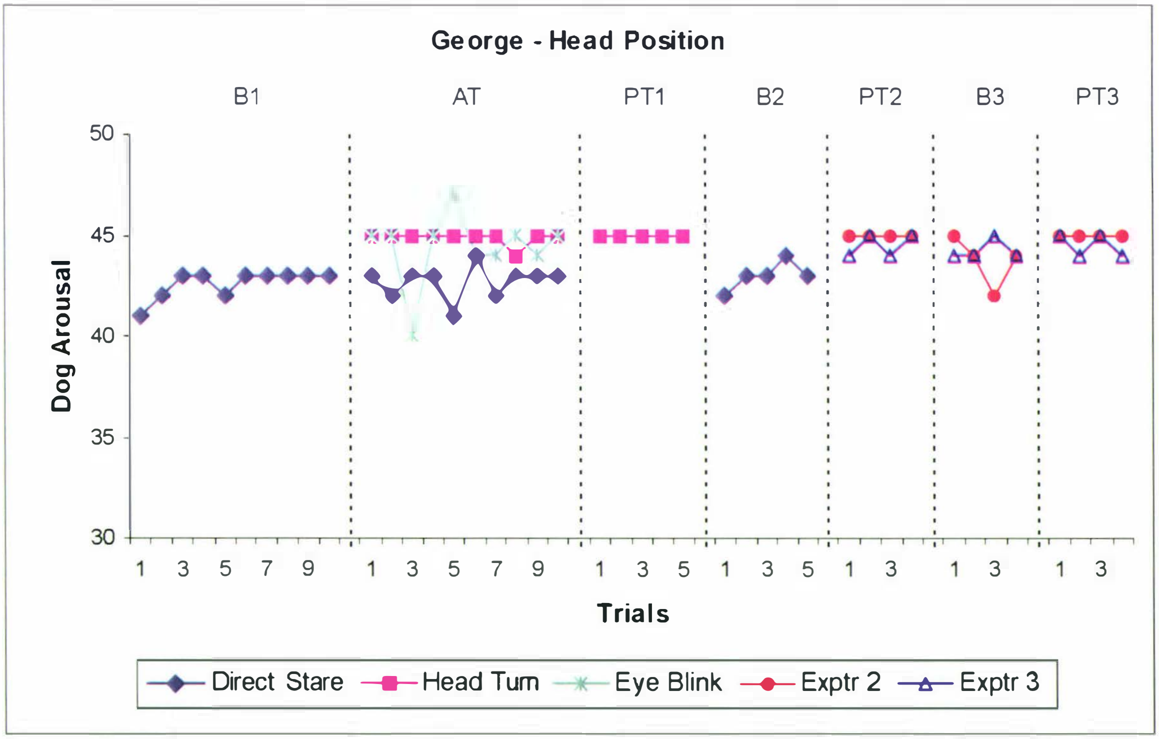


Figure 18. **Arousal scores for George as measured by Head Position**

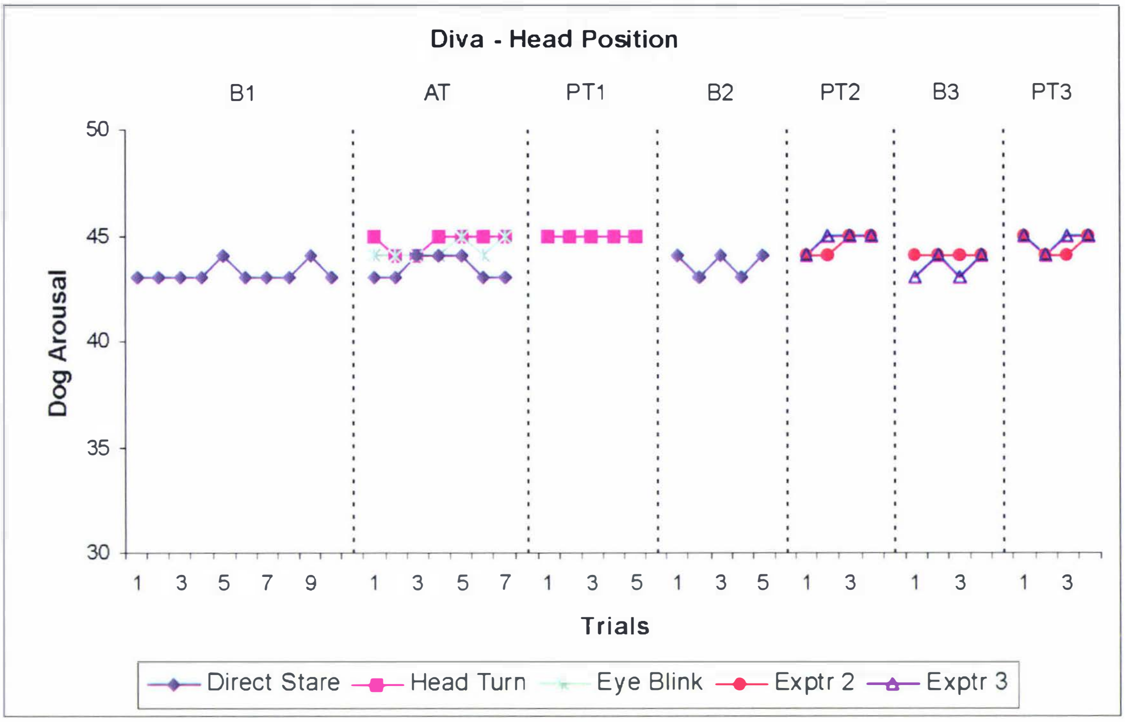


Figure 19. Arousal scores for Diva as measured by Head Position

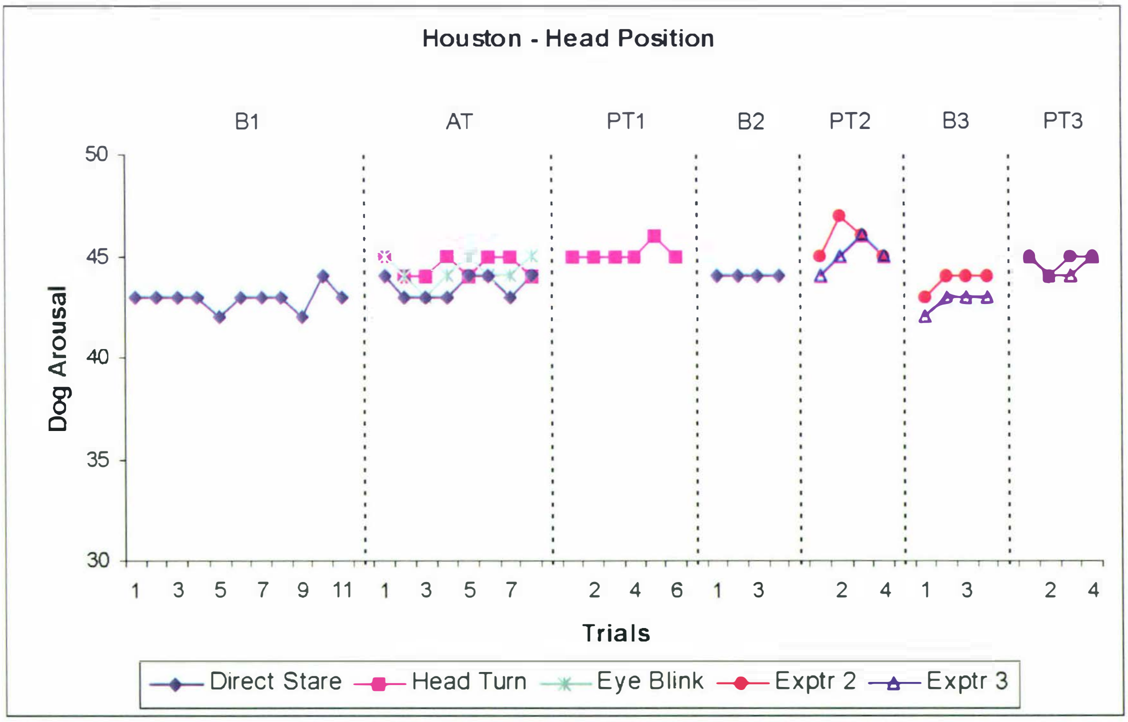


Figure 20. Arousal scores for Houston as measured by Head Position

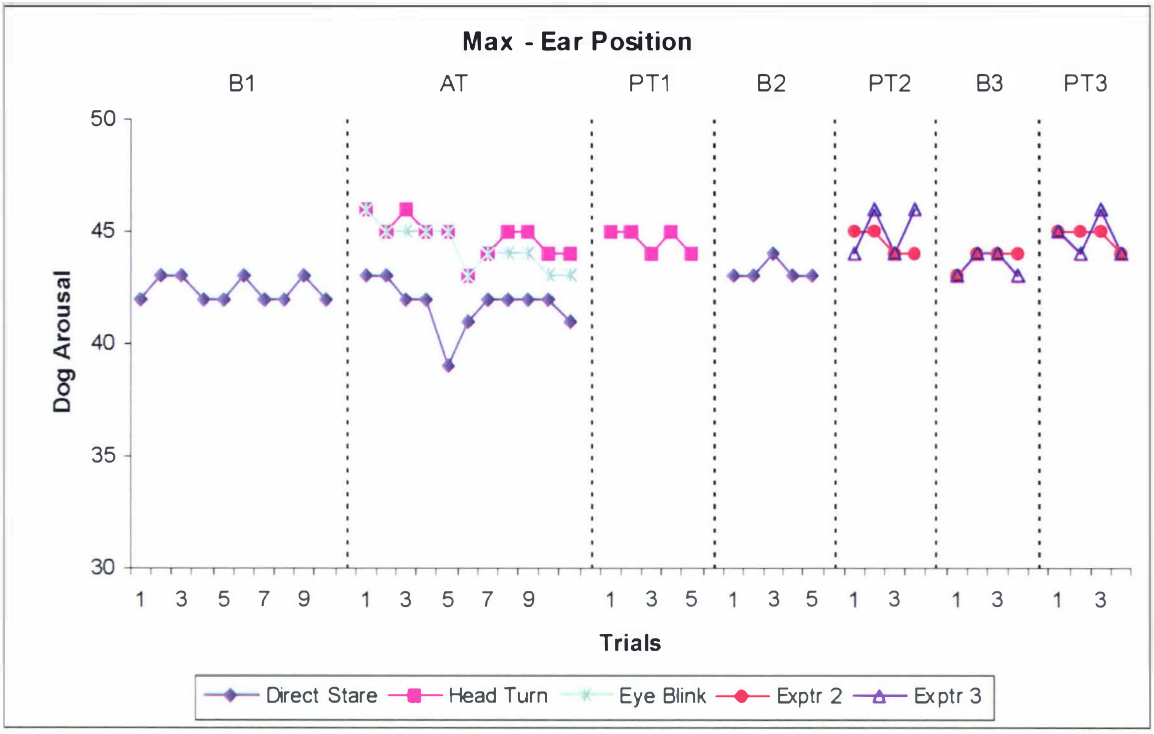


Figure 21. Arousal scores for Max as measured by Ear Position

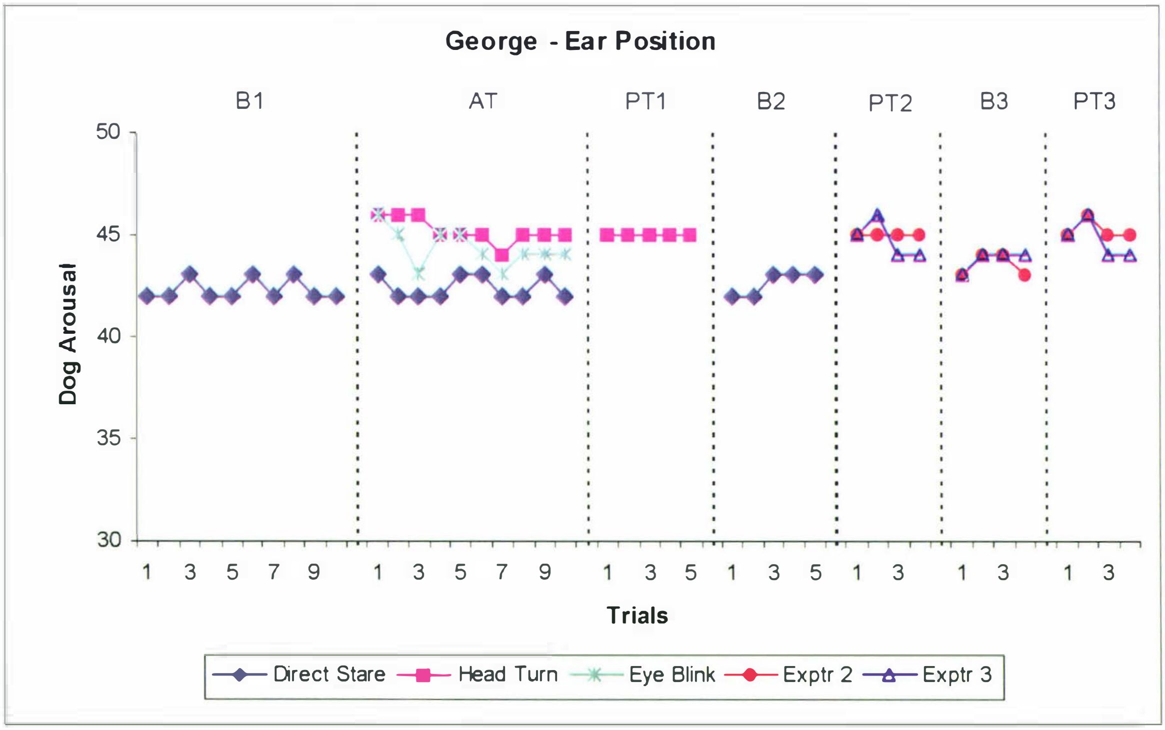


Figure 22. Arousal scores for George as measured by Ear Position

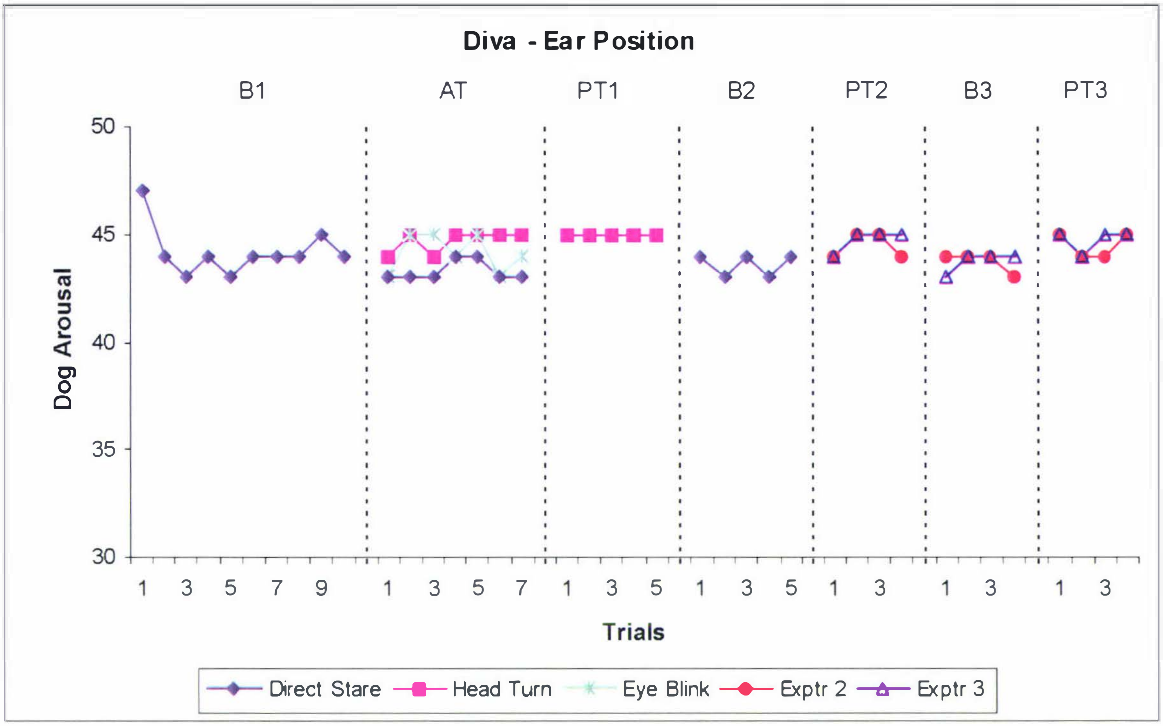


Figure 23. Arousal scores for Diva as measured by Ear Position

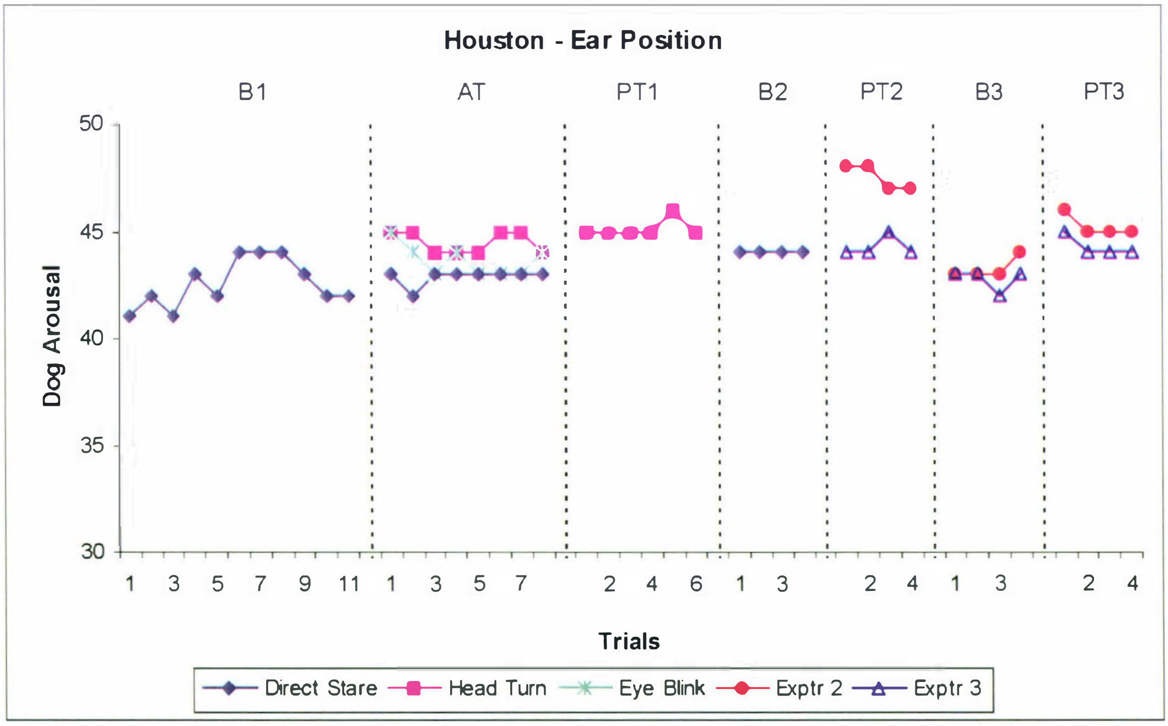


Figure 24. Arousal scores for Houston as measured by Ear Position

