

THE INFLUENCE OF AUDITORY STIMULATION ON THE BEHAVIOUR OF DOGS HOUSED IN A RESCUE SHELTER

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Abstract

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This study explored the influence of five types of auditory stimulation (human conversation, classical music, heavy metal music, pop music, and a control) on the behaviour of 50 dogs housed in a rescue shelter. The dogs were exposed to each type of auditory stimulation for 4 h, with an intervening period of one day between conditions. The dogs' position in their kennels (front, back), their activity (moving, standing, sitting, resting, sleeping), and their vocalisation (barking, quiet, other) were recorded over 4 h at 10 min intervals during each condition of auditory stimulation. The dogs' activity and vocalisation were significantly related to auditory stimulation. Dogs spent more time resting and less time standing when classical music was played than when any of the other stimuli were played. Exposure to heavy metal music encouraged dogs to spend significantly more of their time barking than did other types of auditory stimulation. Classical music resulted in dogs spending significantly more of their time quiet than did other types of auditory stimulation. It is suggested that the welfare of sheltered dogs may be enhanced through exposure to appropriate forms of auditory stimulation. Classical music appears particularly beneficial, resulting in activities suggestive of relaxation and behaviours that are considered desirable by potential buyers. This form of music may also appeal to visitors, resulting in enhanced perceptions of the rescue shelter's environment and an increased desire to adopt a dog from such a source.

Keywords: *animal welfare, behaviour, captivity, dogs, enrichment, music, rescue shelters*

Introduction

The value of music and other forms of auditory stimulation for psychological well-being is well documented in humans. Research suggests that both our moods (eg Hayakawa *et al* 2000; McCraty *et al* 1998; Scheel & Westefeld 1999; Sousou 1997) and our behaviour (eg North *et al* 1999; Ragneskog *et al* 1996; Yalch & Spangenberg 2000) can be influenced by the type of auditory stimulation to which we are exposed. Exposure to 'grunge rock' music, for instance, can result in increased hostility, sadness, tension and fatigue, whereas listening to 'designer music' (ie music created to have a specific effect on the listener) can result in increased mental clarity, vigour and relaxation (McCraty *et al* 1998).

Recognition of the benefits associated with music for human well-being has prompted recent research into the value of auditory stimulation as a means of enriching the environment of captive animals. The value of auditory enrichment has been studied in a variety of species, including birds (Gvoryahu *et al* 1989; Ladd *et al* 1992; Nicol 1992; Reed

et al 1993), cattle (Evans 1990; Uetake *et al* 1997; Wisniewski 1977), horses (Haupt *et al* 2000) and primates (Brent & Weaver 1996; Hanson *et al* 1976; Markowitz & Line 1989; Novak & Drewson 1989; Ogden *et al* 1994; O'Neill 1989; Shepherdson *et al* 1989). Many of these studies report changes in the behaviour and/or physiology of animals exposed to music recordings, radio broadcasts or ecologically relevant sounds. Admittedly, the findings arising from such work are far from conclusive in terms of their implications for the animals' welfare, largely because of our limited understanding of bioacoustics in different species (Newberry 1995). Nonetheless, the changes in the animals' behaviour and physiology recorded in response to auditory stimulation cannot be denied, highlighting the potential value for a form of enrichment that is frequently overlooked.

To date, the effect of auditory stimulation on the behaviour of dogs housed in animal rescue shelters is unknown. Rescue shelters provide temporary housing for thousands of stray and abandoned dogs every year. However well these dogs are cared for, it cannot be ignored that being in such a situation is stressful (Hennessy *et al* 1997; Tuber *et al* 1999). Research suggests that music may be a useful moderator of stress in humans (eg Mockel *et al* 1995). The question still remains as to whether auditory stimulation has such a beneficial effect in dogs. Dogs housed in rescue shelters are regularly exposed to music as staff go about their daily husbandry duties. Information regarding the effects of enriching the environment of sheltered dogs through the provision of auditory stimulation (eg music, human conversation) would prove very useful, furthering our understanding of how to house sheltered dogs in ways that promote their welfare whilst in captivity and improve their chances of being rehomed.

In the following study, we investigated the behaviour of sheltered dogs in response to five types of auditory stimulation — namely, classical music, heavy metal music, pop music, human conversation and no music (control) — to determine whether the dogs' behaviour was influenced by their auditory environment. The influence of the length of time for which the dogs were exposed to each condition of auditory stimulation on their behaviour was also examined.

