

**Bayne, K.A. (2002) Development of the human-research animal bond and its impact on animal well-being. ILAR Journal. 43(1) 1-9**

Discussion of the factors that determine the development of bonds between those caring for animals such as dogs, particularly in research environments, and the animals they are responsible for and highlighting the role this plays in the welfare of animals kept.

**Bayne, K.A. (2003) Environmental enrichment of non-human primates, dogs and rabbits used in toxicology studies. Toxicological Pathology. 31(Suppl.) 132-137**

Discussion of social enrichment such as pair or group housing and non-social enrichment, such as pen furniture, food enrichment and toys in enriching the experience of animals kept in research environments with specific reference to U.S. Department of Agriculture guidelines and the evidence base for this.

**Beerda, B., Schilder, M.B.H., van Hooff, J.A.R.A.M., de Vries, H.W., (1997) Manifestations of chronic and acute stress in dogs. Applied Animal Behaviour Science. 52. 307-319.**

Categorisation and analysis of stress responses of dogs kept in poor housing conditions or other circumstances detrimental to their welfare in terms of behavioural, physiological and immunological effects.

**Beerda, B., Schilder, M.B.H., van Hooff, J.A.R.A.M., de Vries, H.W., Mol, J.A. (1999) Chronic stress in dogs subjected to social and spatial restriction. I – Behavioural responses. Physiology and Behaviour. 66(2). 233-242.**

Finding that dogs kept in isolation in small kennels showed high incidence of behavioural stress responses including excessive self-grooming, paw lifting, vocalising, low body posture and increased coprophagy and stereotypies. During a variety of challenges socially and spatially restricted dogs exhibited a heightened state of aggression, excitement and uncertainty. The study involved direct comparison of wide range of behavioural responses between dogs kept for 6 weeks in small, indoor kennels and those provided with enriched spacious outdoor housing in groups.

**Bradshaw, J.W.S. , Goodman, D., Lea, A.M., and Whitehead, S.L. (1996) A survey of the behavioural characteristics of pure-bred dogs in the U.K. Veterinary Record. 138. 465-8**

Survey of small animal vets and dog care professionals concerning the behavioural characteristics of 49 breeds of dog and of perceived differences between males and females. Three major underlying traits labelled aggressivity, reactivity and immaturity were identified which were used to classify breeds into 8 behavioural breed groups.

**Brummer, S.P., Gese, E.M., Shivik, J.A. (2010) The effect of enclosure type on the behaviour and heart rate of captive coyotes. Applied Animal Behaviour Science. 125. 171-180.**

Finding that kennelled coyotes exhibited more stereotypical behaviours than those kept in either small or large pens. Coyotes in large pens spent more time exploring and exhibiting wild-type behaviour. Heart rate responses were higher for kennelled coyotes than those kept in pens when humans were present, and this was slower to return to baseline levels.

**Christie, L., Opie, W., Head, E. (2009) Strategies for improving cognition with ageing : insights from a longitudinal study of anti-oxidant and behavioural enrichment in canines. AGE. 31. 211-220.**

Finding that both feeding of dietary anti-oxidant supplements and behavioural enrichment led to improvements in cognitive ability in aged dogs. In combination benefits were greater.

**Cobb, M., Lill, A., Bennett, P. (2009) The effect of enrichment on the welfare and performance of kennelled working dogs. Poster. Available from author at mia.cobb@monash.edu.**

Compared guide dogs remaining in puppy raising home environments, guide dogs entering guide dog training kennels and dogs in the same facility provided with a composite enrichment programme. Kennelled dogs showed marked increases in stress hormone compared to 'home' dogs. There was significant individual variation in stress responses measured but no overall difference in these responses for those experiencing a composite enrichment programme versus control groups over the period examined (15 days). The authors note that the control group comprised dogs which themselves experienced a relatively enriched environment.

