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## **Breeding dogs for beauty and behaviour:**

*Journal homepage: [www.elsevier.com/locate/applanim](http://www.elsevier.com/locate/applanim)*

*Applied Animal Behaviour Science 137 (2012) 1– 12*

*Contents lists available at SciVerse Science Direct*

Why scientists need to do more to develop valid and reliable behaviour assessments for dogs kept as companions.

Tammie Kinga,

Linda C. Marstona,

Pauleen C. Bennettb,

1 a Anthrozoology Research Group,

Animal Welfare Science Centre,  
School of Psychology and Psychiatry,  
Monash University, Building 17, Clayton Campus, Wellington Road,  
Victoria, 3800, Australia  
1 b School of Psychological Science La Trobe University,  
PO Box 199,  
Bendigo, Victoria,  
3552, Australia

**Article info article history:**

Accepted 27 November 2011

Available online 18 December 2011

Keywords:

Behaviour

Behaviour assessment

Companion dog

Dog breeding

Human–animal interaction

**Modern dog abstract;**

In the past, dogs were bred to perform specific utilitarian roles.  
Nowadays, the dog's most common role is that of human companion.

Our world has changed dramatically since the first dog breeds were developed, yet many of these existing breeds remain popular as companions.

While dogs kept as companions can provide a range of benefits to humans – the reason why these wild ancestors were taken, tamed ... so that they can do for man better and faster than man – for benefits; in some cases the relationship between dog and human can be tenuous or even dangerous.

Many dogs' exhibit behaviours their owners consider undesirable and these dogs therefore – because of these natural born with expected behaviours - may and do cause disruption and injury to humans and other animals.

As a consequence, many are relinquished to shelters.

It is proposed that some of this unsuitable behaviour may be the result of inappropriate dog-owner matching, made more likely by the general change in the role of dogs, from working animal to companion animal, coupled with a strong tendency for modern owners and breeders to select dogs primarily on the basis of morphological, rather than behavioural, characteristics.

This paper highlights how the roles for dogs have changed and the importance of taking physical health and behaviour, as well as perceived beauty, into consideration when breeding and selecting dogs as companions.

With the measurement of behaviour and limitations of existing canine breed behavior it is suggested that scientific development of accurate behavioural assessments will be able to identify desirable canine behavioural traits and would provide invaluable tools for a range of dog-related organizations.

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\* Corresponding author. Tel.: +61 3 9905 1713; fax: +61 3 9905 3948.

E-mail addresses: [tammie.king@monash.edu](mailto:tammie.king@monash.edu) (T. King),

[linda@marston.com.au](mailto:linda@marston.com.au) (L.C. Marston),

[pauleen.bennett@latrobe.edu.au](mailto:pauleen.bennett@latrobe.edu.au) (P.C. Bennett).

Tel.: +61 3 5444 7460; fax: +613 5444 7850.

0168-1591/\$ – see front matter © 2011 Elsevier B.V.

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doi:[10.1016/j.applanim.2011.11.0162](https://doi.org/10.1016/j.applanim.2011.11.0162) T. King et al. / Applied Animal Behaviour Science 137 (2012) 1– 12

7. Conclusion

## 1. Introduction.

Dogs are present in almost every human society and are among the most popular pets/companions/working dogs in western cultures (Archer, 1997).

They are also the earliest domesticated animal species (Clutton-Brock, 1995), with fossil evidence indicating that dogs and humans have lived alongside one another for thousands of years (Morey, 2006; Miklosi, 2007).

Individual dogs and humans often form close emotional bonds with one another (Crawford et al., 2006).

In some cases, however, the bond between dog and owner can break down (Serpell, 1996).

Occasionally this results in a person being badly injured or killed by one or more dogs (Cassell and Ashby, 2009).

In addition, many unwanted dogs are relinquished to animal shelters annually.

*In Australia, approximately 30% of these dogs are euthanized (Marston et al., 2004).*

*Similar statistics have been reported in the United States (Kass et al., 2001; Bartlett et al., 2005).*

This review begins by briefly examining the process of dog domestication and historical relationships between dogs and humans.

It then examines the roles dogs currently undertake, comparing these with roles performed previously.

Available information suggests that the types of dogs considered behaviorally “ideal” in the past may not be considered ideal in the present day.

## **2. Domestication of *Canis familiaris*.**

The exact process of how dog domestication occurred and where it originated is disputed, but genetic and archaeological evidence indicates that modern dogs are descendants of the wolf (*Canis lupus*) (Dayan, 1994; Savolainen et al., 2002; Saetre et al., 2004).

Archaeological evidence indicates that dogs were the first animal to be domesticated (Morey, 1994; Clutton-Brock, 1995; Morey, 2006), having been associated with humans for at least 15,000 years (Dayan, 1994; Vellanoweth et al., 2008).

During the process of domestication dogs' ancestors underwent a host of changes in morphology, physiology and behaviour.

With few exceptions, such as the Siberian Husky & Alaskan Malamute, which are thought to be the best representatives of the ancestral dog gene pool (Parker et al., 2004) domestic dogs gradually lost their lupine appearance, becoming smaller in overall size and with their facial region shortened (Morey, 1994).

In addition to physical characteristics, modern wolves and dogs differ in their behaviour {modern wolves still live and eat wild and domesticated dogs mostly live and eat most like their human families MK}

Many dogs not only appear juvenile, even as adults, but they also act in a manner similar to juvenile wolves.

Dogs may bark, whine and solicit attention throughout their lifetime, whereas wolves only exhibit these types of behaviours when they are young (Morey, 1994).