Methods

Study site

The National Canine Defence League (NCDL) Rehoming Centre in Evesham (Worcestershire, UK) was used as the study site. The shelter is capable of housing 180 dogs at any one time. Dogs housed in this centre are generally housed singly or in pairs, either in one of four circular-style kennels or in one of four line-block-style kennels. The dogs' enclosures are cleaned every morning and as required throughout the course of the day. The animals are fed once per day in the afternoon.

Dogs housed in the shelter's circular-style kennels were used in the study. Each of the dogs' kennels comprised a wire-mesh front, a door at the back of the pen to allow staff access to the enclosure, and solid concrete floor and walls. The kennel was divided into two sections, referred to hereafter as 'front' and 'back' (see Figure 1). From the front of their kennels, the dogs could view conspecifics housed in the opposite kennel blocks and humans as they walked past the front of the animals' pens. From the rear of their kennels, dogs could see other dogs that also happened to be at the back of their kennels, and shelter staff. Whenever they were at the back of their kennels, the dogs were largely hidden from the view of the public.

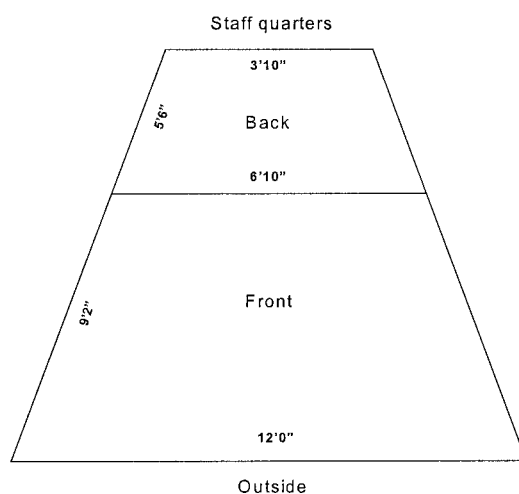


Figure 1 The layout of a dog's kennel in the rescue shelter.

Subjects

Twenty-seven neutered male and 23 spayed female dogs, all randomly chosen, were used as subjects. The majority of the dogs were cross-breeds, thus preventing any valid analysis of breed differences. All of the dogs were healthy and between 6 months to 6 years of age. This sample was representative of dogs admitted to the NCDL in terms of breed, age, and sex. All of the subjects were housed singly.

Auditory stimulation

Five conditions of auditory stimulation (one control, four experimental) were developed for the study:

1. *Control*: In this condition, the dogs were exposed to no auditory stimulation other than that arising naturally from the animals' environment, eg noise from routine staff husbandry duties and visitors to the rescue shelter.

2. *Human conversation*: Under this condition, the dogs were exposed to a radio programme devoted purely to conversation (ie no music). The dogs were also exposed to auditory stimulation arising naturally from their environment.

3. *Classical music*: In this condition, the dogs were exposed to a randomly chosen mixture of tracks from the 'The Very Best of the Classic Experience' (EMI Virgin Records) album. The dogs were also exposed to auditory stimulation arising naturally from their environment.

4. *Heavy metal music*: Under this condition, the dogs were exposed to a randomly chosen mixture of tracks from Metallica's 'Metallica' album (Vertigo Records), in addition to the auditory stimulation arising naturally from their environment.

5. *Pop music*: In this condition, the dogs were exposed to a randomly chosen mixture of tracks from the 'Now 44' album (EMI Virgin Records). The dogs were also exposed to auditory stimulation arising naturally from their environment.

Procedure

The four experimental conditions of auditory stimulation (ie human conversation, classical, heavy metal and pop music) were presented to the dogs using a CD/radio player. The device

was placed in the middle of each kennel block (ie the staff quarters; see Figure 1) to ensure an even distribution of sound to all of the dogs housed there. Decibel readings were taken from outside each kennel block to ensure that all of the dogs housed in the same kennel block, irrespective of the pen they resided in, were exposed to a similar level of sound. The sound level seemed equally loud to both the experimenter and one of the shelter staff upon standing outside each of the dogs' pens whilst testing the auditory stimuli.

Dogs were exposed to each of the five conditions of auditory stimulation on five separate days, with an intervening period of one day in between each of the conditions. The dogs were exposed to each condition of acoustic stimulation for a period of 4 h, in line with previous studies on the behaviour of sheltered dogs (Wells 1996; Wells & Hepper 1992, 1998, 2000). The dogs were always presented with the acoustic stimuli at the same time of day (1000h–1400h) to prevent any inconsistent exposure to extraneous events in the shelter environment, such as feeding and kennel cleaning. To control for any potential order effects, dogs were exposed to the five conditions of auditory stimulation in a different order.