**Dalla Villa, P., Barnard, S., Di Fede, E., Podaliri, M., Syracuse, C., Serpell, J.A. (2012) Comparison between group and pair-housing conditions : effect on shelter dogs' behaviour and welfare. Journal of Veterinary Behaviour : Clinical Applications and Research. 7(6)**

Study looked at shelter dogs in Italy kept in large enclosures of 5 to 8 dogs. Compared these with experimental condition in which dogs kept in male/female pairs in smaller enclosures. Group housing was associated with higher activity levels, more visual and olfactory exploration, while pair-housing was associated with relatively more lying. The authors conclude, however, that the behaviours observed in both pair and group housing represent important welfare improvements compared to those reported for dogs kept in isolation. Few conflicts were observed in either case, though mild agonistic encounters were more frequent in group housing. Some dogs were reported as experiencing more stress in group housing, however.

**Dalla Villa, P., Barnard, S., DiFede, E., Podaliri, M., Candeloro, L., DiNardo, A., Siracusa, C., and Serpell, J.A. (2013). Behavioural and physiological responses of shelter dogs to long-term confinement. *Veterinaria Italiana*. 49(2) 231-241. doi:10.12834/VetIt.2013.492.231.241**

Finding of a general decrease in activity when older dogs (eg over 4 years) in rescue shelters previously kept in social groups in large pens were moved to pair-housing in smaller pens (eg decreases in locomotor, social and exploratory behaviours).

**Dreschel, N.A. (2010) The effects of fear and anxiety on health and lifespan in pet dogs. *Applied Animal Behaviour Science*. 125(3) 157-162.**

Report of on-line survey of over 700 dog owners whose dog had recently died. Finding that there was a relationship between descriptions of mood and behaviour and illness and age at death. Dogs described as 'well-behaved' lived a longer life. Stranger-directed fear in particular was associated with a shorter lifespan. Non-social fear and separation anxiety were linked to skin problems.

**Gaines, S.A., Rooney, N.J., Bradshaw, W.S. (2008) The effect of feeding enrichment upon reported working ability and behaviour of kennelled working dogs. *Journal of Forensic Science*. 53(6). 1400-1404.**

Finding that providing daily feeding enrichment activity for kennelled working dogs had no detrimental effect on working ability, health or behaviour compared to those not provided with this, and that they showed increased ability to learn.

**Gorman, C. (1995) *The Ageing Dog*. Ringpress Books Ltd.**

Coverage of the physical and mental changes dogs may undergo as they age and the associated health problems that can arise. Adopts a very practical and compassionate approach to advising on how a dog's caretaker may respond to enable a dog to live a full life even when older.

**Graham, L., Wells, D.L., Hepper, P.G. (2005) The influence of olfactory stimulation on the behaviour of dogs housed in a rescue shelter. *Applied Animal Behaviour Science*. 91. 143-153.**

Explored influence of five types of olfactory stimulation on behaviour of dogs in a rescue shelter. Found that dogs exposed to a diffusion of essential oils for several hours over a period of 5 days, spent more time resting on exposure to lavender and chamomile, and vocalised less. Diffusion of rosemary and peppermint increased standing, moving and vocalising.

**Haverbeke, A., Rzepa, C., Depiereux, E., Deroo, J., Giffroy, J.,**

**Diederich, C. (2010) Assessing efficiency of a human familiarisation and training programme on fearfulness and aggressiveness of military dogs. Applied Animal Behaviour Science. 123. 143-149.**

Military working dogs showed higher posture, less yawning, less fearfulness and less aggression towards humans following a period of positive and frequent interactions with dog-handlers and training.

**Head, E. (2007) Combining an antioxidant-fortified diet with behavioural enrichment leads to cognitive improvement and reduced brain pathology in aging canines. Annals of the New York Academy of Sciences. 1114. 398-406.**

Found that dogs combining an anti-oxidant enriched diet and behavioural enrichment, including social, physical and cognitive components leads to substantial improvements in cognition and reduced brain pathology.

**Hiby, E.F., Rooney, N.J. and Bradshaw, J.W.S. (2004) Dog training methods – their use, effectiveness and interaction with behaviour and welfare. Animal Welfare. 13. 63-9.**

Questionnaire study asking dog owners about methods of training used and extent of obedience and behaviour problems. Correlation found between obedience and use of reward based training but no association between reported obedience and punishment methods. Higher incidences of problem-behaviours were reported with punishment approaches. The authors suggest that punishment methods are likely to be a welfare concern with no obedience benefit.