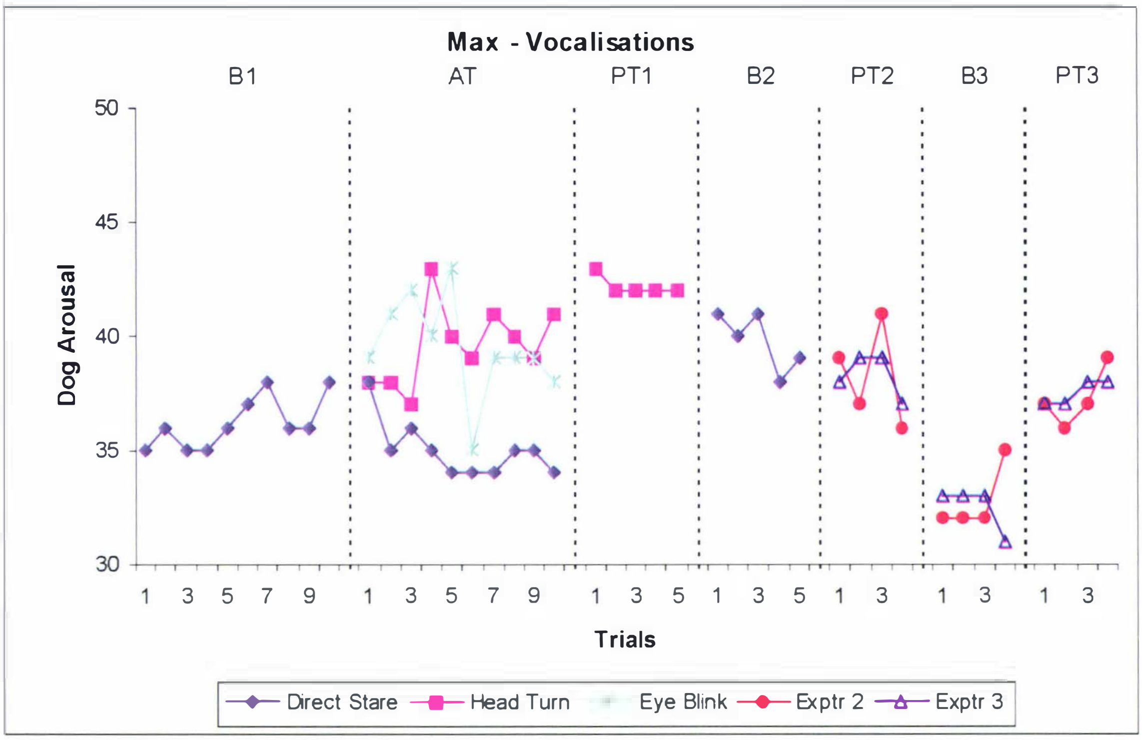


Figure 25. Arousal scores for Max as measured by Vocalisations

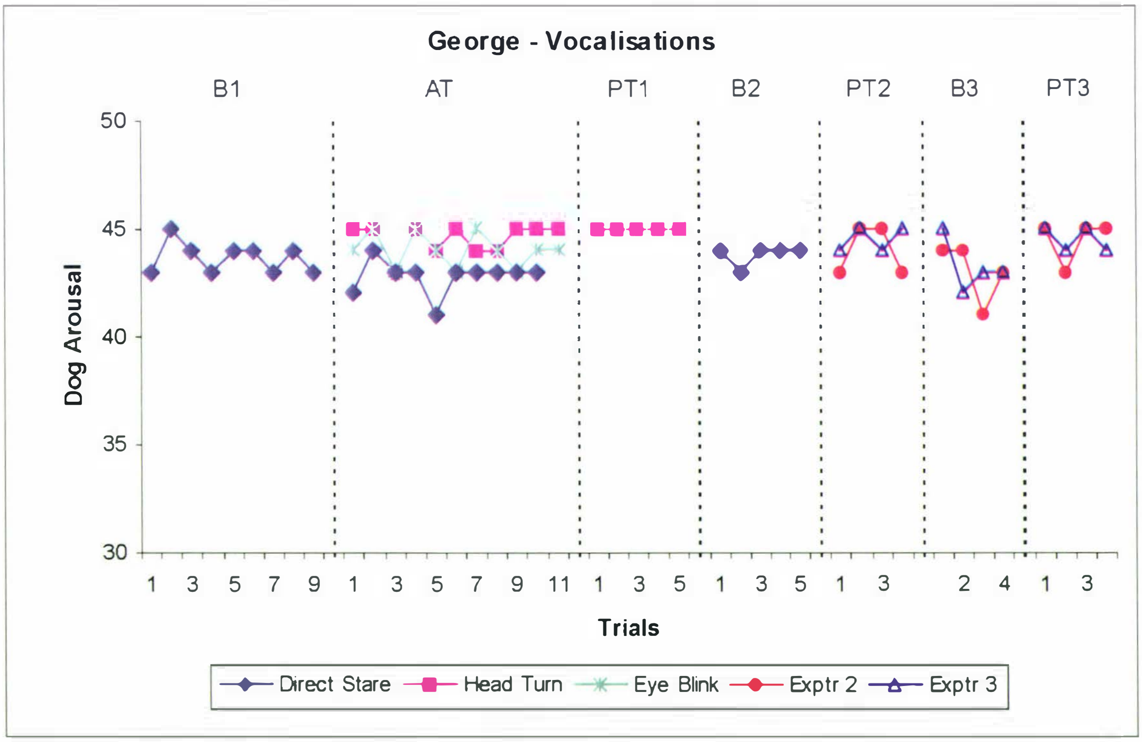


Figure 26. Arousal scores for George as measured by Vocalisations

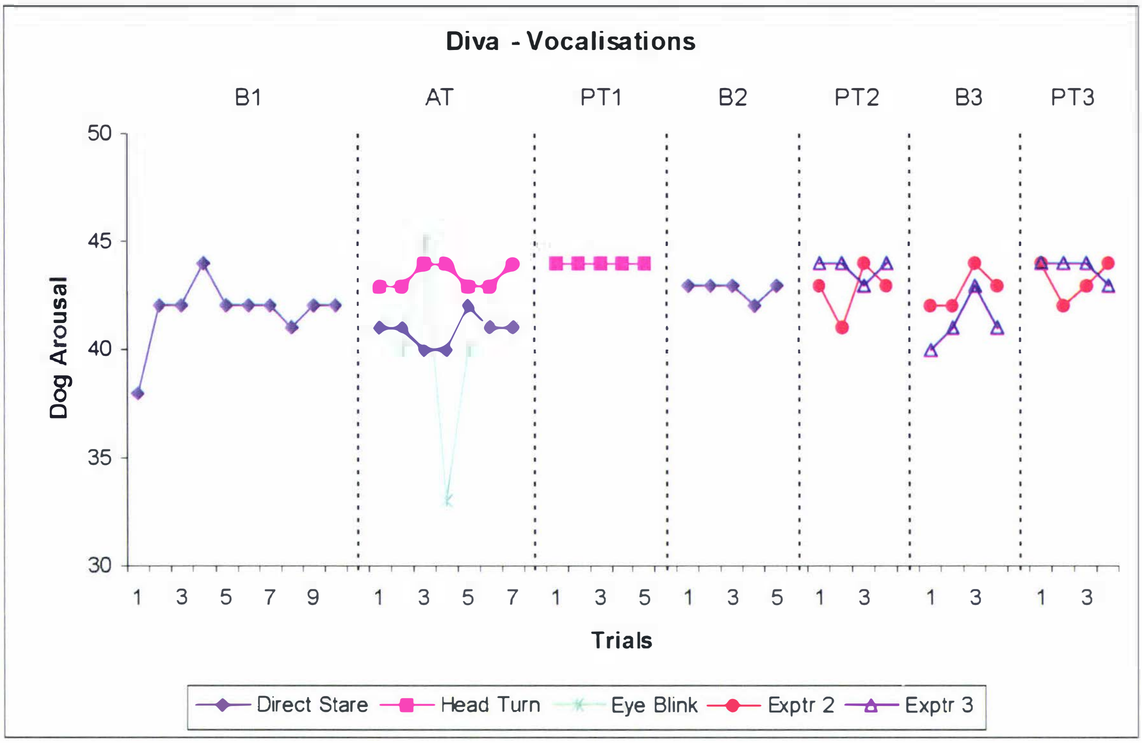


Figure 27. Arousal scores for Diva as measured by Vocalisations

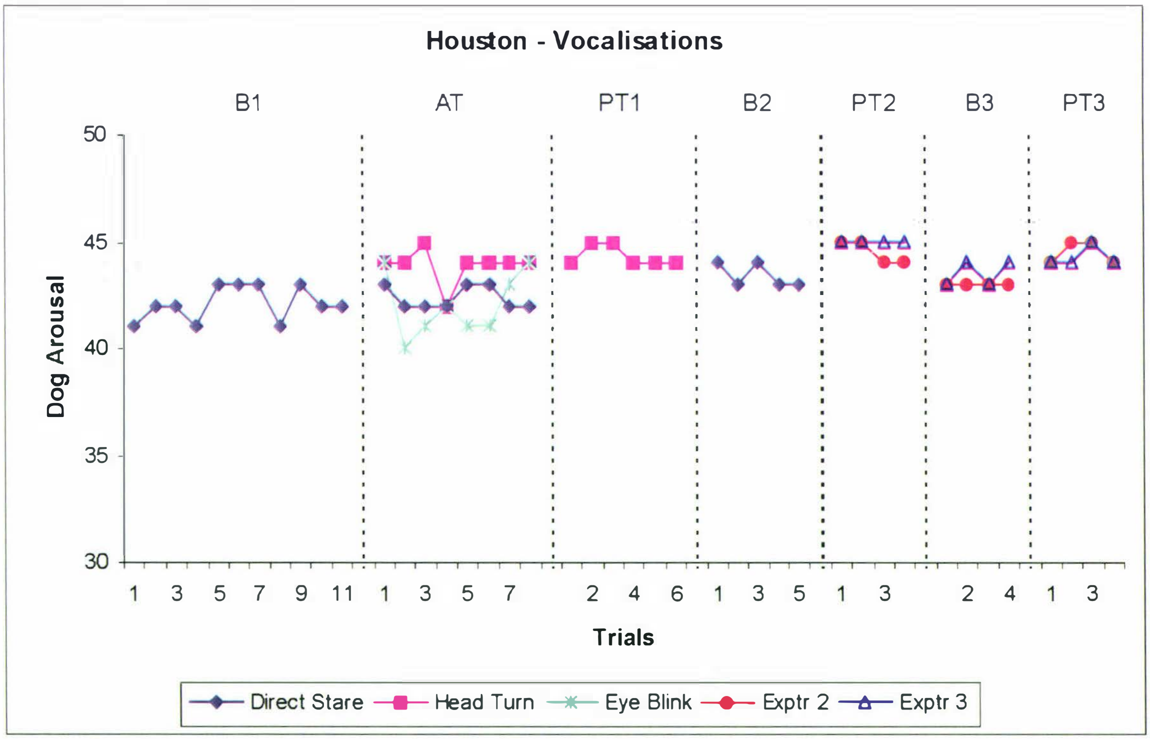


Figure 28. Arousal scores for Houston as measured by Vocalisations

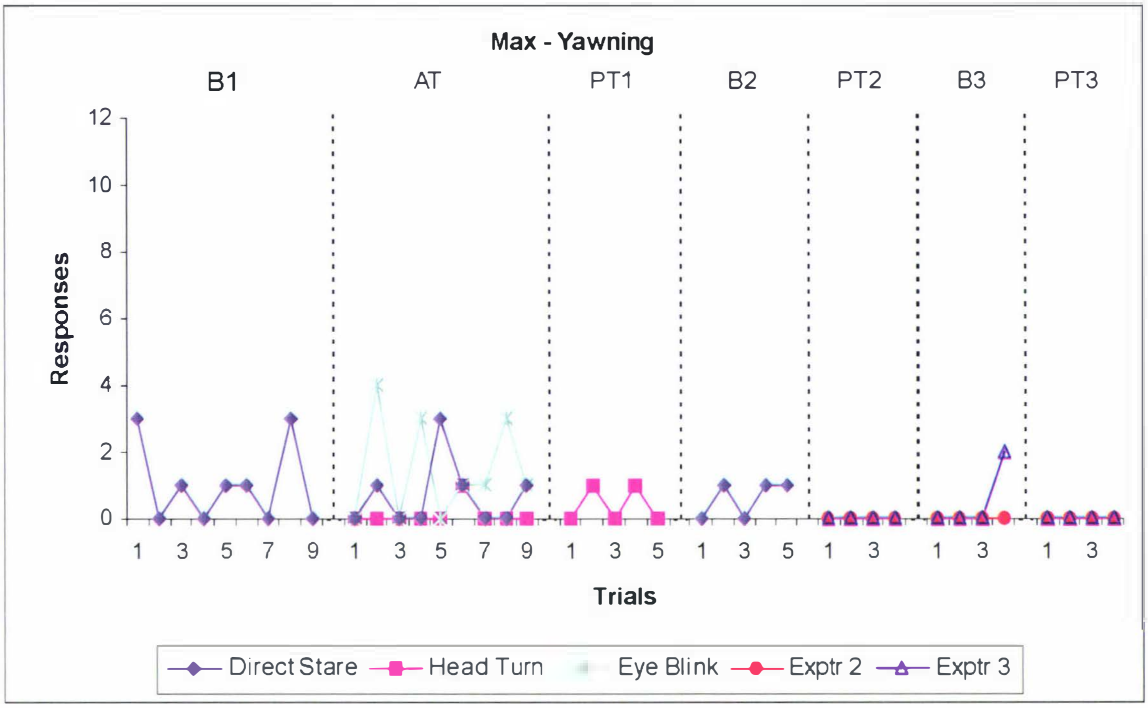


Figure 29. Arousal scores for Max as measured by Yawning

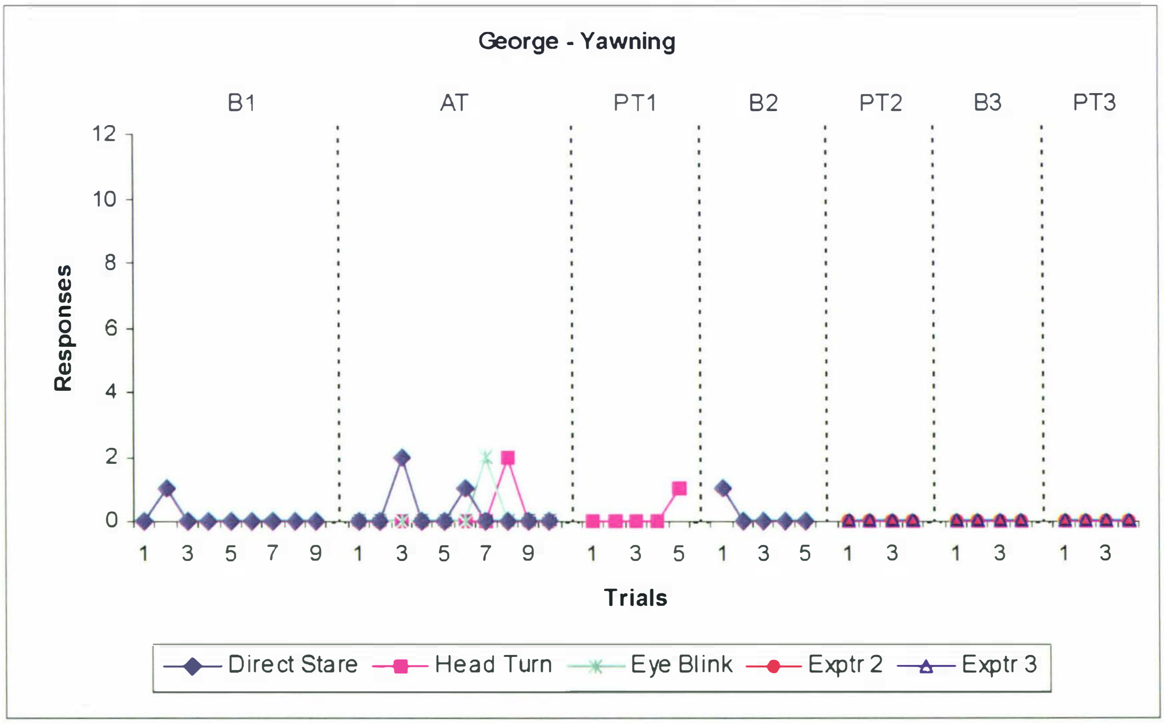


Figure 30. Arousal scores for George as measured by Yawning

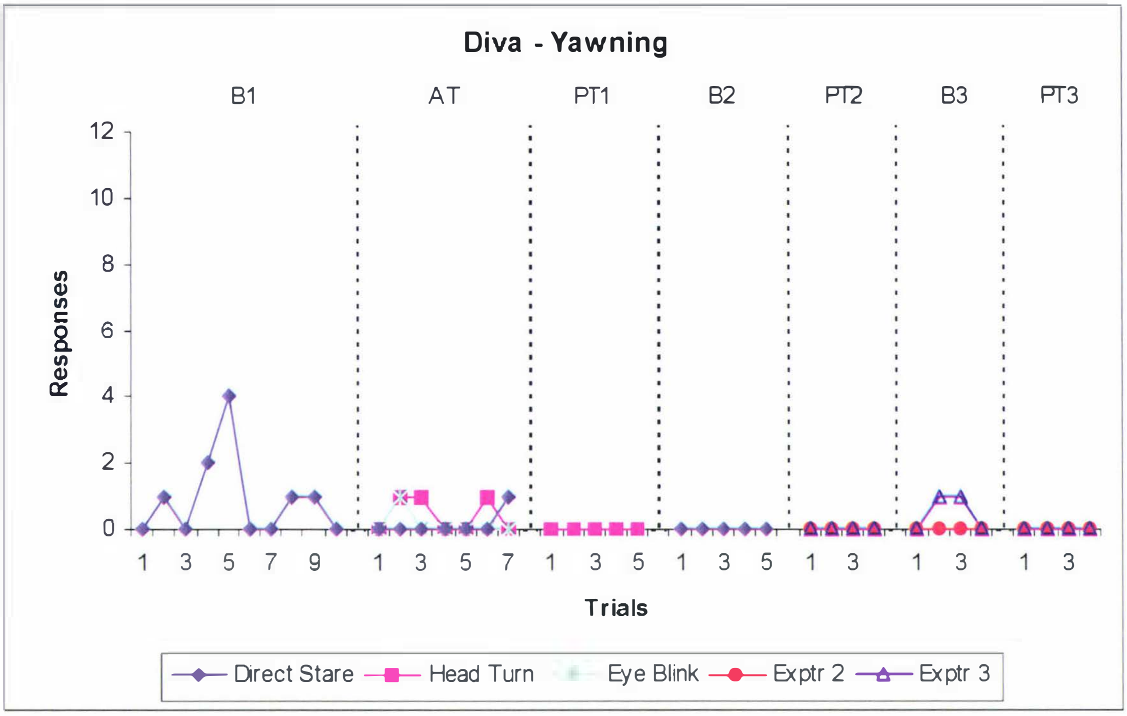


Figure 31. Arousal scores for Diva as measured by Yawning