This suggests that physiological and behavioural characteristics are interrelated.

Russian fox-farm experiments, conducted in the 1950s by Dmitri Belyaev, provide evidence to support this view.

In these experiments the process of domestication was replicated by selectively breeding foxes which were tamer and calmer than their littermates.

In the process of selecting purely for behavioural traits, Belyaev discovered that the foxes' physical phenotype also changed.

Eventually individuals that exhibited tame and friendly behaviours also showed a higher probability of possessing piebald coats, floppy ears and curled tails and they barked, actively sought human interaction and their reproductive cycle was modified (Belyaev, 1979).

Belyaev's experiments may explain the diverse phenotypic variation which exists among different dog breeds today.

If humans originally selected dogs primarily for various roles, based on their behavioural characteristics, then it could be expected that their appearance might also differ.

The following sections describe in more detail how development of different dog breeds progressed and why this has significant repercussions for dogs in today's society.

### **3. Historical relationships between dogs and humans: The development of dog breeds.**

It is believed that distinctive breed types came into existence around 3000–4000 years ago, as a result of artificial selection by humans (Clutton-Brock, 1995).

Miklosi (2007) suggests that diversification of dogs occurred earlier, around 5000–7000 years ago, when humans moved from hunter gatherer lifestyles to settlements involving agriculture and started selecting dogs for working roles.

Regardless of the exact timeframe, it is undisputed that people have been selecting for certain behaviours and temperaments, as well as particular physical characteristics, such as colour, coat length, height and facial appearance.

King et al. / *Applied Animal Behaviour Science* 137 (2012) 1– 12 3 for many years.

Currently, approximately 350 different breeds of dog are recognized by Kennel Clubs around the world (Spady and Ostrander, 2008).

These breeds vary enormously in their size, shape, colour and behavioural predispositions.

It has been suggested that the morphological variation seen within dog breeds may be an indirect consequence of selection for diverse and specialised behavioural abilities (Serpell, 1995). This is consistent with findings from Belyaev's farm fox experiments.

Most dog breeds were developed in Europe in the 1800s (Ostrander, 2007) and almost that time every breed was created to perform a particular function, the three main purposes being to hunt, guard and herd.

People relied on dogs to perform tasks in a specific, predictable way, which assisted them during their lives.

In addition to their early working roles, dogs also provided humans with companionship as a result of the close bonds they form with people.

This helps to explain their continued popularity over the world, even though many of the traditional roles no longer exist.

Indeed, in recent times many dogs have been bred and acquired purely as companions for people.

Such dogs might usefully be identified by the specific descriptive term 'companion dog', much as previous generations of canines were identified by terms such as {*fighting, catch attack dogs MK*}, guarding dogs, herding dogs, gundogs and toy dogs.

While these traditional descriptors are still widely used to group purebred breeds into distinct functional categories, we propose that the term companion dog be applied to a dog of any given breed or breed type, whose primary function is to serve as a human companion.

Perhaps surprisingly, the emphasis on keeping dogs for companionship rather than for other functional roles led gradually to an emphasis on physical appearance rather than function.

It may have been assumed that all dogs were equally capable of fulfilling the companionship role, so that personal preferences in morphology could be satisfied.

Alternatively, perhaps the emphasis on morphology reflects the fact that few people who own dogs for companionship are interested in breeding, and that reproductive control via surgical sterilization is now widely accepted as being a responsible ownership behaviour (Rohlf et al., 2010).

Almost no information is available regarding where companion dogs come from, but it is widely believed that dog breeding is conducted primarily by those who breed purely for commercial reasons, to satisfy consumer demand for "pet dogs", and by those who compete with their dogs in competitions that reward specific morphotypes rather than specific behaviours.

In agreement with this conjecture, many developed countries report high levels of surgical sterilization (spay/neuter) among the companion dog population.

In Australia, for example, approximately 78% of companion dogs are sterilized and therefore unable to contribute to subsequent generations.

The practice of selecting dogs on the basis of appearance rather than working ability initially coincided with the banning of dog fighting and bull baiting in England in 1835 (Lindsay, 2000).

Breed standards, consisting of a written set of guidelines outlining specifically how each breed of dog should look and behave, were constructed.

Dog breeders were, and still are, encouraged to adhere to these often “ambiguous written breed standards” by breeding dogs accordingly.

While the interpretation of the standards can vary widely between individuals, generally the main aim is to produce dogs which possess correct conformation, good health and suitable temperament as described by the relevant standard.

**Subsequent to these standards being created, dog shows were introduced.**

Dog shows primarily judge physical appearance, while behaviour and temperament is often left to be subjectively judged by owners.

To summarize, the development of dog breeds resulted in an array of dogs which differ morphologically and behaviorally.

Dogs were originally bred for their working ability but the emphasis on functionality has altered from what it was in the past.

Currently, dogs are kept primarily as companions, yet decisions on dog breeding may be mostly based on how a dog looks while behavioural traits may be overlooked.

The next section discusses current relationships between companion dogs and people, demonstrating the importance of dog behaviour, rather than morphology, in satisfying modern needs.

#### **4. Present day relationships between dogs and humans:**

##### **The pros and cons of dog ownership.**

Some dogs {*breeds*} continue to perform specialized tasks within organizations such as the police, military, customs and quarantine services (Fuchs et al., 2005).

In addition, dogs are also used to provide assistance to people with disabilities, in the case of guide dogs for the blind, pets as therapy, seizure alert dogs and hearing-dogs (Wells, 2007; Serpell et al., 2010).