**Hiby, E.F., Rooney, N.J. and Bradshaw, J.W.S. (2006) Behavioural and physiological responses of dogs entering rehoming kennels. Physiology and Behaviour, 89. 385-391**

Finding that for dogs entering a rehoming kennels drinking and grooming increased over time, while panting and paw-lifting decreased. Low drinking levels were associated with higher cortisol levels. Stress hormone levels tended to decrease over time for dogs returning to kennels but to increase for dogs relinquished from homes. However, stress levels were similar and high for both groups on arrival.

**Horowitz, D., Landsberg, G., Luescher, A., Neilson, J., and Simpson, B. (2002) Enriching the environment of our pets : The psychology of play and behaviour modification. Veterinary Forum. Available at : <http://www.hilltopanimalhospital.com/enrichment-dogs.htm>**

Report of forum of veterinary behaviour specialists from the American Veterinary Medical Association exploring methods of introducing enrichment activities and play to encourage healthy behaviour and social well-being in dogs. The participants identified social companionship, provision of play opportunities, establishing a predictable daily routine,

providing opportunities for exploration of the environment, use of toys and play in training and as rewards as important. More generally the evidence for the value of particular enrichment approaches is discussed.

**Kogan, L.R., Schoenfeld-Tacher, R., Simon, A.A. (2012) Behavioural effects of auditory stimulation on kennelled dogs. Journal of Veterinary Behaviour. 7. 268-275.**

Investigation of the impact of music on activity level, vocalisation and body shaking of kennelled dogs. Found that classical music was associated with more time sleeping and less vocalising. Heavy metal music compared to other types of music was associated with more body shaking indicative of nervousness.

**Lefebvre, D., Giffroy, J., Diederich, C. (2009) Cortisol and behavioural responses to enrichment in military working dogs. Journal of Ethology. 27. 255-265.**

Found that dogs exposed to regular exercise and human contact occurring over a number of days (eg 20 minute intervals three or four times a day) showed significant decreases in stress hormones while this did not occur for dogs provided with irregular bouts of longer exercise and contact. It was noted that all kennelled dogs in the study showed some stereotypical behaviour.

**Luescher, A.U., Medlock, R.T. (2009) The effects of training and environmental enrichment on adoption success of shelter dogs. Applied Animal Behaviour Science. 117. 63-68.**

Dogs in a rescue centre that received training (eg wearing a head halter, coming forward when approached, walking on a lead, to sit and not jump up on people) were significantly more likely to be adopted than those not receiving training.

**McGreevy, P. (2009) A modern dog's life. University of New South Wales Press.**

Wide-ranging text addressing dog behaviour and welfare based on available scientific evidence and experience. Discusses the particular challenges and welfare problems for dogs created for dogs by modern human lifestyles.

**McMillan, D., Duffy, D.L., Serpell, J.A. (2011) Mental health of dogs formerly used as 'breeding stock' in commercial breeding establishments. Applied Animal Behaviour Science. 135. 86-94.**

Compared the health and behaviour of adult dogs brought up in a domestic environment with those of equivalent age, breed and sex reared in commercial dog breeding establishments ('CBE' dogs) with permanent kennelling and limited exercise, enrichment and social contact. CBE dogs

showed significantly higher rates of health problems. They also showed substantially higher levels of fear for both social and non-social stimuli, higher passivity, more house-soiling, lower trainability, excitability and energy. The authors conclude that typical conditions in 'puppy mill' or 'puppy farm' environments are injurious to the mental health and welfare of dogs.

**Morris, C.L., Grandin, T. and Irlbeck, N.A. (2011) Companion animals symposium : Environmental enrichment for companion, exotic and laboratory animals. Journal of Animal Science. 89. 4227-4238**

**Available at :**

<http://www.grandin.com/references/companion.animal.symposium.2011.pdf>

or

<http://jas.fass.org/content/89/12/4227>

Considers neurophysiological and other evidence for the operation of physiological/brain systems underpinning animal emotion. Highlights core motivational systems with an identified neurophysiological basis including fear, seeking, rage, panic, play, lust and care/nurturing. Suggests that enrichment methods may be specifically designed to enable the expression of highly motivated behaviours that are driven by emotional events in the brain. Discusses a range of enrichment strategies for companion animals including dogs suitable for application in both domestic and kennel/commercial/research environments.