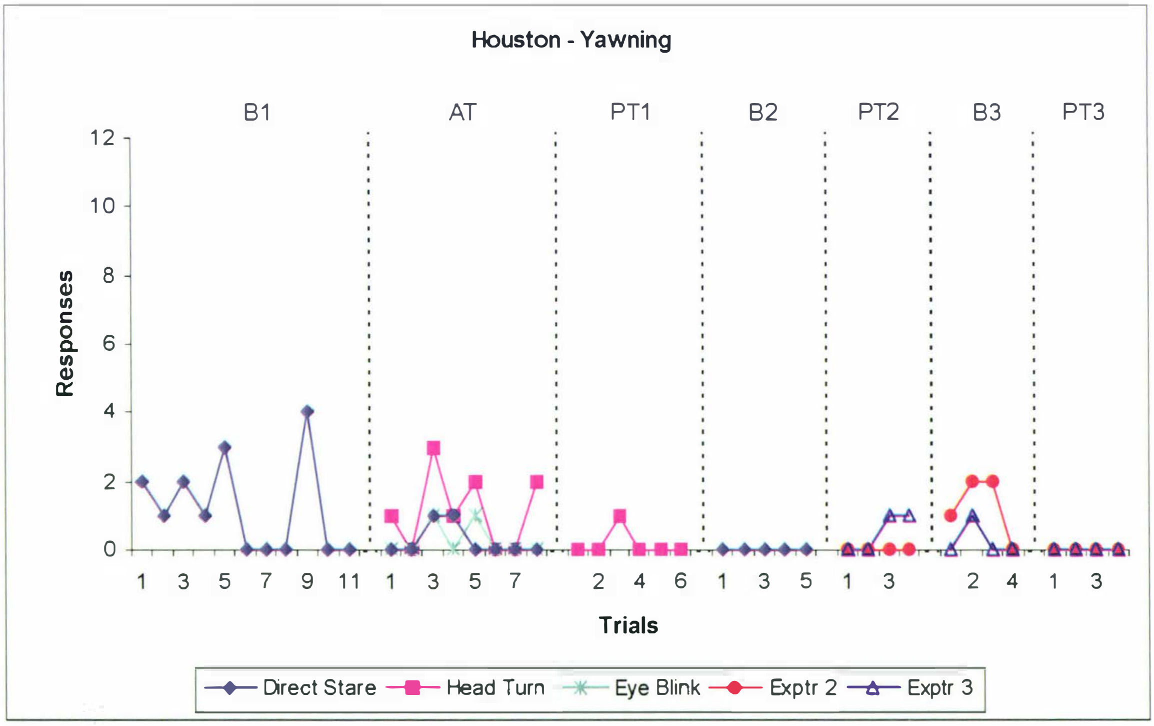


Figure 32. Arousal scores for Houston as measured by Yawning

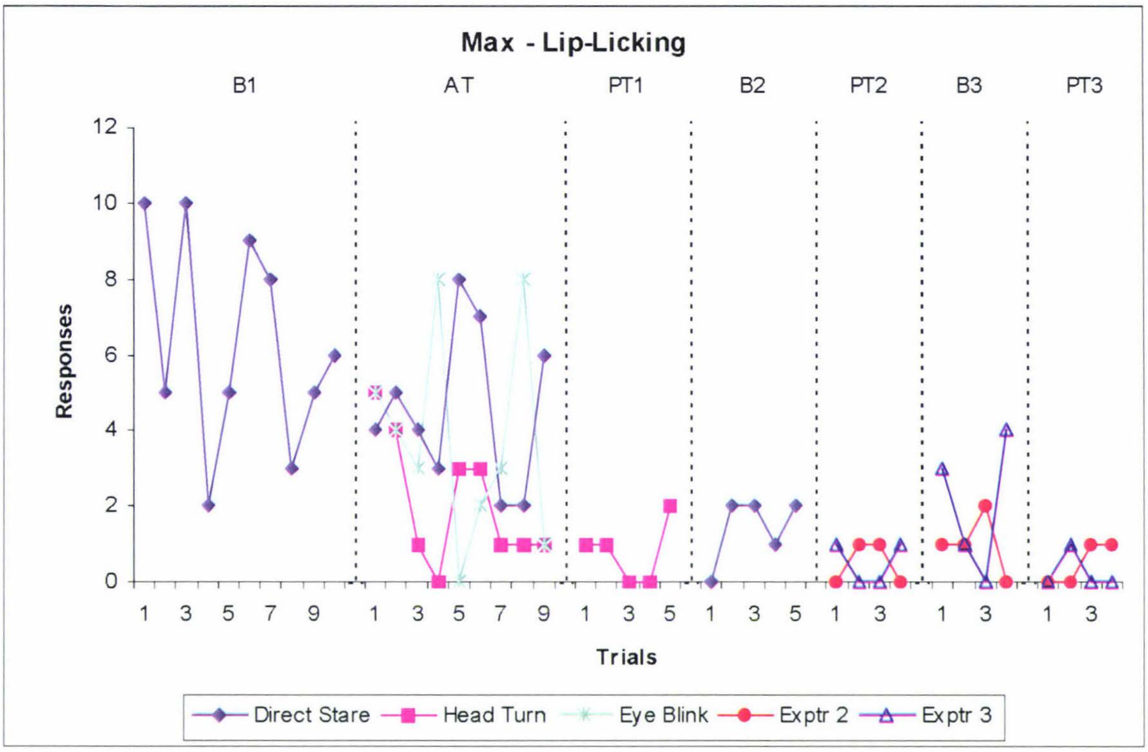


Figure 33. Arousal scores for Max as measured by Lip Licking

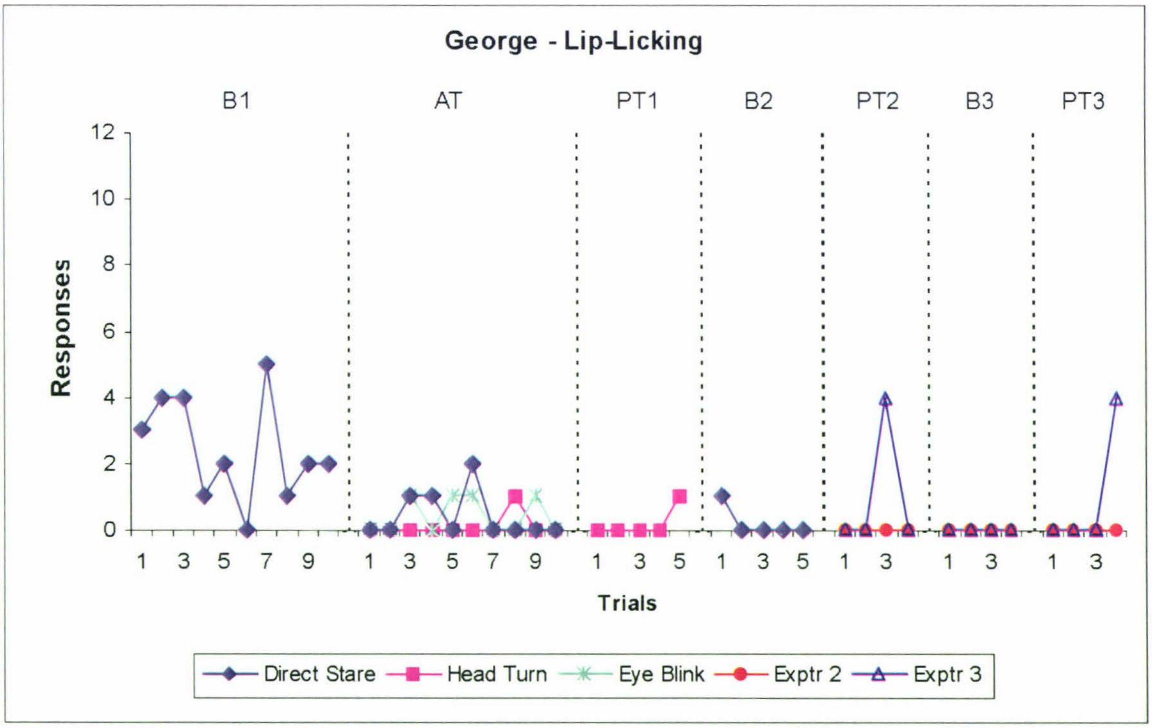


Figure 34. Arousal scores for George as measured by Lip Licking

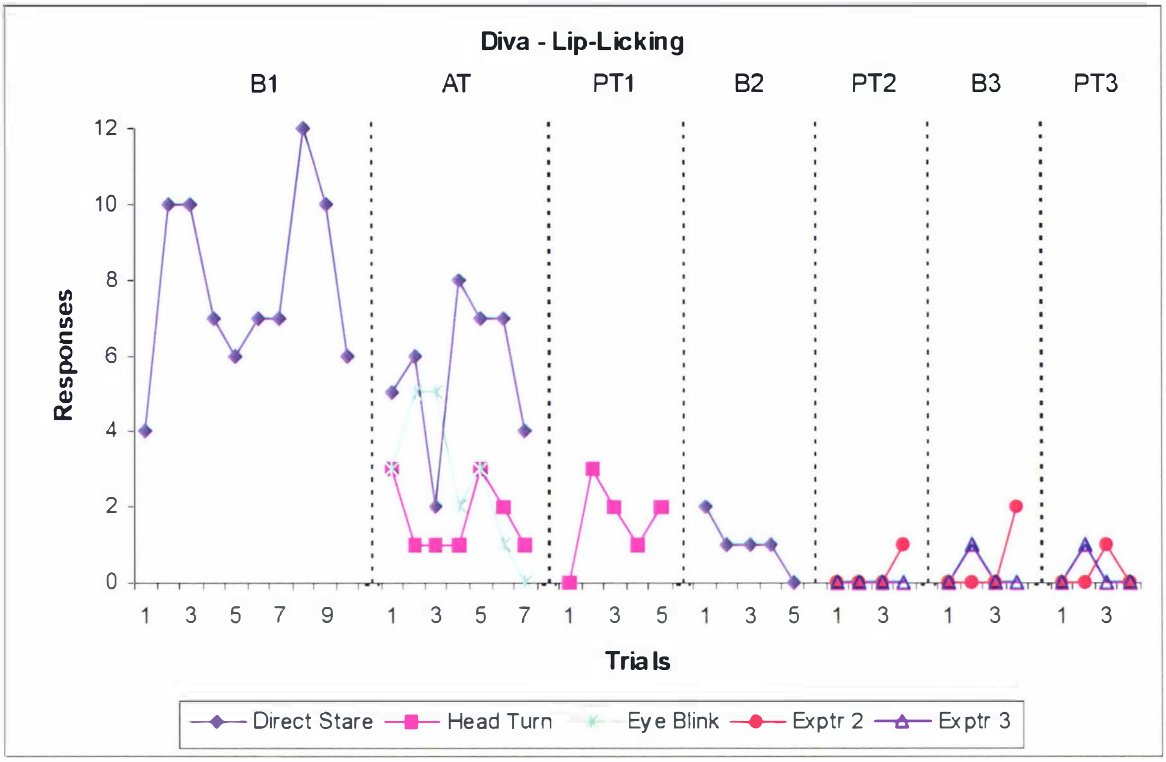


Figure 35. Arousal scores for Diva as measured by Lip Licking

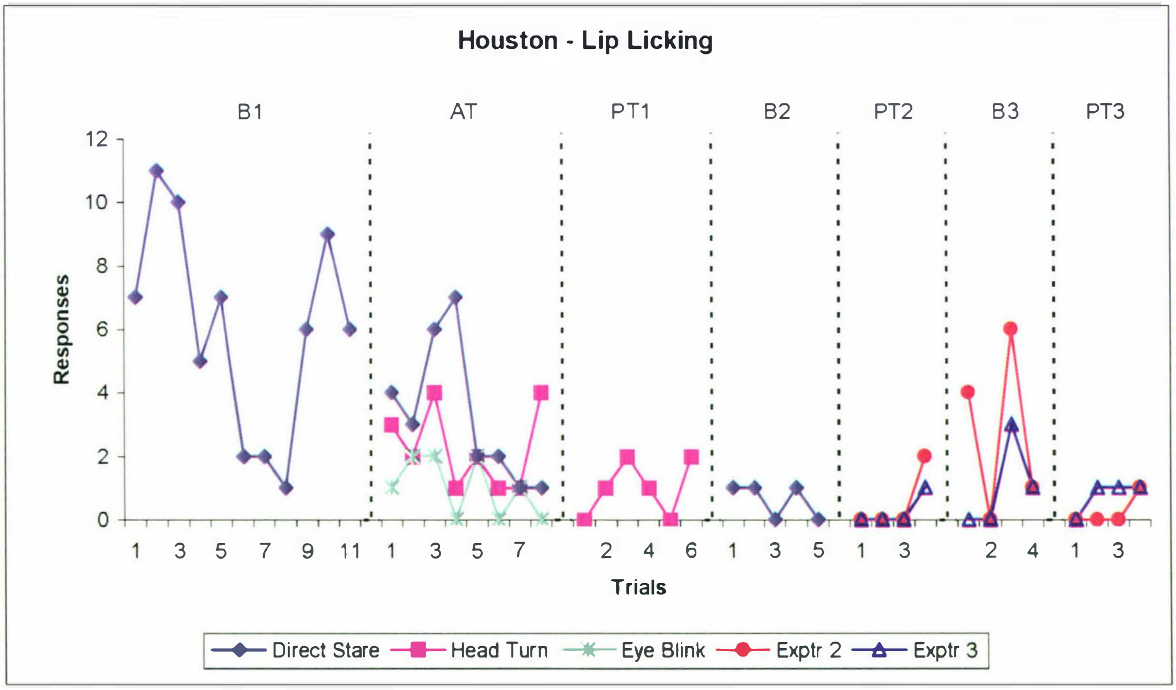


Figure 36. Arousal scores for Houston as measured by Lip Licking

3.2. Alternating Treatments Phase (AT)

3.2.1. Direct Stare Treatment

In trials where the Direct Stare treatment was continued, Tail Position was fairly stable at levels of around 43, similar to those in the B1 phase, although for George initially the level was lower similar to the levels in the later part of the baseline. Head Position was also fairly stable across the phase at similar levels to those during baseline. The greatest variability occurred with Max and George although the levels of both plateaued at 43 in the last three trials. Ear Position was also fairly stable and at similar levels to the baseline phase. Diva was an exception in that a slightly lower level of around 43 was recorded in this phase. Vocalisation remained fairly unchanged from baseline in both stability and level for George and Houston. Diva showed a slight drop in level settling around 41 while Max showed the most variable results with a downward trend levelling at around 34.