The {*some dog breeds*} dogs' abilities to learn and be directed by humans has enabled people to use dogs in specialist roles in which their superior sense as been utilized to seek out narcotics, accelerant, bombs, termites, missing persons and, in some cases, malignant tumours (Pickelet al., 2004).

Furthermore, many farmers in rural areas rely on dogs {*for family protection and*} to herd or guard livestock, while recreational hunters have dogs accompany them to assist in capturing or retrieving their kills.

The array of breeds which currently exist still possess traits specific to these tasks.

Although great differences in behaviour are exhibited across breeds of dog (Svartberg, 2006), there is also large variation in the behaviours exhibited by individuals of the same breed (Takeuchi and Houpt, 2004; Svartberg, 2006; Spady and Ostrander, 2008).

This issue is critical to the discussion being developed in this review and is discussed in more detail in a later section.

The total number of dogs in modern communities that participate in specialist activities is small, as highlighted in a recent Australian survey which indicated that, of the total population of over 3.4 million dogs, only 4195 are currently used in working roles (Branson et al., 2009).

Nonetheless, dog ownership remains prevalent.

In the United States 78.2 million dog's reside in 40% of households (American Pet Products Association, 2011).

In the United Kingdom, there are estimated to be 7.3 million pet dogs in 22% of households (Pet Food Manufacturers' Association, 2011).

In Australia, 3.41 million dogs live in 36% of households (Australian Companion Animal Council, 2010).

This raises the question of exactly what roles these dogs perform?

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Research has consistently demonstrated that modern dogs are most commonly kept as pets or companions, rarely, if ever, undertaking the role that their ancestors were selectively bred to perform.

For example, in a recent study, most (83.7%) dogs were reported by owners to have been purchased for the purpose of providing companionship (Bennett et al., 2007).

Similarly, another study reported that 74% of the participants claimed that the main benefit they received from owning a dog was that of companionship and over half (52%) of participants obtained a dog primarily for companionship (Kobelt et al., 2003).

Results such as these confirm that relationships between dogs and people may have altered quite profoundly over recent decades.

Indeed, many people now require their dog to live closely with them, sharing their home and sometimes their bed (McGreevy and Nicholas, 1999).

Such an undertaking would have been totally unrealistic in years gone by, when veterinary medicine was not sufficiently advanced to control the spread of parasites and disease (Grier, 2007).

The popularity of dogs as companions can be further illustrated by the increase in sales in recent years of pet-related products.

The Australian pet industry contributes around AUS\$ 6.02 billion (US\$ 5.99 billion) to the economy annually and employs more than 44,700 people.

Of that total expenditure, 59.7% is spent on dogs ([Australian Companion Animal Council, 2010](#)).

Similarly, in the USA, US\$ 50 billion dollars is expected to be spent on dog products in 2011 ([American Pet Products Association, 2011](#)).

Many of these products are luxury items, purchased by owners not because they are required to sustain the health and function of the dog, but to express the owners' feelings towards the dog as a valued family member ([Holbrook and Woodside, 2008](#)).

Coupled with the increase in closeness of people and their companion dogs are numerous scientific reports that owning a dog is associated with physical and psychological benefits ([Wells, 2007](#)).

For example, people who live with dogs are at lower risk of cardiovascular disease and depression, dogs facilitate social contact, and petting your dog lowers stress levels ([Anderson et al., 1992](#); [Patronek and Glickman, 1993](#); [Cutt et al., 2007](#)).

In fact, it has been estimated that pets save the Australian economy approximately AUS\$ 988 million in health expenditure annually ([Headey, 1999](#)).

These factors suggest that the dog's current primary role of companion may be as valuable as its historical roles, although some caution is required when interpreting existing data.

The financial benefits of owning a dog have been challenged by [Parslow and Jorm \(2003\)](#), who claim that dog owners do not save on health care costs through reducing the number of doctor visits.

In fact, their study found that pet owners use significantly more pain relief medications than non-pet owners ([Parslow and Jorm, 2003](#)).

Consistent with this possibility, Herzog (2011) recently argued that evidence in support of health benefits associated with pet ownership is unconvincing, due mainly to methodological issues in existing studies. Chur-Hansen et al. (2010) also drew attention to the fact that more rigorous methodologies are required to investigate the impact of companion dogs in therapeutic settings, with many existing studies depending on very small sample sizes and researchers who are not blind to experimental conditions and who often have a vested interest in the study results.

Finally, dogs are not always viewed in a positive light by the general public.

Media around the world tends to focus a large amount of attention on news stories involving dog attacks;

especially if a child has been injured or killed (Lodge and Hood, 2002).

*This has created a false impression* that dog-related injuries to humans have become more numerous and severe than in the past when, in fact, statistics indicate that more people sustain injuries associated with objects such as front-porch steps, kitchen utensils, balloons and slippers than with dogs (Bradley, 2005).

Debates about whether dogs are good or bad for humans are likely to continue indefinitely and may never be resolved while they are cast in such black and white terms.

A more fruitful approach may be for researchers to consider under what conditions benefits accrue and, in particular, whether some dogs perform better as human companions than others.

In the past, it was widely accepted that some dog breeds performed certain functions more successfully than did other dog breeds.

Hence, the division into guarding dogs, herding dogs, gundogs *{and other disciplines}* and so forth that was discussed previously.

Whether some dog breeds are also more successful as companions is largely unknown, although the media's use of graphic pictures and emotive language in relation to dog bite incidents are in part responsible for some members of the public becoming afraid of some dogs, especially the breeds which are said to be involved in attacks (Cohen and Richardson, 2002; Hallsworth, 2011).