**Newbury, S., Blinn, M.K., Bushby, P.A. et al. (2010) Guidelines for standards of care in animal shelters. The Association of Shelter Veterinarians. Available at :**

<http://www.oacu.od.nih.gov/disaster/ShelterGuide.pdf>

Very comprehensive and detailed guidelines based on scientific evidence for those managing dogs in shelter environments. Includes evidence-based recommendations relating to : Management and record-keeping; facility design and environment; population management; sanitation; physical health; behavioural health and mental well-being; group housing; animal handling; euthanasia; spaying and neutering and animal transport (among others).

**Nippak, P.M.D., Mendelson, J., Muggenburg, B., comeMilgram, N.W. (2007) Enhanced spatial ability in dogs following dietary and behavioural enrichment. Neurobiology of Learning and Memory. 87. 610-623.**

Finding that dogs (beagles) receiving either a specific anti-oxidant diet or an enrichment programme comprising physical exercise, environmental stimulation and cognitive challenges showed improved performance on spatial ability tasks. Aged dogs previously housed with other dogs and exposed to an outdoor environment in early development showed greater benefits. The authors conclude long-term dietary intervention and enrichment can buffer age-associated cognitive decline.

**Normando, S., Stefanini, C., Meers, L., Adamrelli, S., Coultis, D., Bono, G. (2006) Some factors influencing adoption of sheltered dogs. Anthrozoös. 19(3) 211-224.**

Finding that return rate of dogs after adoption from a shelter was associated with behavioural problems. Fearful dogs were returned more often than dogs with other problems.

**Petronek, G.J., Glickman, L.T., Beck, A.M. et al. (1996) Risk factors for relinquishment of dogs to an animal shelter. J.Vet. Med. Assoc. 209. 572-581**

Study of characteristics of dogs and their owners that were predictive of relinquishment to dog shelters in the U.S. Amongst others dogs with behavioral problems and little veterinary care were at greater risk of relinquishment than were dogs with regular veterinary care, and behavioral problems were associated with inappropriate care expectations.

**PDSA Animal well-being report – 2011, 2012 and 2013. Available at : <https://www.pdsa.org.uk/pet-health-advice/pdsa-animal-wellbeing-report>**

Findings of repeated large population survey of pet owner practices showing that a significant proportion of dogs kept do not receive adequate daily exercise, that a substantial and increasing number of dogs are left alone regularly for in excess of 5 hours and that only a minority receiving adequate socialisation and training experiences.

**Pullen, A.J., Merrill, R.J.N., Bradshaw, J.W.S. (2010) Preferences for toy types and presentations in kennel-housed dogs. Applied Animal Behaviour Science. 125. 151-156.**

Finding that robust toys are little-used by kennel-housed dogs, but that interaction was relatively prolonged with less robust toys. Authors conclude that interest to dogs is greater if toy can be chewed and/or makes a noise. Hanging toys were generally not favoured by dogs.

**Pullen, A.J., Merrill, R.J.N., Bradshaw, J.W.S.(2013) The effect of familiarity on behaviour of kennelled dogs during interaction with conspecifics. Journal of Applied Animal Welfare Science. 16(1) 64-76.**

Finding that when kennelled dogs are given the opportunity to interact with other dogs, they initially spend more time interacting with unfamiliar dogs (eg within first 3 minutes) but subsequently explore independently, but interact more closely with familiar dogs after this initial period.

**Rehn, T., Keeling, L.J. (2011) The effect of time left alone at home on dog welfare. Applied Animal Behaviour Science. 129. 129-135.**

Finding that dogs left by owners for periods in excess of 2 hours showed a

more intense greeting, more activity, more attentiveness as well as more lip-licking and body-shaking to the owner than when left for shorter periods (eg half-an-hour).