3.2.2. Head Turn Treatment

The Head Turn treatment produced quite stable responding on Tail and Head Positions with levels around 45 for all the dogs on most trials. With Ear Position, levels were similar but slightly more variability was evident, with a downward trend for Max and George. Vocalisations were fairly stable, although not as stable as with the other three measures. Levels varied between the dogs but were generally around 44-45. Max was the only exception with a much lower level around 40 and more unstable responding, although stability increased towards the end of the phase.

3.2.3. Eye Blink Treatment

With the Eye Blink treatment, the Tail Position levels tended to be between the Head Turn and Direct Stare treatments levels, except for Diva whose level was around 45 and slightly more stable than with the Head Turn treatment. For George, levels were very unstable and were lower than Direct Stare on three occasions. Overall, however, the mean of 43.2 was between the levels of the other two treatments. Head Position levels proved to be slightly unstable overall with levels around 44, slightly lower than Head Turn and slightly higher than Direct Stare. Again, the variability was greatest with George although toward the end of the phase the variability decreased, with levels stabilising between those under the other two treatments. Ear Position levels tended to be slightly less stable than for the previous two measures, but again they stabilised around 43-44, intermediate between those under the other two treatments.

Vocalisations again proved to be the most variable measure with the greatest instability shown by Max. Low levels around 39-40 were recorded for Max and Diva, with slightly higher levels for George and Houston with 44 and 42 respectively. Levels however, still tended to lie between those under the other two treatments, although Diva and Houston showed some exceptions. For both subjects, Eye Blink means were slightly lower and showed more instability than Direct Stare.

3.3. Preferred Treatment 1 Phase (PT1)

The Head Turn treatment consistently produced stable responding closest to non-arousal (45). For this reason it was selected as the preferred treatment for all the dogs. Responding tended to be quite similar to that with Head Turn during the AT phase, although with greater stability across the first four measures.

Tail, Head and Ear Position levels were very stable on 45 for all subjects. A slight rise in Head and Ear Positions occurred on one occasion with Houston and a slight drop in Ear Position occurred on two occasions with Max. Vocalisation levels showed little change with George, Diva and Houston, although stability increased. With Max there was a large increase in stability and calmness, with a level around 42.

3.4. Baseline 2 Phase (B2)

With the return to baseline conditions, the Direct Stare treatment generally produced similar but slightly higher levels than did the same treatment during the B1 and AT phases. Levels for Tail Position were mostly on 45 for all dogs, with occasional minor exceptions. Head and Ear Position levels were generally around 43-44, only slightly lower than PT1 levels. Vocalisations tended to be more variable, but responding was generally around 44-45 for all dogs, again with the exception of Max. Responding for Max was usually around 42, somewhat higher and more stable than his responding under the same treatment in the AT phase.

3.5. Preferred Treatment 2 Phase (PT2)

A return to the Head Turn treatment, but by the secondary experimenters, produced a general arousal level on all four measures of around 45 for all dogs. The biggest exceptions were on Ear Position with Houston where levels were around 47-48 with experimenter 2 and 44 with experimenter 3 and on Vocalisations with Max who showed considerably lower levels than during either PT1 or B2, and in comparison with the other dogs. Occasional minor differences in levels between the two experimenters were seen with all dogs on all measures except Tail Position.

3.6. Baseline 3 Phase (B3)

Generally, in this phase, with the exception of Tail Position, levels dropped back to around 44 or below on each measure, similar to B2 results and lower than PT2 results. For Tail Position they remained very stable at 45. Again, no striking differences in level can be seen between the secondary experimenters although many of the differences across dogs seen in the earlier phases were found. Again Max showed unusual responding with extremely low Vocalisation levels of around 32-33, well below B2 results.

3.7. Preferred Treatment 3 (PT3)

With a return to Head Turn conditions, with the secondary experimenters, there was a general reversal to levels obtained during the PT2 phase on all four measures and for all four dogs. Stability was generally slightly greater than during the PT2 phase and the difference between the experimenters of Max's Vocalisations decreased.

3.8. Yawning and Lip Licking

Yawning tended to be very unstable across all the phases and all dogs and was most variable during the B1 and AT phases. Levels trended down to zero in the later phases although there were occasional increases during the PT2 phase for Houston and the B3 phase for Max, Diva and Houston. Lip Licking was also unstable across the phases and subjects. Again, an overall decrease in responding across the phases can be clearly seen for all subjects also with a few spasmodic increases.

3.9. Behaviour of Dogs Across the Experiment

Looking across the phases, an overall trending toward the level of least arousal can be observed. For the first four measures, Tail Position, Head Position, Ear Position and Vocalisations, this is reflected by a gradual upward trend towards a level of 45. For the other two measures, Yawning and Lip Licking, a downward trend towards zero can be seen although this trend is not always apparent when viewing the phases individually. This overall calming is particularly apparent with Lip Licking where a dramatic decrease in responding can be seen from the B1 phase to the PT3 phase for all dogs. Even with the most stable measure, Tail Position, this trend towards greater calming is apparent. Quite submissive responses are recorded for the B1 phase on this measure, but in the last three phases all four dogs maintained a level of 45. A gradual increase in the stability of responding can also be seen across the phases. This can be found with all dogs on all measures but, again, it is particularly pronounced with Lip Licking.

3.10. PAC Analysis

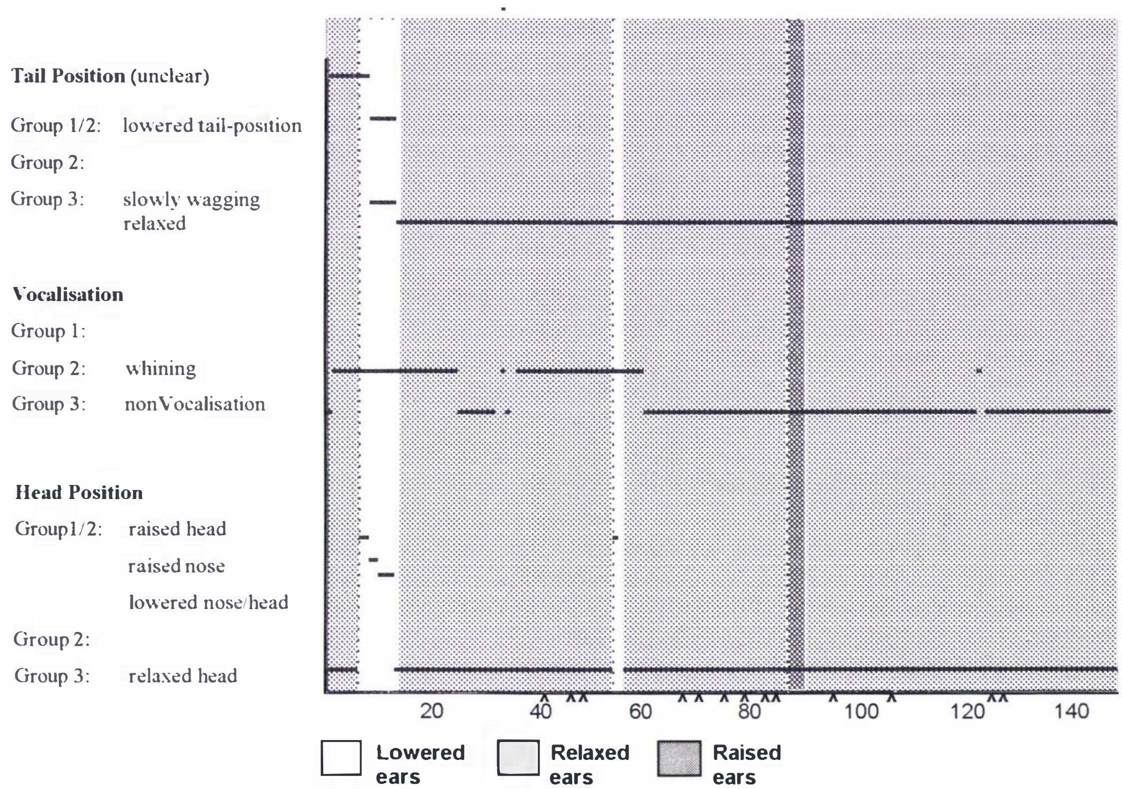
3.10.1. Study Files

The strength of PAC lies in detailed analysis. The aim in this study was to tests its value on a small sample of data since it was not feasible (due to time and size constraints) to digitise and analyse the entire video recordings on one computer system. Thirteen video sequences (trials) of Max responding across the various phases were digitised. Max was selected for his larger range of responses and because of his lighter colouring, which enabled easier viewing as a digitised image. These sequences are identified as the PAC study files.

3.10.2. Results and Interpretation

The initial queries focused on the four main behaviours, Head Position, Ear Position, Tail Position and Vocalisations, within each trial. For example, "Max any-action Head Position". Further queries aimed to focus on identifying a correlation, or lack of correlation, between the behaviours.

Graphs, representing the behavioural descriptions across the time span of each trial were produced. The design of the graphs was such that all four behaviours measured in a trial, plus instances of external noise, could be viewed in the same graph. Three of the behaviours are shown along the y-axis as a function of the



fourth behaviour, which is shown along the x-axis. Figure 37 shows all the instances of the measured

Figure 37. Behavioural measures during trial 170, AT phase.

behaviours in trial 170 during the AT phase. The 2½ minutes duration of the trial is represented along the x-axis, which shows the time in seconds. The markers at the bottom of this axis indicate occurrences of external noise. The measure of Ear Position, which is divided into three categories of lowered, relaxed and raised Ear Position, is represented along the x-axis by gradations of shading. It should be noted that any of the behaviours measured could have been placed on the x-axis. Attempting to minimise confusion when reading the graphs it was decided to use only Ear Position on the x-axis to maintain consistency. Along the y-axis, represented by broken black lines, are the other three measures, Tail Position, Vocalisations and Head Position. The small overlap in the lines can be attributed to the unavoidable delay in reaction by the observer.

Each of these behaviours was divided into three mutually exclusive groups based on the same grouping used in the main study (Table 2 and Figure 11). Each behaviour was assigned a value between one and five, indicating the level of aggression or submission displayed. Since behaviours in groups 4 and 5 were never seen, the graphs show only groups 1-3. The results presented in this way allow for comparisons of behaviours, identification of patterns across trials and also enable possible correlations or lack of correlations between behaviours to become apparent.

During the majority of the time in all trials, Ear Position is relaxed. This appears to be correlated with group 3 behaviours in the other three categories. That is, relaxed Tail Position, relaxed Head Position and Non-Vocalisations are mostly seen during relaxed Ear Position.

From findings in previous studies (Fox, 1969; Fox, 1970; Rugaas, 1997) an expected correlation between the submissive behaviours of lowered Ear Position and whining or yelping seemed to be apparent and is illustrated graphically in Figures 37, 38 and 39. On the graphs, the white vertical area marks lowered Ear Position. On all three graphs for around ten to fifteen seconds the dog had lowered ears. Looking up this vertical white stripe, other behaviours the dog was expressing during this time can be seen. The onset of whining coincides in all three trials with lowered Ear Position, whining carries on longer than lowered Ear Position but ceases shortly after.

A possible correlation exists between lowered ears and tail wagging. Tail wagging, both slow and fast, is seen during these trials only in conjunction with lowered Ear Position. Head Position also showed some interesting results. During lowered Ear Position, Max also showed periods of group 1 and 2 behaviour, raised head, raised nose and lowered nose.

Two short instances of raised Ear Position can be seen in Figure 38. Associated with this are upright or raised Head Position and Non-Vocalisations. Tail Position could not be ascertained, as it was unclear in the video clip. No instances of raised ears were recorded during trial 198 (Figure 39) and for the majority of the time