It is well established that media and cultural backgrounds can influence the stereotyped images that people form of some breeds (Notari and Goodwin, 2007) and it has been documented that breed stereotypes exist in Australia (Bennett and Mornement, 2009).

A result of these social processes, some breeds may be labelled aggressive and avoided by those seeking a companion dog. Indeed, such stereotyping has resulted in breed specific legislation being enacted in some countries, where certain breeds are either banned or where their owners are forced to adhere to dangerous dog laws (Schalke et al., 2008) even if their individual dog is an affectionate, friendly animal who behaves in a socially acceptable manner.

Although government officials implement these rulings, there is little evidence to support the notion that some breeds are inherently more dangerous than others (Rosado et al., 2007; Kaspersson, 2008; Schalke et al., 2008) or that dog bite injuries to humans have been significantly reduced by breed specific legislation (Klaassen et al., 1996; Collier, 2006; Cornelissen and Hopster, 2010).

Restricting dog breeds per se is perhaps unlikely to reduce incidents involving dangerous dogs, unless extensive regulations which include muzzling of dogs and fining irresponsible owners are properly enforced (Villalbi et al., 2010).

Although any muzzled dog poses less of a risk to the public, it has been reported that people tend to perceive the dog as a danger and will behave in a fearful manner (Racca and Baudoin, 2009).

This has negative implications for sociable dogs whose owners have to comply with regulations based on a dog's appearance or breed.

These dog owners may be less inclined to walk or socialize their dog that is required T. King et al. / Applied Animal Behaviour Science 137 (2012) 1– 125 to be muzzled based on its breed.

**A more effective solution might be to educate the public on dog behaviour and identify individual dogs that may pose a risk to humans, based on their behavioural attributes, using a scientifically designed assessment which accurately measures dog behaviour.**

This approach is discussed in more detail in later sections.

Even when specific dog breeds are not perceived to be dangerous, the place of individual companion dogs in society may be tenuous.

In Australia, peoples' homes usually include a confined backyard and, as a result, many dogs have regular access to an outdoor area (Kobelt et al., 2007).

Although this may seem ideal, studies have shown that dogs who live in large sized dwellings, particularly those who live in family homes that have a backyard, are rarely taken out and walked for long (Marinelli et al., 2007).

This lack of social interaction with other dogs and people can {and do} result in dogs developing behavioural problems, such as excessive barking, digging, destructiveness, aggression (Kobelt et al., 2003), which can cause community disruption and even endanger the public.

Dogs which are unable to adapt to the role of a modern day companion animal, including behaving in a way that is considered desirable by their owners, are more likely to be relinquished to shelters (Marston et al., 2004) where 31.5% are euthanized (Marston et al., 2004).

The most common reason for the relinquishment of dogs in Australia is that the owner is moving house, followed by canine behaviour problems such as escaping, hyperactivity/boisterousness and barking (Marston and Bennett, 2003; Marston et al., 2004, 2005).

Similar trends were found in the United States ([Lindsay, 2000](#)), where issues related to moving house were found to be the most common cause of relinquishment, followed by behavioural issues such as hyperactivity, noisiness, fearfulness and house training problems ([New et al., 2000](#)).

Another study indicated that Taiwanese dog owners are more likely to relinquish a dog if it develops behavioural problems such as barking and house soiling ([Weng et al., 2006](#)).

In Great Britain, dogs which are returned to a shelter after being adopted, are most commonly returned because of perceived behavioural problems that the new owner is unwilling or unable to tolerate ([Wells and Hepper, 2000](#); [Diesel et al., 2008](#)).

In addition, the main behaviour problems reported by Iranian dog owners were excessive activity, inappropriate elimination, fearfulness and aggression towards unfamiliar people ([Khoshnegah et al., 2011](#)).

It appears that similar canine behavioural problems are reported worldwide.

These findings indicate that the behaviour of a companion dog often determines whether the dog can live comfortably with its human family, and remain in that household for its entire life, or whether it is relinquished to an animal welfare shelter or pound.

In many instances, how a dog behaves in a shelter also determines whether the dog will live or die.

In an Australian shelter over a period of one year, 53.9% of dogs were euthanized due to behavioural reasons while 34.5% of those euthanized had health issues ([Marston et al., 2004](#)).

This indicates, therefore, that, in addition to behaviour, the overall health of the dog is of utmost importance.

In contrast, there is no evidence to suggest that a dog's morphotype, how it looks, is critical in determining its success as a human companion.

In light of these findings, it is difficult to explain why the health and behaviour of companion dogs appear to be given less emphasis when making breeding decisions, which focus instead on how the animals look (McGreevy and Nicholas, 1999).

Breeding dogs with exaggerated morphologies in an attempt to conform to breed standards has been linked with the increased likelihood of a range of disorders, including breathing difficulties, cardiovascular issues, skin conditions and musculoskeletal disorders (Asher et al., 2009).

These problems are not unrecognized, and a number of Kennel Clubs around the world have started to take a proactive approach in enhancing pedigree dog welfare and improving breeding practices (Rooney, 2009).

However there has, to our knowledge, been no systematic attempt to promote the breeding of purebred dogs with the temperament and behavioural predispositions best suited to the role of companion dog. In fact, Kennel Clubs often include a clause encouraging members to breed dogs which conform behaviorally to their respective breed standard and discouraging members from breeding dogs for the pet market.