**Rooney, N.J., Gaines, S.A., and Bradshaw, J.W. (2007) Behavioural and glucocorticoid responses of dogs (Canis familiaris) to kennelling : investigating mitigation of stress by prior habituation. Physiol. Behav. 92(5) 847-54.**

Examined behavioural and physiological responses of labradors entering training kennels. Compared responses of the those which had previously experienced time in the kennels with those that hadn't. Stress hormone (glucocorticoid) levels increased in all dogs on entering kennels. This increase was higher for those without previous kennel experience and remained above baseline levels for this group after 12 weeks. Behavioural measures used in this study did not have a clear relationship with corticoid levels.

**Rooney, N., Gaines, S. Hiby, E. (2009) A practitioner's guide to working dog welfare. Journal of Veterinary Behaviour. 4. 127-134.**

Comprehensive review of evidence concerning the effects of housing and husbandry, and environmental enrichment in particular, on both dog welfare and working ability. Provides an evidence-based guide to practitioners responsible for caring for and/or handling working dogs. Evidence-based recommendations for good welfare practice provided include :

Introducing dogs to the kennel environment gradually ; providing increased contact with handlers and caretakers ; avoiding leaving dogs alone for long periods; making the dog's routine predictable; pair-housing ; providing time for free-running in paddocks or other areas, in pairs whenever possible ; making the kennel environment more interesting and comfortable ; avoiding negative interactions and punishment whenever possible; introducing dogs to potentially stressful situations in a positive way.

**RSPCA. A good practice guide for enforcement bodies ;: Meeting the welfare needs of seized dogs in a kennel environment. Available at : <http://www.politicalanimal.org.uk/RSPCA/kennel%20guide%20final.pdf>**

A comprehensive guide to ensuring dog welfare in kennel environments. Designed specifically to provide guidance to those caring for dogs kept in kennels following seizure under dangerous dogs legislation, the Guide has much more general applicability than this and is relevant to dogs kept in most kennelled situations. It's coverage includes legal requirements for care, providing a suitable environment, kennel design, exercise, transport, diet, enabling expression of natural behaviour, socialisation and health.

**Sales, G., Hubrecht, R., Peyvandi, A., Milligan, S., Shield, B., (1997) Noise in dog kennelling – is barking a welfare problem for dogs?**

**Applied Animal Behaviour Science. 52. 321-329.**

Finding of high noise levels in a range of kennel environments including shelters, training establishments and laboratories. These noise levels were caused mainly by barking but also by husbandry procedures. The authors note that welfare effects would be predicted from noise levels observed but that there is currently a lack of adequate guidelines for noise levels in kennels.

**Schipper, L.L., Vinke, C.M., Schilder, M.B.H., Sprinjit, B.M. (2008) The effect of feeding enrichment toys on the behaviour of kennelled dogs (Canis familiaris). Applied Animal Behaviour Science. 114. 182-195.**

Finding that dogs provided regularly with a Kong containing food treats showed more appetitive behaviour, higher levels of activity and reduced barking compared to dogs kept in similar conditions but without feeding enrichment.

**Stafford, K. (2007) The welfare of dogs. Springer.**

General text on the occurrence of dog populations throughout the world, the uses to which dogs are put, and evidence, including statistical data, on the extent of welfare and health problems. Provides a discussion of evidence relating to environmental enrichment.

**Stephen, J.M., Ledger, R.A. (2005) An audit of behavioural indicators of poor welfare in kennelled dogs in the United Kingdom. Journal of Applied Animal Welfare Science. 8(2) 79-95.**

Survey of the incidence of behavioural indicators of poor welfare across a sample of rescue shelters. 15 behaviours were measured and incidence recorded. The most common behaviour observed was excessive barking. Over time (6 week observation period after entry to kennels) dogs were more likely to pace repetitively and wall bounce. Fear-related behaviours and poor appetite generally decreased over the period. Breed differences, age and gender were related to prevalence of particular welfare indicators.

**Taylor, K.D., Mills, D.S. (2007) The effect of the kennel environment on canine welfare : a critical review of experimental studies. Animal Welfare. 16. 435-447.**

Critical and comprehensive review of the experimental research regarding the physical, social, sensory, occupational, nutritional and psychological aspects of the kennel environment.