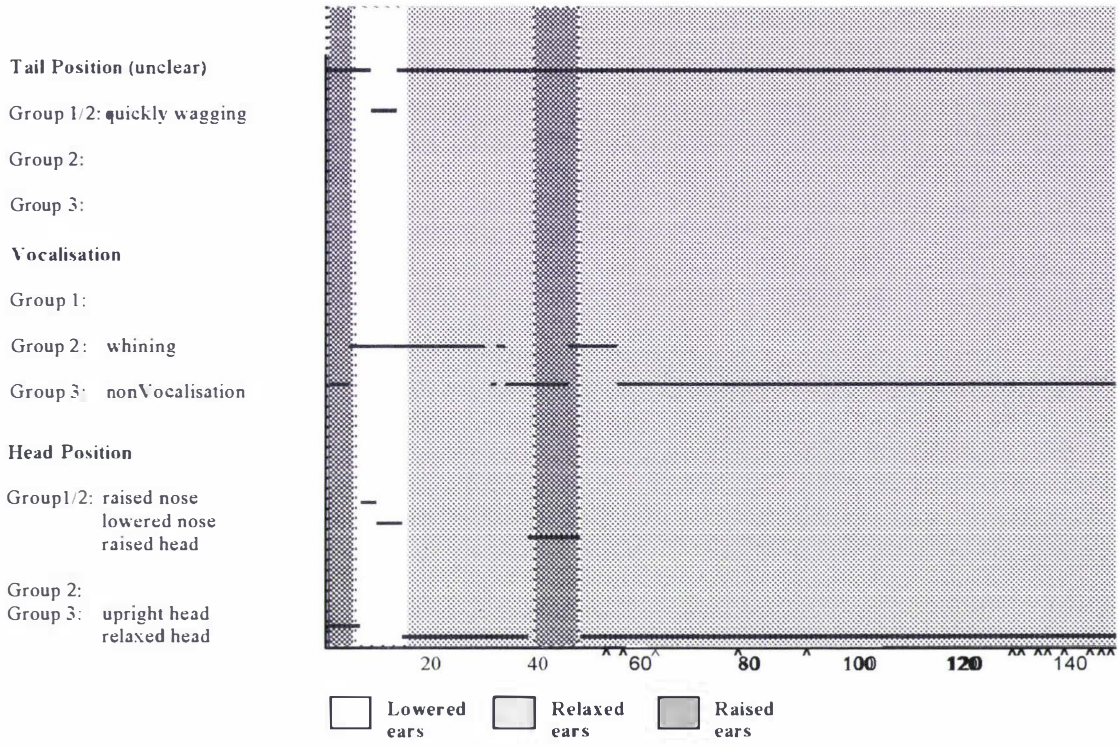


Figure 38. **Behavioural measures during trial 86, AT phase**

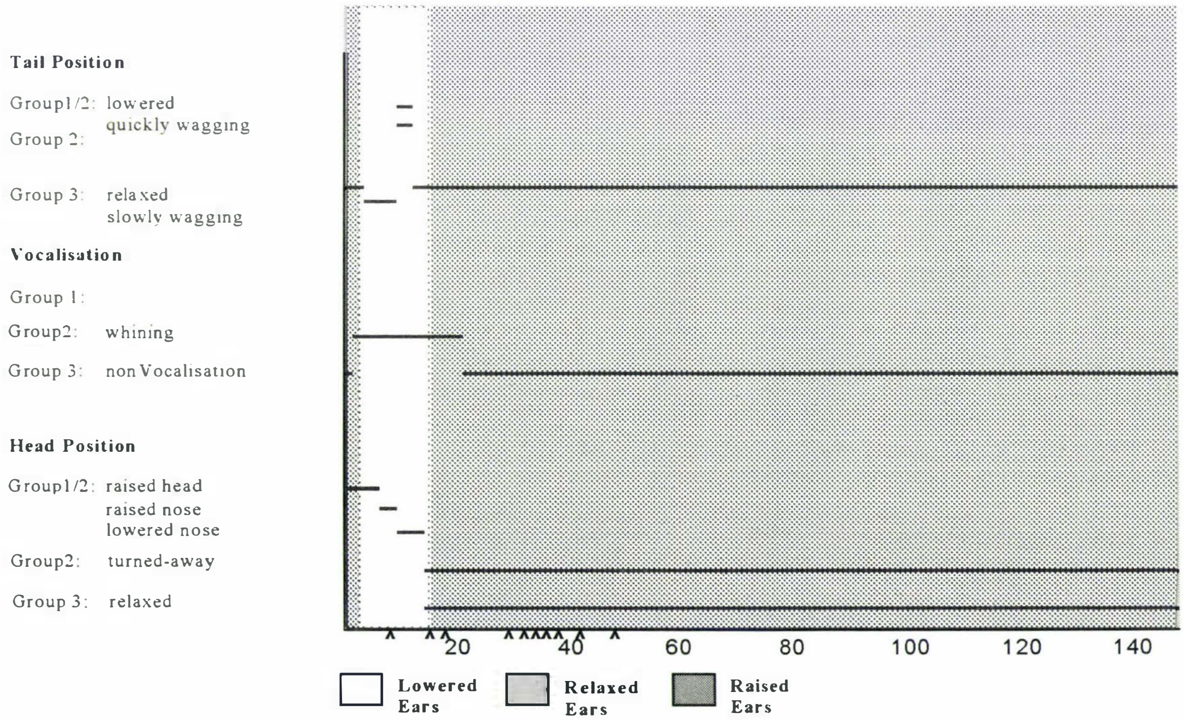


Figure 39. **Behavioural measures during trial 198, AT phase**

relaxed Ear Position was associated with group 3 behaviours (relaxed head and tail and Non-Vocalisations). No marked changes in behaviour in any of the digitised trials can be attributed to external noise.

CHAPTER 4: DISCUSSION

This study investigated the effect of three human behaviours, Direct Stare, Head Turn and Eye Blinking, on the level of dog arousal. Arousal in the dog was measured by six components of dog behaviour: Tail Position, Head Position, Ear Position, Vocalisations, Yawning and Lip Licking.

The Head Turn treatment was found to evoke the least arousal with all dogs, while Direct Stare evoked the most, with Eye Blink midway between the two. In nearly all cases of arousal, submissive arousal was in evidence. Tail Position, Head Position, Ear Position and Vocalisation components showed the most stable responding with Ear Position showing the clearest differential control. Yawning and Lip Licking components showed less differential control, with more variable responding.

4.1. Measurement of Dog Arousal

Arousal was considered to be present when any type of behaviour other than a calm, neutral disposition was evident. Both submissive arousal and dominant arousal were evidenced by departures from calmness and neutrality, but in different directions. Although each type of arousal may have a different cause (Blackshaw, 1991; Fox, 1969; Goddard, 1985; Schenkel, 1967; Voith, 1982; Wright, 1991; Young, 1982), the presence of either increases the probability of aggression, so both were of interest in this study.

Behavioural testing of fearfulness and dominance in dogs towards humans is often measured by the proximity of the dog to the human (Goddard, 1984; Borg, 1991), with more fearful dogs remaining at greater distances from the human. In this study the dogs were enclosed in a cage so this method was considered inappropriate. Six behavioural components were used to measure arousal: Tail Position, Head Position, Ear Position, Vocalisations, Yawning and Lip Licking. The first four components were measured on a scale where 45 marked a calm disposition; higher scores indicated aggressive arousal (where the dog displayed dominance) and scores below the 45 mark indicated submissive arousal (where fear or avoidance reactions were seen). The last two showed the rate at which of yawning and lip licking occurred during the trial.

The six measures were chosen from the literature (Fogle, 1995; Eltringham, 1995; Scott, 1950; Schenkel, 1967; Rugaas, 1997) as indicators of arousal. In Eltringham's (1995) study, arousal was successfully assessed using the position of the tail and facial expression as measures. Tail Position was likewise used in the present study, while facial expression was divided into Ear Position, Head Position, Yawning and Lip Licking, in order to investigate the role of these individual components. In Eltringham's (1995) study she used a measure of arousal called "facial expression", which combined both the head, ear and mouth expressions.

Yawning and Lip Licking behaviours, as indicators of arousal, have only moderate support from the scientific literature (Fox, 1970), although the popular literature has readily cited them as indicators of a stressed dog (e.g. Rugaas, 1997; Abrantes, 1997). It would be expected that the more submissive arousal the dog experiences, the greater the instances of Yawning and Lip Licking (Rugaas, 1997; Abrantes, 1997; Fox, 1970). A Vocalisation component was measured since vocalisations such as growling, barking, howling and whining have been previously used to test for aggression (Borg, 1991).

Based on previous research (Goddard, 1985; Fox, 1970; Fox, 1969; Schenkel, 1967) it could be expected that these six measures should show significant covariance. Arousal scores on the different measures showed a considerable similarity across the dogs; with only a few exceptions all measures revealed similar and consistent patterns. Similar trends and levels of arousal between the measures were also found. Head position, Ear position and Vocalisation measures yielded the greatest similarities, while the Yawning and Lip licking components showed less similarity to the other measures and the greatest variability. Tail Position was very stable but showed little differential control across the treatments. The similarity of patterns that were found with the Head and Ear position measures would seem to indicate that these two components tend to strongly co-vary, and could possibly have been compacted into one measure.

Despite the similarity in patterns between the measures, slight differences were also found. Some measures appeared to be more sensitive measures of behaviour, and were possibly better indicators of arousal. Head Position and Ear Position seemed to be the best measures of dog arousal. The most stable and consistent results with the clearest reversals (levels reverted back to original phase with same treatment) across all dogs came from these measures. Head and Ear Position were also quite sensitive measures in that they showed clear and stable distinctions with small but consistent changes between the treatments and phases.

Tail Position also showed stable results, however virtually no difference was detected between the treatments. This measure may not have been sensitive enough to pick up differences in arousal that the other measures did. It must be noted that the experimental dogs used in this study were not in a strongly aroused state and it may simply be that Tail Position is best suited as an indicator of extreme arousal, rather than of moderate arousal.

Clear distinctions between the treatments on Vocalisations indicated that this was the most sensitive measure. However, this measure showed greater variability than the Tail, Head and Ear Position measures. Despite this, responses from all dogs on this measure show a similar pattern to those shown with the other measures. The increased variability seen with the Vocalisation measure may be due to the multiple components of which this behaviour is comprised. Barking, whimpering or whining and growling may each occur differently in various situations such as defence, play, attention-seeking, greeting, boredom, warning, submission and pain.

Contrary to some popular literature (Rugaas, 1997; Abrantes, 1997) the Yawning and Lip Licking components proved to be poor measures of dog arousal. Both these measures produced consistently unstable results overall. With Yawning all subjects displayed a marked lack of this behaviour. The Lip Licking measure is of some interest in that a downward trend can be clearly seen across the phases. The results presented from these components would indicate that Yawning and Lip Licking are not adequate measures of dog arousal due to their variability and lack of clear patterns. These measures are accordingly given less attention.

Generally, arousal scores for the four main measures remained close to the 45 mark with only a few exceptions, where scores typically dropped below 40. It is important to note that, although dog arousal scores may deviate from 'calm' (arousal score 45) by only one or two units, these represent appreciable changes in arousal. Behaviourally, the changes were clearly obvious. Tail Position, Head Position, Ear Position and Vocalisations were given more weight due to the consistent and stable nature of their patterns.

4.2. Treatment Effect on Dog Arousal

It was hypothesised that the dogs would react to Direct Stare with more arousal compared to the other less threatening postures - Head Turn and Eye Blink. These, less threatening treatments, were developed from the popular literature on calming signals for reducing aggression in dogs (Abrantes, 1997; Nott, 1992; Rugaas, 1997) and from the scientific literature on conspecific wolf and dog behaviour (Bekoff, 1977; Fox, 1970; Fox, 1969; Fox, 1975; Schenkel, 1967; Scott, 1950). These treatments approximated submissive behaviours displayed by lower ranking dogs and wolves.

The main treatment effects are presented graphically in Figures 10-33. Generally a clear difference in dog arousal was shown during the alternating treatments phase, between the three treatments. Usually there was a good demonstration of differential control between the Head Turn treatment and the Direct Stare, with the data paths showing minimal overlap (Cooper, 1987). One exception was the Yawning measure, where virtually no clear differential control was shown by any of the treatments. Generally, less clear-cut control over responding was seen with the Eye Blink treatment, due to greater variability in responding. Arousal levels with Eye Blink, however, were usually between Head Turn, which typically produced minimal arousal, and Direct Stare, which generally produced submissive responding.

The Direct Stare treatment reflected the main components found in the behaviour of a dominant dog or wolf - direct eye contact and large upright body position (Figure 1). However, since the treatment emulated an aggressive signal, whether it would evoke a dominant or submissive response was not predictable. As expected, the Direct Stare treatment produced the most arousal in all dogs.

However, during the B1 and AT phases, Direct Stare clearly resulted in arousal levels substantially below the 45 mark indicating that this treatment had evoked submissive, rather than dominant, arousal.

During the B2 phase, however, an overall increase in calmness was seen. This occurred across all the measures, including Yawning and Lip Licking. Despite this rise in calmness, the Direct Stare treatment still evoked more arousal than the Head Turn treatment in the PTl phase, with the exception of the Yawning measure where no difference was seen. (Another possible exception to this is in the Tail Position measure where little difference can be seen overall with Max and Houston.) However, despite only a slight difference in level between PT1 and B2, the dogs continue to show more instability in their responses to the Direct Stare treatment.

The Head Turn treatment consistently produced calm responding in all dogs on the four main measures. Only occasionally did responding stray from the 45 mark. The only marked exception was with Max on the Vocalisations measure, where responding was quite submissive (although still calmer than under either Direct Stare or Eye Blink). Due to the consistently calm responses this treatment evoked it was implemented as the 'preferred treatment' following the AT phase. During the PT1 phase, Head Turn continued to produce calm and stable responses from the dogs. With many of the dogs, an increase in the stability of the responding across all measures was seen. This was not limited to any of the measures and could even be seen with the Yawning and Lip Licking components.

While, generally, clear differential control was shown across measures, less differential control was shown between Eye Blink and either Direct Stare or Head Turn. The Eye Blink treatment, which was implemented only during the AT phase, produced erratic and unstable responding across all dogs and measures. There was a high degree of overlap in the data paths resulting in a less clear demonstration of experimental control. Despite this, some consistent findings are evident.

A moderate amount of submissive responding occurred with the Eye Blink treatments across dogs and measures with the mean level generally lying between the Direct Stare and Head Turn treatments. A couple of exceptions were seen with the Tail Position measure for both Diva and Houston where, overall, Eye Blink produced the calmest results across the phase. Since, however, these were the only two exceptions, and responding did not differ too substantially from the Head Turn treatment, Head Turn was chosen as the preferred treatment. The generally unstable nature of the behaviour produced by the Eye Blink treatment made interpretation difficult, and this treatment was generally less effective in reducing arousal. While this treatment may have a moderate effect on reducing arousal in dogs, its efficacy seems to be too inconsistent to recommend it as a calming signal.