For example, members of the Australian National Canine Council who breed dogs are expected to conform to a code of ethics which includes **the following requirement:**

“A member shall breed primarily for the purpose of improving the quality and/or working ability of the breed in accordance with the breed standard, and not specifically for the pet or commercial market” (Australian National Kennel Council, 2008).

This means that breeders are encouraged to produce dogs which possess temperaments and behaviours that are suited to their historical role {I like this MK}, rather than their most common role nowadays, as companions.

One could argue that breeds which were primarily developed to serve as human companions would make better companion dogs than those developed to guard possessions or herd sheep.

This may be the case, yet there is no objective measure to assess their or other breeds, suitability.

Additionally, in the past, dogs that did not fit the criteria for which they were purposely bred would be culled, usually meaning that they were killed (or never be used as for breeding).

This ensured dogs that were not suitable did not consume valuable resources and prevented unwanted characteristics being passed on through generations.

Today these dogs are typically neutered, which is an equally effective form of genetic culling.

However, since these animals can still be sold as pets, it is possible that many dogs, not particularly well suited either to their traditional role or to their modern role as human companion, nonetheless live in society.

While it is relatively easy to find fault with the current policies and procedures of established Kennel clubs, it should also be stressed that registered pedigree dogs account for only a very small proportion of the dogs residing in most developed countries;

in Australia the proportion is only 2% of the total dog population (Australian National Kennel Council, 2009; Australian Companion Animal Council, 2010).

Any form of dog breeding which produces dogs primarily as human companions should place emphasis on producing healthy animals with  
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behavioural predispositions which make them suitable as companions in today's society.

Unfortunately, information about where most dogs come from and how breeding dogs are selected, other than within the purebred community, is entirely absent from the scientific or popular literature. The information provided thus far in this review supports the need to accurately identify and breed healthy dogs which exhibit behaviours suited to coexisting comfortably with people as well as other animals. If the putative benefits of dog ownership are to be maintained and the welfare of dogs protected, it is critically important that dogs, regardless of their breed or breed type, live harmoniously in our present community.

This could potentially be achieved through a combination of educating the public about dog training and behaviour health testing individuals accurately identifying individual dogs which possess suitable temperaments prior to using these dogs in breeding programs.

There is a clear need to protect the general public from dangerous dogs through identifying dogs which are ill-suited for their current role as human companions, but identifying those that are well suited is equally important.

By doing this, the welfare of both humans and dogs can be protected, such that people will be able to continue enjoying the benefits of dog ownership *{as companion or then for any other discipline a dog is needed MK}*

**In summary**, it is evident that people and dogs share a special bond as a result of their close association over thousands of years.

This close relationship has enabled people to utilize dogs to assist them in a variety of ways.

Today the most common function is to provide companionship. However, companion dogs are not always viewed in a positive manner, especially if they exhibit unacceptable behaviour or cause injury to people.

Because the behaviour of a companion dog is so critically important to its welfare and survival, it is essential that those interested in human dog relationships to understand where behaviour comes from and whether, and, if so, how, it can be modified – *{or then by preference get the breed that will be a companion animal and pet and not breeds that are guard, attack or fighting dogs MK}*.

The following section defines behaviour and discusses the concepts of temperament and personality, establishing in the process that many canine behaviours reflect a combination of heritable and learned responses to environmental situations.

## **5. Where does behaviour come from?**

When referring to animals, behaviour can be defined as the actions or reactions of an individual in response to a particular situation or stimulus (Grier, 1984).

### **A number of factors determine how an animal will behave.**

These include;

the genetic make-up of the individual the environment and the experiences to which the animal has previously been exposed.

Experiential influences on dog behaviour were initially documented by Scott and Fuller (1965), who outlined a number of sensitive periods of development in the dog, suggesting that; early experiences in a puppy's life can markedly affect the adult dog's behaviour (Scott and Fuller, 1965).

Consistent with this, it has been suggested that differences between individual dogs can be partly explained by; experiences during early life, such as early stimulation methods, socialization enrichment experiences (Battaglia, 2009).

It has also been documented that experiences occurring between three and six months of age can *{and do}* influence the development of problematic behaviours such as avoidance and aggression in dogs (Appleby et al., 2002).

This means that dog breeders and owners are responsible for providing puppies with an optimal developmental environment during this critical period of canine development to ensure they mature into suitable companion dogs.

Although these data confirm that dog behaviour is influenced by experience, it is also well established that evolution and domestication have played a role in shaping inherited behavioural predispositions (Galibert et al., 2011).

**Dog breeds differ not only in appearance from other breeds but also in the way they typically behave.**

*(This might be the reason for a breed to be sought after MK).*

Most Border Collies instinctively know how to herd, for example, while most retrievers know how to retrieve *{etc.}* (Hart and Hart, 2005).

Genetic influences on behaviour are often captured by the terms temperament and personality, terms that are commonly used in dog behaviour studies; often interchangeably.

Temperament has been described as referring to relatively consistent basic dispositions, inherent in the individual, which are present from a young age and modulate the expression of activity, reactivity, emotionality and sociability (Goldsmith et al., 1987).

Experimentally, temperament traits are typically revealed by behavioural differences that exist between individuals, particularly those exposed to similar environmental influences, and studies have shown that these are generally heritable.

For example, a number of traits, such as cooperation with people and courage exhibited by Labrador Retrievers, show moderate to high rates of heritability, while affability and prey drive are highly heritable in German Shepherd Dogs (Wilsson and Sundgren, 1997a) and fearfulness and nervousness are highly heritable in Guide Dogs (Goddard and Beilharz, 1983).