**Titular, M, Blackwell, E-J, Mendl, MT & Casey, RA 2013, 'Cross sectional study comparing behavioural, cognitive and physiological indicators of welfare between short and long term kennelled domestic dogs'. Applied Animal Behaviour Science, vol 147., 149-158**

Study compared welfare of short long-term kennel housed rehoming centre dogs. Affective states were measured with a judgement bias test. Direct assessment of behaviour was conducted, and urinary cortisol:creatinine levels measured. Each dog's caretaker completed two questionnaires: an objective indication of dogs' behavioural responses to familiar people, unfamiliar people and other dogs, and a more subjective staff evaluation of behavioural characteristics and overall welfare. Cortisol:creatinine ratios were relatively high in both groups. long-term dogs showed more resting behaviour play less with people, bark and growl more at strange dogs and play more with objects when with another dog. Overall, this study suggested large individual variation in measures of welfare and behaviour, but few differences between dogs housed for more than 6 months as compared to those housed for shorter periods.

**Tuber, S., Hennessy, M., Sanders, S. and Miller, J. (1996) Behavioural and glucocorticoid responses of adult domestic dogs (*Canis familiaris*) to companionship and social separation. *Journal of Comparative Psychology*. 10(1) 103-108.**

When tested in a novel environment dogs showed increased activity and glucocorticoid levels and these responses were equally large whether a kennel mate was present or not. However, activity and glucocorticoid levels were not elevated if the dogs were in the presence of their human caretaker. Dogs were more often observed in proximity with and soliciting behaviour from the human than the kennel mate.

**Wells, D.L., Graham, L. and Hepper, P.G. (2002) The influence of length of time spent in a rescue shelter on the behaviour of kenneled dogs. *Animal Welfare*. 11. 317-325.**

The length of time spent in rescue kennels was found to relate to a number of behaviours, some of which were viewed as likely to make a dog less attractive to adopters as time went by. Long-stay dogs were more likely to be inactive and to spend large amounts of time lying down.

**Wells, D. (2004) A review of environmental enrichment for kenneled dogs, *Canis familiaris*. *Applied Animal Behaviour Science*. 85. 307-317.**

Review of research on environmental enrichment for dogs. Addresses particularly two main categories of enrichment – animate (i.e. provision of social contacts with conspecifics and humans) and inanimate (i.e. enrichment through provision of toys, cage furniture, auditory and olfactory stimulation).

**Wells, D. (2009) Sensory stimulation as environmental enrichment for captive animals – a review. *Applied Animal Behaviour Science*. 118. 1-11.**

Review of research focusing on auditory, olfactory, and visual methods of

stimulation for captive animals and their effects. The authors note that programmes of sensory enrichment that target the dominant sense, using harmless, non-stressful stimuli are likely to result in the greatest welfare benefits. They also note that stimuli specific to a natural habitat may not always be meaningful or beneficial, and that in some cases stimuli that do not occur in the wild may have more welfare advantages. More generally discusses factors to consider when providing sensory enrichment.

**Wells, D., Hepper, P.G. (2000) The influence of environmental change on the behaviour of sheltered dogs. Applied Animal Behaviour Science. 68. 151-162.**

Study examined responses of kennelled dogs in a shelter to various minor changes in their environment. Contact with people resulted in dogs spending more time at the front of the pen, as did movement of their bed to this position. Dogs were more frequently adopted if they received regular human contact, if their beds were at the front of the pen and if toys were present in the pen.

**Wemelsfelder, F. (2005) Animal boredom : understanding the tedium of confined lives. In McMillan, F.D. Mental health and well-being in animals. Blackwell Publishing.**

Discussion of the welfare problems created for animals by their confinement in barren environments, lack of stimulation, challenge and choice. The author concludes that the welfare consequences of this are very widespread and severe. The paper also highlights the potential benefit of a range of strategies eg environmental enrichment, to counter these effects, and emphasises that a primary solution is to give animals more choice in how they deal with challenges, not to take those challenges away.

**Young, R.J. (2003) Environmental enrichment for captive animals. Blackwell Publishing.**

Text covering general principles of environmental enrichment including it's purposes, approaches and ways of measuring effectiveness.