4.3. Experimenter Effect on Dog Arousal

In order to see whether treatment effect would hold across different people, two secondary experimenters were introduced. Two further preferred treatment phases and a baseline phase were reinstated in order to compare and assess the effects of secondary experimenters on dog arousal. Generally, in the last three phases with the secondary experimenters, arousal levels were comparable to those in PT1 and B2. However, with the exception of Tail Position, which remained completely stable on 45 throughout the last three phases, responding showed more instability than with the primary experimenter. Again with the exception of Tail Position, differences between PT2 (Head Turn conditions) and B3 (Direct Stare conditions) were similar to those found with the primary experimenter. A successful reversal to PT2 results can also be seen with the reinstatement of the Head Turn treatment in the last phase.

Contrary to some findings on gender differences and dog attacks, which have generally shown that males elicit more avoidance in dogs than females (Jagoe, 1996; Lore, 1985; Pickney, 1982; Wright, 1991; Voith, 1981), no major differences were found between the experimenters. The primary experimenter was female, as was experimenter 2, while experimenter 3 was male. The lack of gender difference may be due to the consistency of approach by the experimenters. In order to achieve maximum consistency the three treatment behaviours (Head Turn, Eye Blink and Direct Stare) were operationally defined and the experimenters were given specific instructions on how to act during each trial. Alternatively, differences in approach might explain gender differences found in other literature rather than a reaction by the dogs, to gender *per se*.

4.4. Treatment Effects on Individual Dogs

While ontogenic conditioning histories presumably produced some differences in levels of arousal, for individual dogs, the magnitude of the changes in arousal under the different treatments were similar across dogs. Both ontogenic and phylogenic contingencies play an important role in individual behaviour, with socialisation factors being a very important part of a dog's ontogeny. Given the variations in each of the dog's ontogenic history it is possibly a little surprising to see such similar and consistent behaviour across these individuals. This would support the idea that different approaches can produce consistently different effects across a range of dogs.

The amount of fluctuation and the level of arousal within a phase, however, did vary slightly between the individual subjects. The behavioural effects of malsocialisation in dogs have been thoroughly studied (Young, 1982; Voith, 1981; Wright, 1987; Jagoe, 1996; Hart, 1985; Fox, 1967). Diva and George, considered the more highly socialised of the subjects, consistently responded with fairly low levels of arousal that were typically quite stable and compatible with studies on socialisation. Max, the most vocal and submissive dog who was thought to be less well socialised, showed more variable results and displayed some quite unusual responding picked up by the Vocalisations measure. On this measure Max showed high levels of submission across all the phases and with all the treatments, although a difference can still be observed between the treatments, consistent with that shown by the other dogs. The differential effects of the treatments were shown to be the same between the dogs although the absolute levels were different.

George showed a slightly greater level of submission than the other dogs on the Tail Position measure, particularly with the Direct Stare treatment. On other measures, this dog's responding generally did not vary greatly from the other subjects. It is not known why this difference occurred. This dog may have been particularly expressive with her tail, however the difference is not particularly large and during the AT phase a slight upward trend was observed, bringing George's submission level to almost the same level as the others, suggesting it was a transient effect. During the B2 phase levels were generally similar for all dogs.

Houston was the most poorly socialised, youngest and most aggressive dog. It should be noted that this dog tried, and partially succeeded, in biting one of the secondary experimenters – experimenter 3 (male experimenter). This is of interest as in a few of the trials with the secondary experimenters, Houston's results rise above 45 into aggressive arousal. However, contrary to what was expected, this dog displayed noticeably more overt dominance aggression toward experimenter 2 (female experimenter) than experimenter 3 or the primary experimenter. This finding conflicts with the literature on gender differences and dog attacks that shows males evoke more aggression in dogs. For the other dogs no difference was found in their responding across experimenters.

The fear biting response is one of the many behavioural problems that may result from insufficient socialisation (Young, 1982). Case studies have indicated that the fearful dog bites only when it is reached for or approached, or perceives that it cannot escape. The fearful dog displays body language consistent with a submissive response (Abrantes, 1997; Fox, 1970; Kleiman, 1967; Schenkel, 1967; Young, 1982). Since experimenter 3 was bitten whilst attempting to touch Houston, it is plausible that the dog reacted out of fear which would account for the greater submissive results obtained with this experimenter.

4.5. Design

The use of a small-N research design was considered most appropriate, providing many advantages for this type of study. The main advantage of small-N designs is that they facilitate a detailed examination of the behaviour of individuals. Both individual variation and consistency between subjects are highlighted with this type of design. Furthermore, despite any differences between the individuals, clear patterns in the data can be detected. Due to the longitudinal nature of this study, patterns and effects can be seen that would either be unavailable or masked, in a large-N design. For example, despite when the absolute levels varied, the direction of the change and relative levels across treatments were consistent. If mean values had been generated, as in a large-N design, these relatively small but consistent effects would have been obscured. The individual measures also withstand detailed analysis under this design. The covariation of measures across dogs, within dogs, and across measures can be examined. This kind of detailed analysis is difficult, if not impossible, with a large-N design.

A common view of small-N designs is that they cannot yield conclusions that extend beyond the one or few subjects included in the study; they are considered to have little external validity. However, results from large-N group designs can only be extrapolated to other groups not to other individuals. Small-N designs can be used to evaluate a number of research questions with individuals that can be generalised to other individuals through replication (Kazdin, 1982). Pavlov, a physiologist who made great advances in respondent conditioning research, based his experiments primarily on one or a few subjects at a time. Generalising from the results of a few subjects is considered less risky when the subjects are non-human animals (Myers, 1996). If measuring a process that is relatively invariant, the results from a small-N experiment would have greater external validity than if measuring a behaviour for which large differences among subjects are expected (Myers, 1996). In the present study, similar results were found across the individuals. Further direct replications with other individual dogs and systematic replications with other treatment variables would enable strong externally valid conclusions. The findings in this study are consistent with those of Eltringham (1995) who used different dogs, different treatment variables, and different measures of arousal.

An alternating treatments design has some particular advantages. Possibly the biggest advantage lies in its efficiency in comparing different treatments simultaneously within a single phase. This allows for quick assessment of treatment effects and selection of the most effective intervention. Sequence effects are also minimised during the alternating treatments phase, since the independent variables are rapidly alternated with one another in a random manner that produces no particular sequence (Cooper, 1987). This type of design is further enhanced by the use of an initial baseline phase, followed by a "preferred treatment" phase, which allows for further comparisons between treatments, using the strength of sequential changes. These enhancements also allow for evaluation of possible multiple treatment interference.

Another advantage of alternating treatments designs is their flexibility. Changes to the design can be made during the running of the experiment. Also, further questions can be examined after the main data collection. In the present study, this was done by employing a B-A-B reversal design to examine possible effects to two treatments when given by different experimenters. The main advantage of the B-A-B reversal is that it is a robust design for assessing functional relationships and highlights changes with clarity (Cooper, 1987; Kazdin, 1982). This design generally worked very well as a means of comparing the effectiveness of the three conditions, however some limitations must be noted.

The last three phases involved B-A-B reversal rather than the more usual A-B-A sequence. While the design was not flawed, it was limited in that it did not allow for direct comparisons across experimenters, since both the treatment and experimenter were changed simultaneously in PT2. Odd points occurred at various places and PT2 results may have been contaminated due to the introduction of new experimenters simultaneous with a treatment change. Despite this, PT3 results show good reversal to PT2 phase levels.

In alternating treatment designs, many crucial decisions about the design can be made only as the data are collected. Decisions about when to present or withdraw experimental conditions are made during the investigation itself. Deciding when to change phases, so as to maximise the clarity of the data, is a fundamental design issue. There is no widely agreed upon rule for when to alter phases. Kazdin (1982) states that the usual rule of thumb is to change phases only when the data are stable. It is also generally acceptable to change when the data are trending away from the direction expected in the following phase. However, problems emerge when the baseline data show a trend in the same direction as expected to result from the intervention. This could be seen with the Lip Licking component, which showed a downward trend, making the evaluation of any intervention effect difficult.

It is sometimes recommended (Kazdin, 1982) that all phases be equal in duration in a single study. The theory behind this is that in a given period of time maturational influences may lead to a certain pattern of performance. If phases are equal in duration, the effects of confounding factors may be relatively equal in each phase. In this study, however, maintaining phases of equal length was not always feasible, as achieving stability of data was considered of greater concern. As there were several dependent measures that did not covary perfectly, it was sometimes difficult to achieve stability on all of these before changing a phase. Had the experimenter waited for this to occur, the overall trend to greater calmness apparent across the study may have prevented differential effects by the various treatments being measured.

One of the potential disadvantages of small-N designs where repeated measures are taken, is the habituation effect that may arise as a result of continued testing. When looking across all phases some residual or longitudinal effects seem to be apparent. On all the measures, all dogs showed levels of arousal that trended towards the line of least arousal across the phases (45 with the first four measures, and 0 with Yawning and Lip Licking). Baseline rose in level across the entire study, not just in the first two phases. The level of the dogs' responses typically rose slightly in each phase across the duration of the study with only a few exceptions. This would seem to indicate the occurrence of a calming effect over time. An attempt to minimise such longitudinal effects was a major reason for keeping the trials and phases short.

In a similar study (Eltringham, 1995) this effect was not found. This difference may be accounted for by the greater period of time the present study spanned along with the large amount of time the primary experimenter spent with the dogs. The length of time may have muted the effect of the dog-human interaction. Arousal-producing behaviours by familiar humans may have less effect on a dog than if performed by an unfamiliar person (Lore, 1985). An attempt was made to minimise this problem through the use of a secondary person as 'dog handler', reducing the amount of contact the primary experimenter would have with the dogs.

4.6. Multiple Treatment Interference

When more than one treatment is provided, the possibility exists that one treatment's effect may have been influenced by the effect of another treatment (Kazdin, 1982). This multiple treatment interference can lead to ambiguous results, and may limit the conclusions that can be drawn. The question of whether the effects observed under any of the alternating treatments would be the same if each treatment were implemented alone is raised.

There was some evidence that multiple treatment interference may have occurred in the AT phase. A slight increase in calmness can be seen with the Direct Stare treatment when compared to the level under the same condition in B1 across the four main measures. There were a few exceptions where level stayed the same, but overall there was a trend towards a calmer response in the AT phase. Again, the Vocalisations measure showed unusual responding from Max. An upward trend was seen in the B1 phase, while a trend in the opposite direction is seen with the same treatment in the AT phase while no real change in level was seen. The reason for these results are unknown, however this dog continued to display abnormal responding on this measure while no other dog showed similar behaviour. This rise in level may have been caused by the introduction of the other two treatments. The extent to which the effects of the Direct Stare treatment are owed in part to the other two treatments is unknown. However, the possibility exists that the rise in level was not the result of multiple treatment interference, but rather due to a longitudinal effect resulting from repeated measurements, or both. Despite this calming tendency, for whatever reason, a difference between the treatments was still apparent.

Use of a preceding Baseline phase allowed for evaluation of effects of multiple treatment interference on Direct Stare, while the Preferred Treatment phase enabled the assessment of treatment effects on Head Turn. No difference was seen with Head Turn or Direct Stare when compared to the level or trend under the same condition in the alternating treatments phase. Although a slight increase in stability was seen, these results indicate that if multiple treatment interference was present, its effect was minimal.

4.7. PAC Analysis

The use of the PAC system was mainly exploratory in nature; while there was the potential to see if it produced similar findings while extending the possibilities of analysis, the system was not used to its full potential. It did, however, benefit the study and has highlighted some important advantages and future uses for the system.

PAC requires the careful defining and redefining of the vocabulary used in the study to cover all variables of interest. This prompted some rethinking of operational definitions to a more precise level. This enabled a better understanding of what was being measured and also highlighted some inadequacies within vocabulary on dog arousal. The building of the coding language revealed some illogical and overlapping categories. For example, some behaviours that were visually similar could be described in different ways. Future behavioural studies performed using the PAC system would benefit by less global operational definitions. Prior to the data collection these could be trialed in order to reduce ambiguity.

PAC also supports the combination of quantitative and qualitative research methods. This is likely to have considerable value in applied behaviour analysis, which emphasises both precise definition of variables as well as their accurate measurement. With regards to instrumentation, the PAC system could potentially be of importance in the calibration of observer reliability, and may also allow for an investigation of changes in accuracy over time. Instrumentation can be a threat to internal validity, where changes in the assessment procedure over time may be the result of human observers whose judgements about the criteria for scoring behaviour may change over time. The system could facilitate the use of training sequences, which could be of use as a means to training observers and experimenters in order to improve accuracy of procedure and observer reliability.

Viewing the digitised images in rapid sequences was not used in this study although it is a function that could benefit future similar studies. With treatment integrity, where the experimenter's behaviour is checked for correctness and accuracy, an observer could view the images in rapid sequences in order to detect inconsistencies in behaviour. With conventional methods of analysis, changes in the experimenter's behaviour may occur too slowly for an observer to detect.

The PAC system could also effectively act as a domain knowledge base. Since each study builds upon the previous, a domain knowledge base containing visual examples, and information about analysis with behavioural recordings, could facilitate future work in this area. From this, covariation within a study and between studies could be facilitated.