This evidence indicates that canine behaviours are controlled, at least in part, by genetic components (Spady and Ostrander, 2008; van der Waaij et al., 2008) and that individual dogs exhibit different behavioural responses to various stimuli, presumably because they differ in their underlying temperament.

In human research, the term personality is used to refer to the patterns of characteristic thoughts, feelings and behaviours that characterize an individual and distinguish one from others and which persist over time and situations (Phares and Chaplin, 1997).

Temperament has a role, along with experience, in the development of an individual's personality (Ley and Bennett, 2007) and, as a result, will influence an individual's behaviour in response to the environment. As a relatively new area of research, the study of personality in domestic dogs is becoming increasingly popular (Jones and Gosling, 2005).

A range of studies have been published in journals pertaining to zoology, psychology, veterinary medicine, anthrozoology, animal welfare and biology.

It is now commonly accepted that dogs possess personality traits (Svartberg and Forkman, 2002; Ley et al., 2008).

Traits such as playfulness, curiosity/fearlessness, sociability and aggressiveness have been listed as personality components in the dog (Svartberg, 2005, 2006), as well as extraversion, motivation, training focus, amicability and neuroticism (Ley et al., 2008).

Researchers often avoid using the term personality when referring to animals, at risk of T. King et al. / Applied Animal Behaviour Science 137

(2012) 1– 127 it sounding anthropomorphic (Jones and Gosling, 2005), however, a number of recent studies have acknowledged that a range of animal species including honeybees (Wray et al., 2011), birds (David et al., 2011), primates (Uher and Asendorpf, 2008) and horses (Lloyd et al., 2008) possess distinct personality traits.

**To summarize**, how a dog behaves reflects a combination of factors relating to its inherent (genetic) temperament and the environment it lives in, as well as its past experiences.

Dogs within the same breed often share common temperament traits {can be expected to have}, although the expression of these may vary between individuals and they may differ by possessing individual characteristics, some of which are heritable.

These combine with experience to produce distinct personality traits, which then influence the tendency of each dog to react in specific but generally consistent ways to future stimuli – {learned behaviour}.

This is significant because it means that personality can be inferred from how an individual behaves in certain situations, and that this, by extension, tells us something about the dog's underlying temperament and how it might react in other situations.

Of course it is difficult to infer exactly what temperament traits are actually being tested, as they are hypothetical constructs and we can only measure the behaviour offered, but repeated measures of behaviour over time or in different situations may provide insight into underlying temperament constructs.

Potentially, therefore, if behaviour could be accurately measured, individual dogs could be selected for breeding based on temperament characteristics.

Because such traits are at least partly heritable, this would assist in producing offspring with suitable temperaments for their various roles in human society.

It has been suggested previously that assessments which accurately identify desirable working dog traits provide a means to possibly examine correlations between behavioural phenotypes and specific genetic markers (Olson et al., 2004).

This approach should not be limited to working dogs, however, and could potentially be used to investigate genes associated with desirable companion dog behaviours.

To conduct studies such as these would require cooperation between dog breeders, geneticists and ethologists but, given the importance of the companionship role, may be of even greater value than similar studies conducted with working dogs.

Companion dogs could be bred which not only conform to physical standards but which are also healthy and possess the temperament traits - necessary for them to develop, given appropriate experiences, desirable behavioural traits.

While this approach sounds promising, it clearly depends on breeders having access to techniques and instruments with which to assess the behaviour of individual dogs.

Breeders armed with tools to measure particular traits and who can also provide puppies with appropriate early environmental stimulation should be able to make substantial improvements in the dogs they breed for the various working roles and as companions for people.

The following section examines different approaches to measuring behaviour; with the objective of determining whether scientists could be doing much more to assist responsible breeders meet their breeding goals.

## **6. Measuring dog behaviour.**

It is in the interests of dog breeders to select for the temperament and/or behaviours they view as desirable in their breeding dogs, as well as for appearance *{breed conformation}*, and it might be assumed that most do this to the best of their ability.

However, without scientific expertise, objectivity and appropriate tools, accurate selection is likely to be difficult.

A number of different approaches are employed to study canine behaviour.

**These include:**

owner-directed questionnaires;

expert ratings of breed differences;

standardized assessments;

observational studies ([Spady and Ostrander, 2008](#)).

All of these approaches have their uses, however the most commonly used method to measure behaviour is the standardized assessment which, in theory, should provide more objective data than owner derived information from questionnaires.

The complexity of dog behaviour means that the development of accurate measuring devices is extremely challenging.

Nonetheless, in an attempt to identify dog temperament or personality traits researchers interested in dog behaviour have developed a range of behavioural assessments involving series of subtests which measure a variety of behaviours.

Behaviour can be recorded using a video camera, written or dictated verbal descriptions, automatic recording devices, paper check sheets and computer event recorders ([Martin and Bateson, 2007](#)).

In Sweden, for example, the Dog Mentality Assessment is utilized by a range of breed clubs and working dog organizations ([Svartberg, 2002](#); [Svartberg and Forkman, 2002](#)).

This not only provides breeders and working dog groups information on their dog's behaviour but it also enables longitudinal data to be collected, which will continue to inform researchers on the assessments' capabilities.

A range of behaviour assessments have been developed for a variety of reasons.

**These include:**

to investigate personality using the dog as a model (Svartberg and Forkman, 2002);

for assessing specific temperament traits such as fear (King et al., 2003);

or aggression (Netto and Planta, 1997; Bräm et al., 2008; De Meester et al., 2011);

measuring pet dog attachment to people (Topal et al., 1998);

assessing working dog temperament traits (Wilsson and Sundgren, 1997b,a);

examining heritability of temperament traits (Wilsson and Sundgren, 1998).

Furthermore, some dog shelters or dog rescue organizations administer some form of behavioural assessment prior to re-homing dogs

(van der Borg et al., 1991;

Netto and Planta, 1997;

Mornement et al., 2010;

Dowling-Guyer et al., 2011).

Currently, the most widely used assessments exist to test the suitability of working dogs in various roles such as;

police dogs (Slabbert and Odendaal, 1999),

guide dogs (Goddard and Beilharz, 1986;

Murphy, 1998;

Serpell and Hsu, 2001;

Batt et al., 2008;

Tomkins et al., 2011), detection dogs (Maejima et al., 2007;

Rooney et al., 2007)

military dogs (Haverbeke et al., 2009; Sinn et al., 2010).

Each of these assessments contains elements that have been successful in predicting the success of working dogs.

Information such as this saves organizations money by enabling them to invest resources only in dogs which have the potential to become operational 8 T. King et al. / *Applied Animal Behaviour Science* 137 (2012) 1– 12

Data from studies investigating the usefulness of behavioural tests for working dogs supports the general notion that, when developed correctly, a behaviour assessment is a valuable tool in evaluating a dog's aptitude to a particular working role.

In principle, therefore, it should be equally possible to gain information on an individual dog's suitability in the role of "companion dog".

In practice, however, many limitations exist among existing behavioural tests for companion dogs.

The development, design and data obtained from various canine behaviour assessments across a range of disciplines have been reviewed on a number of occasions and it has been reported that very few behaviour assessments for dogs exist that provide accurate, reliable measures of behaviour

(Jones and Gosling, 2005; Diederich and Giffroy, 2006).

Furthermore, few are developed using a systematic scientific approach and most lack reports of the test's reliability and validity (Taylor and Mills, 2006).

Reviews of the literature regarding behavioural assessments report an enormous amount of variation in how tests are conducted, their application, the behaviour that is being assessed, the dogs that are used plus a range of other variables (Jones and Gosling, 2005; Diederich and Giffroy, 2006).

It is advised that care is needed when designing and administering a new behavioural assessment and it should be prepared appropriately to be a useful measuring tool (Diederich and Giffroy, 2006).

## **6.1. How scientists can help breeders.**

This situation is clearly of great concern, since it leaves breeders without any objective means of assessing the behaviour of dogs destined to be, or to produce, companion dogs.

It also suggests, however, a number of ways in which scientists could help breeders motivated to breed the best companion dogs possible to achieve this aim.

First, breeders need to know that the vast majority of dogs in the modern world are kept primarily as companions, with no requirement for the specialist behaviours that were once highly sought after.

Breeders who want to breed in accordance with traditional breed standards stressing such behaviours should be extremely cautious about where they place their dogs, which may or may not be able to satisfactorily meet the needs of companion dog owners.

Second, breeders need to know that specific behaviours are critical in determining the success or failure of companion dogs; what these behaviours are what they can do to develop them in the dogs they breed.

**A previous study investigating the characteristics of 'ideal' companion dogs is instructive in this respect, indicating that most people want dogs;**

that are safe with children

friendly towards people

calm and well-behaved (King et al., 2009).

Additional studies are required to confirm these findings but focusing on these traits in breeding programs is likely to be worthwhile.

Third, breeders and companion dog owners need information about how to prepare their dogs for the life they might be expected to lead.

Currently, very little information exists on appropriate rearing practices of companion dogs and what levels of socialization and training are required to produce suitable companions.

Those involved in puppy rearing often adhere to protocols recommended by Scott and Fuller, who conducted research in the 1960s (Scott and Fuller, 1965).

This highlights the need for further studies which examine the effects of current rearing and socialization practices on puppies in the present day.

Fourth, breeders require access to information demonstrating that behaviour in dogs is highly heritable.

This is critical information since breeders may currently choose to breed from dogs with less than ideal behavioural characteristics, on the assumption that these undesirable behaviours are the result of inappropriate learning experiences and will not, therefore, be passed down to future generations.

This assumption is untenable.

While learning does contribute to canine behavioural traits, the high heritability of many temperament traits indicates that focusing on breeding only from dogs which display desirable behaviours should be mandatory.

Fifth, breeders need to know about the limitations of existing behavioural assessments and about the potential pitfalls associated with measuring behaviour.

The average dog breeder searching for a behaviour assessment is likely to be overwhelmed by the variety of protocols that exist both within and outside the scientific literature.

It is possible they would be unable to access or interpret the findings or the results relating to the assessment's reliability and validity.

Therefore, there is a clear need for more scientific research to be conducted on companion dog behaviour assessment protocols, and for the results to be widely disseminated, not only to other scientists, shelter organizations, {breeders} and breed clubs, but to the many dog breeders not affiliated with these kinds of organizations.

Perhaps most importantly, breeders need to be included as collaborators in future attempts to develop behavioural assessments which may be of benefit to them.

This is difficult to achieve in the companion dog area, since there are no over-arching industry bodies that could contribute to or oversee research efforts.

Purebred societies do exist, of course, and have done for hundreds of years, but, as already discussed, these represent a comparatively small number of breeders.

If scientists want to assist dog breeders by providing them with accurate behavioural assessments, it is essential that researchers ensure that the measurement tool is robust, valid, reliable and easy to administer, but also that it is ecologically valid—that it assesses those behaviours most relevant to the tasks companion dogs are being required to perform and that it provides information that breeders, as major stakeholders, want to know.