PAC allows for a more precise look at the instances of the measured behaviours throughout each trial. A request for instances of a particular behaviour or a particular period of time in a trial can be made. This means that the exact moment and duration of a behaviour can be viewed at any time. Other behaviours that occur preceding, accompanying or following a selected behaviour can also be viewed. These selected instances can be viewed either from the digitised recordings or graphically as in Figures 37-39. With the ability to view selected sequences and behaviours, covariations and correlations between the behaviours may become apparent. For example, in Figures 37-39 a possible correlation was shown to exist between lowered ear position and tail wagging. A further possible correlation was seen with the onset of whining and lowered ear position.

This system would most likely be better suited to studies involving more complex social interactions between several individuals. The system was designed for studies that involve situations where a large amount of interaction between people, or between people and the environment. In this study, the experimenter's behaviour generally remained unchanged and as a result was of little importance. Although PAC benefited this study, if more 'free' and unexpected interactions between the dogs and the experimenter had occurred, the PAC system may have been utilised to a greater extent. Focusing on several individuals in a study using only the traditional methods of analysis is very difficult, and the potential benefit of PAC in this area of behavioural research is enormous.

4.8. Practical Implications and Future Directions

Various factors play a role in dog-human interactions. The outcome of the interaction (whether or not aggression is involved) is dependent on factors pertaining to both the dog and human. For the dog, variables such as socialisation, breed, age, sex and the situation influence the potential for aggression towards humans (Baxter, 1989; Beaver, 1983; Beck, 1975; Blackshaw, 1991; Borchelt, 1983; Goddard, 1984; Freedman, 1961; Fox, 1967). For humans, the variables are similar; age, gender, culture/race, prior knowledge or experience, situation and body language or behaviour can all effect the outcome of an interaction (Eltringham, 1995; Fox, 1967; Freedman, 1961; Jagoe, 1996; Pickney, 1982; Podberscek, 1991; Voith, 1981; Wright, 1991).

The findings of this study complement and extend those found by Eltringham (1995). Both studies highlight the role of a crucial factor, human behaviour, in determining how a dog responds towards that human. Both studies emphasise that the dog-human relationship is to be viewed in the context of the social behaviour of dogs in general and dog communication in particular. Eltringham's (1995) study was the first of its kind, looking specifically at what behaviours trigger aggression, and although based on previous findings, was unique in its approach. Most of Eltringham's (1995) findings were supported in this study. Both studies found the effect of individual differences between experimenters and between individual dogs to be minimal and both showed that the posture and approach of a person was critical in affecting a dog's behaviour. Whilst the present study examined different treatment behaviours and measured arousal in a somewhat different way, some of the components in operation were similar to Eltringham's, and can therefore be summarised together.

Submissive arousal was found with Direct Stare and to a lesser extent Eye Blink approaches. This has practical implications since submissive arousal is likely to result in biting or other acts of aggression (Young, 1982; Vollmer, 1978). The results of this study support the notion that neither an upright nor a crouched body position while facing the dog is an adequate way to reduce arousal. A lowered body position with an averted gaze would seem the best means of reducing arousal in a dog. These findings are supported by Eltringham's (1995) study where it was found that approaching a dog with a high body profile, direct eye contact and movement, evoked more arousal in the dogs than less threatening approaches such as avoiding eye contact and reducing movement and profile. It would appear from both the present study and Eltringham's that, just as a dominant dog may evoke arousal in another dog, dominant behaviour by humans may cause a dog to respond with increased arousal, potentially resulting in biting or attack.

None of the treatments in the present study evoked dominance arousal in the dogs. All arousal shown by subjects in both studies was primarily submissive arousal with little or no dominance based aggression ever seen. Hence, while this technique may calm fearful or overly submissive dogs, it may not be appropriate for dogs displaying dominance aggression. Some literature has advised against lowering body height around dogs displaying dominance aggression since it places the head in a vulnerable position (Rugaas, 1997). Similar research specifically using dominant dogs would be necessary to understand which components best calm this behaviour.

This study also has implications for how dog behaviour is interpreted. One of the main findings from this study is the lack of evidence to support Lip Licking and Yawning as reliable measures of arousal. Responses from the dogs were too inconsistent and variable to enable any conclusions other than their inadequacy as measures of arousal. Tail Position as a measure, did not however, seem sensitive enough to obtain an accurate picture of the dog's state of arousal. This was surprising since the popular literature (Fogle, 1995; Abrantes, 1997) often recommends the tail as a means to determine the dogs state of mind. The use of multiple measures of arousal in order to obtain a clearer picture of dog behaviour was supported by this study.

4.9. Limitations

Although it may be possible to say that the Head Turn treatment had the most calming effect on the dogs, it is difficult to know which component was in operation to make this the most successful treatment. Since there were slight differences in the procedures between the treatments, for instance, Eye Blink and Head Turn both involved the experimenter being in a crouching position, while Direct Stare used the standing position, the exact component involved in the difference between the three treatments is unknown. Further studies could be beneficial in order to understand the specific components of the experimenter's behaviour involved in the intervention effect.

Minor procedural problems were found after the trials were run. With regard to the measurement of the behaviours, issues were encountered when measuring the behaviour from the videotapes. For some trials the weather, time of day and dark colour of the dogs affected the lighting conditions and made reading the dogs' behaviour difficult. Despite this, inter-observer agreement was still quite acceptable.

Although experimenter gender was briefly addressed in this study, age, as a variable, was not. This study only looked at 22-year-old Caucasian adults from similar socio-economic backgrounds. There is some evidence to suggest that age, cultural background and ethnic origin may affect the behaviour of dogs (Podberscek, 1991; Wright, 1991; Voith, 1981; Rappolt, 1979; Pickney, 1982; Newby, 1997; Lore, 1985; Langley, 1992; Beck, 1975; Baxter, 1989). These differences, however, may have reflected correlated differences in behaviour rather than these characteristics *per se*. A closer analysis of the effect of these factors on dog arousal would be required to establish clearly the causative variables.

4.10. Summary and Conclusions

The effects of human approach behaviours on the level of arousal in four dogs were studied. Three treatments manipulating body height and eye contact by humans were used, while arousal in the dogs was measured using six components. Differences in arousal were found between the three treatments and also between the different measures of arousal. The lowest levels of arousal as measured by the four main components (Tail Position, Head Position, Ear Position and Vocalisations) were recorded with the Head Turn treatment, irrespective of experimenter. The greatest arousal occurred during the Direct Stare treatment, while the Eye Blink treatment produced variable results (although generally arousal levels were intermediate between those during Direct Stare and Head Turn).

Of the six components used to measure dog arousal, Head Position and Ear Position produced the most consistent, clear and stable results. This does not mean that the other measures were inadequate as indicators of arousal, rather it is probable that the Head and Ear Position measures were more reliable and sensitive in their detection of dominance and submission. Tail Position was possibly not sensitive enough, as arousal levels tended to be very stable across all treatments. The Vocalisations measure was possibly too sensitive, leading to unstable results. This measure may have been affected by extraneous variables such as external noise. Results from the other two measures of arousal, Yawning and Lip Licking, were the most inconsistent and proved to be poor indicators of dog arousal. Extremely unstable responding was seen on both, although the Lip Licking measure did show the calming effect over time that was seen with the four main measures.

Although some differences occurred in arousal levels between experimenters, the gender of the experimenter did not show any consistent effect on arousal. This conflicts with the literature. It may be that differences in approach might explain some gender differences found in the literature rather than a reaction by the dogs to gender *per se*. The lack of difference found between the three experimenters in the present study may have been due to the consistency in the approach behaviours.

Few studies have experimentally investigated the dog – human interaction. This study, along with that of Eltringham (1995), has shown inadequacies in some of the popular methods of interpreting dog behaviour, while other, more usual methods, were supported. The findings of the present study demonstrate the critical influence of human behaviour on arousal levels in dogs.

APPENDIX 1

Canine postural body expressions

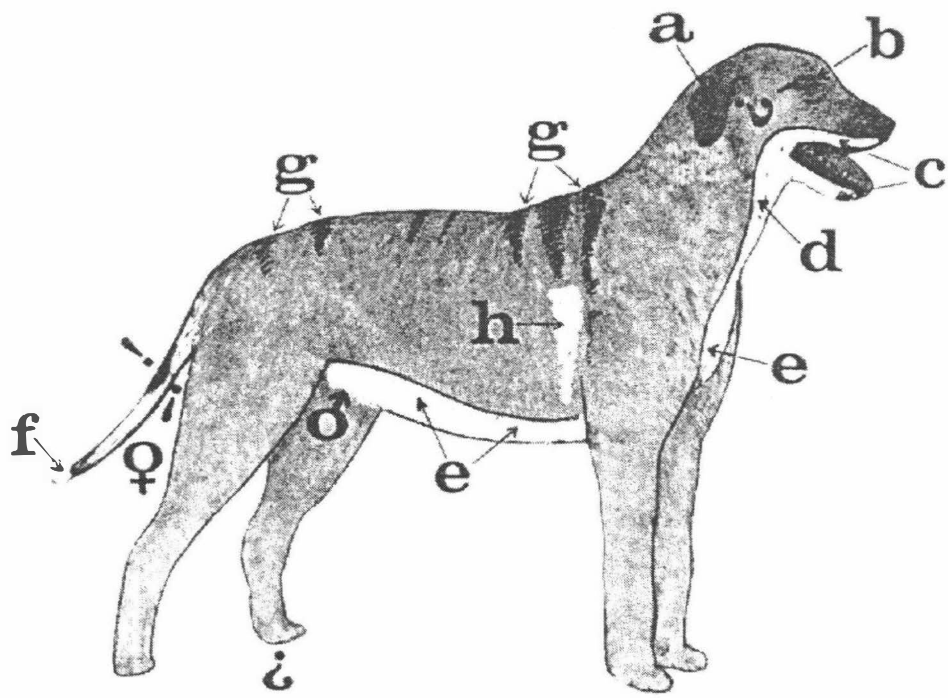


Figure 40. Summary schema of body markings associated with social behaviour (aggression, facial expressions and social investigation) in a dog. *(Fox, 1969).*

(a) Mobile pinna incorporated into various facial expressions and ? refers to external meatus secretions which may serve some olfactory function to conspecifics. (b) Social stimuli provided by eyes – direct stare or head turning and avoidance of eye contact. (c) White muzzle contrasts black lips and enhances visual signal of mouth position. (d) White cheeks may serve to orient attack. (e) Pale ventral region for camouflage may serve as 'white flag' of submission when displayed by animal rolling over on to side. (f) White tail tip may enhance tail displays. (g) Rump and shoulder hackles-coarser, longer hairs with variegated colour are used in agonistic displays (piloerection also enhances these visual display structures). (h) Vertical pale shoulder stripe may serve to orient attack. *(Fox, 1969).*

APPENDIX 2

Human Calming of Dog Arousal

CONSENT FORM

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I understand I have the right to withdraw from the study at any time and to decline to answer any particular questions.

I agree to provide information to the researchers on the understanding that my name will not be used without my permission. *(The information will be used only for this research and publications arising from this research project)*.

I agree/do not agree to the interview being audio/video taped.

I also understand that I have the right to ask for the audio/video tape to be turned off at any time during the interview.

I agree to participate in this study under the conditions set out in the Information Sheet.

Signed: ....

Name: -
....

Date: ....

APPENDIX 3

Example of check sheets used to record data from video recordings using a ten-second time sampling technique

Data Sheet One: Dog Behaviour during Trial

Dog: **Observer:** **Component:**

Phase: **Experimenter:** **Trial:**

Momentary Time Sampling

Behaviour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Tail Position	3	2	3	3	4	2	2	1	3	3	3	3	3	3	3
Head Pos.	2	2	3	3	2	3	3	3	1	3	2	3	3	3	3
Ear Pos.	1	1	2	2	3	2	3	3	2	3	3	3	3	3	3
Vocal.	2	1	2	1	3	3	2	3	2	3	3	3	3	3	3

Event Recording

Behaviour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Yawning	0	2	4	0	0	0	1	0	0	0	0	0	0	0	0
Lip Licking	5	4	2	1	0	1	0	0	0	3	0	0	0	0	0

Data Sheet Two: Experimenter Behaviour During Trial

Dog: **Observer:** **Component:**

Phase: **Experimenter:** **Trial:**

Ten Second Time Intervals

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
✓	✓	✓	✗	✗	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓

✓ = Correct Behaviour or Agreement

✗ = Incorrect Behaviour or Disagreement

APPENDIX 4

Inter-Observer Agreement Measures

	B 1 Max	B 1 George	B 1 Diva	B 1 Houston	AT Max	AT George	AT Diva	AT Houston	B1 & AT All subj.
# of trials scored	8	7	8	8	13	10	4	8	66
# of agreement intervals	670	575	666	648	1047	846	333	660	5445
# of dis-agreement intervals	50	55	54	72	123	54	27	60	495
Overall % agreement	93%	91%	93%	90%	89%	94%	93%	92%	92%
Range	91-94%	88-96%	87-95%	83-96%	84-92%	86-100%	88-96%	87-94%	83-100%

APPENDIX 5

Intra-Observer Agreement Measures

	Max				Diva				Total
	B1	AT	PT1	B3	B1	AT	PT1	B3	
# of trials scored	2	2	2	2	2	2	2	2	16
# of agreement intervals	162	169	167	162	170	165	172	165	1332
# of Dis-agreement intervals	18	11	13	18	10	15	8	15	108
Overall % agreement	90%	94%	93%	90%	94%	92%	96%	92%	93%
Range	88-92%	93-94%	91-94%	90-91%	92-97%	91-92%	94-97%	91-92%	88-97%

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