### **At present, the most commonly tested traits are reactivity**

fearfulness

aggression

sociability

responsiveness to training (Jones and Gosling, 2005).

An emphasis on testing for undesirable traits, such as;

aggression

fearfulness, may be misguided.

Breeders may find such tests uninviting and be unwilling to subject their dogs to the required protocols.

As an example, consider currently available behavioural tests for aggression, which usually involve exposing individual dogs to a range of startling or potentially threatening stimuli and noting their responses, the aim being to elicit aggressive responses if possible (Netto and Planta, 1997;

De Meester et al., 2008, 2011; Duffy et al., 2008).

Some forms of aggression are difficult to assess, and a number of behavioural studies have found that aggression tests can be hard to validate, specifically aggressive behaviours that are not related to fearfulness (van der Borg et al., 2010).

Furthermore, ethical considerations may arise when using particular stimuli to elicit high levels of fear and/or aggression.

Such assessments may affect a dog's welfare state, perhaps even conditioning it to behave in an aggressive or fearful manner.

Although legislative requirements often involve some form of behaviour assessment to determine a dog's level of aggression and whether the dog is safe to be living among the general community (Schalke et al., 2008), this sort of test is of less value to breeders.

It is essential that any assessment provided can be conducted easily, with minimal fuss and without risk of error or injury to the people or dogs involved.

## **6.2. The benefits of identifying desirable behavioural characteristics.**

With these limitations in mind, we propose that what may be needed most over the longer term by dog breeders ... is a general professionalization of the industry.

Much as cattle breeders, sheep breeders and goat breeders have banded together to formalize breeding practices and create industry groups able to fund research and introduce quality assurance programs, so should companion dog breeders be working together to create industry standards.

These industry groups would be used to regulate and encourage the responsible breeding of dogs for the role of human companion, but should not be restricted to purebred dogs.

Breeders who want to continue to select for historic working type traits should be free to do this, of course, but with the caveat that they need to be particularly dedicated in educating potential puppy buyers about the likely behavioural attributes these dogs will exhibit and how best to manage and train these animals to prevent unwanted behaviours developing.

Perhaps most pressing in the short term is development of a range of behavioural assessments that, instead of focusing on measuring behaviours which are considered undesirable, such as fear and aggression, focus on behaviours which are considered desirable, such as safety with children, friendliness towards people, calmness and obedience (King et al., 2009).

The ability to accurately measure and quantify these traits, without putting people or dogs at risk, would be extremely beneficial for breeders who could use the results as a marketing tool, much as they currently use a dog's show ring performance, health status or its success in other competitions.

At present, there are no valid and reliable tests for these behaviours. Our view is that companion dogs breeders should be generally encouraged to focus on breeding and rearing puppies which possess desirable behavioural attributes in addition to health and good conformation.

Assuming such characteristics will prove to be heritable then selectively breeding dogs with such attributes should reduce the level of undesirable behaviour displayed by pet dogs and reduce the numbers of dogs relinquished because of behaviour problems {this as "yester years breeding goals for APBT being practiced}.

Before this can be achieved, the behaviours in question must be able to be reliably identified and quantified.

Although genetic tests may eventually provide a means by which potential breeding dogs can be identified, not only in terms of their susceptibility to genetic diseases but also in terms of their predispositions to exhibit certain behaviours, are these not yet available.

Their development likely depends on being able to measure the behaviours in question, so that the behavioural results can be correlated with genetic analyses, which are often very costly. Even for existing dogs, the ability to confidently characterize a dog's behaviour could help breeders and other dog-related organizations match dogs with owners based upon their lifestyle, experience and preferred choice of temperament.

## **7. Conclusion**

This review outlined the relationship between people and dogs from the early beginnings to the present day.

The strong bond that many humans share with dogs is unquestionable and the attachments that dogs form with people has enabled the relationship between man and his 'best friend' to thrive in many different countries and cultures.

The circumstances of people's lives have altered dramatically over time and the roles dogs play in humans' lives have changed accordingly. No longer are dogs primarily required to serve utilitarian functions, instead they are most commonly kept as companions.

This is an important role, with accumulating evidence suggesting that companion dogs may provide people with a range of health benefits, psychological benefits and social support.

Obtaining these benefits is not guaranteed but may depend on a number of factors, one of which is how suitable the dog in question is for the companionship role.

In the present day, large numbers of dogs are relinquished to shelters and pounds, often because they exhibit behaviours considered problematic.

Furthermore, it is necessary to prevent instances of dog attack in the community.

Rather than restricting specific breeds, it would be more worthwhile in the short term to assess the behaviour of individual dogs to gain information on the dogs' underlying temperament and personality.

This, in conjunction with the development of programs aimed at educating the public on canine behaviour, should help to reduce the number of dog-related injuries to humans and improve the welfare of pet dogs by ensuring that dogs are placed in homes with owners capable of, and motivated to, interact with the dog in an appropriate manner.

Over the longer term, a more scientific approach to assessing dog behaviour may provide useful tools for breeders, helping to reduce the number of unwanted dogs and those which cause community disruption even further.

Our contention is that breeding from dogs that have been objectively identified as having suitable temperaments to be companions will gradually improve the overall quality of available dogs.

It should be possible to breed dogs that conform to health, conformation and behaviour standards.

To encourage this practice, health screenings and behaviour assessments could be recommended by professional bodies, including existing Kennel Clubs but also new organizations dedicated to companion dog breeders, for any dogs used in breeding.

Scientists and those involved in evaluating dog behaviour should be working together with breeders to develop appropriate tools.