For each condition of auditory stimulation, the dog's behaviour was recorded over the full length of time for which the animal was exposed to the auditory stimulation (ie 4 h) using a scan sampling technique (eg Martin & Bateson 1986). At 10 min intervals, the experimenter (LG) approached the front of each subject's kennel and recorded the dog's behaviour as soon as she saw the animal. Recording in all of the experimental conditions commenced as soon as the auditory stimulation was switched on.

Three separate aspects of behaviour, all known to influence public perceptions of dog desirability (Wells 1996), were recorded at each observation, namely:

1. *Position in the kennel*: front; back (see Figure 1).
2. *Activity*: standing (dog supported upright with all four legs); sitting (dog supported by two extended front legs and two flexed back legs); resting (dog reclining in ventral or lateral position, eyes open); sleeping (dog reclining in ventral or lateral position, eyes closed); moving (dog walking, running, or trotting about the cage).
3. *Vocalisation*: barking; quiet (no vocalisation); other (includes whining, growling, whimpering).

Each dog was studied every 10 min for a period of 4 h for each of the five conditions of auditory stimulation. This provided 24 observations of the dog's position in the kennel, its activity, and its vocalisation for each of the five conditions of auditory stimulation. Each behaviour was treated separately. For each behaviour, the number of times the dog was observed in each category (ie for position in the kennel: front, back; for activity: standing, sitting, resting, sleeping, moving; and, for vocalisation: barking, quiet, other) was summed across the 4 h observation period.

Data analysis

Three within-subjects-design ANOVAs (eg Howell 1992) for the factors of auditory stimulation (control, human conversation, classical music, heavy metal music, pop music) and dog behaviour (eg position in the kennel ([front, back]) were carried out in order to determine whether the behaviour of the subjects differed between the conditions of auditory stimulation.

For each of the five conditions of auditory stimulation, a further three within-subjects-design ANOVAs were carried out for the factors of dog behaviour (eg position in the kennel [front, back]) and length of time (hour 1, hour 2, hour 3, hour 4), in order to determine

whether the dogs' behaviour varied according to the length of time for which the animals were exposed to each type of auditory stimulation.

Results

The effect of auditory stimulation on the dogs' behaviour

1. *Position in kennel*: Analysis revealed a significant main effect of position ($F_{1,49} = 27.54$, $P < 0.001$). A post-hoc Newman-Keuls test revealed that dogs spent significantly ($P < 0.01$) more of their time at the front of their kennels (mean number of observations = 14.89 ± 0.48) than the back of their kennels (mean number of observations = 9.11 ± 0.55). The dogs' position in their kennels was not significantly related to the type of auditory stimulation to which they were exposed ($F_{4,196} = 1.59$, not significant).

2. *Activity*: The ANOVA revealed a significant main effect of activity ($F_{4,196} = 130.39$, $P < 0.001$). Dogs spent significantly ($P < 0.01$, Newman-Keuls test) more of their time standing (mean number of observations = 12.99 ± 0.62) than resting (mean number of observations = 7.28 ± 0.59), sitting (mean number of observations = 1.03 ± 0.20), moving (mean number of observations = 2.48 ± 0.30) or sleeping (mean number of observations = 0.22 ± 0.12). The dogs' activity was significantly related to the type of auditory stimulation to which the animals were exposed ($F_{16,784} = 3.90$, $P < 0.001$). The dogs spent significantly more of their time resting ($P < 0.001$, simple effects test) and less of their time standing ($P < 0.001$, simple effects test) during the classical music conditions than during the control, heavy metal, human conversation or pop music conditions (see Figure 2).

3. *Vocalisation*: Analysis revealed a significant main effect of vocalisation ($F_{2,98} = 432.09$, $P < 0.001$). Dogs spent significantly ($P < 0.01$, Newman-Keuls test) more of their time quiet (mean number of observations = 18.90 ± 0.47) than barking (mean number of observations = 4.30 ± 0.42) or engaging in other types of vocalisation (mean number of observations = 0.80 ± 0.17). The type of auditory stimulation to which the dogs were exposed significantly influenced the animals' vocalisation ($F_{8,392} = 7.41$, $P < 0.001$). A test for simple effects revealed that dogs spent significantly ($P < 0.001$) more of their time quiet and less of their time barking ($P < 0.001$) during the classical music condition compared to the other conditions. By contrast, dogs spent significantly ($P < 0.001$, simple effects test) more of their time barking, and less ($P < 0.001$, simple effects test) of their time quiet, during the heavy metal condition than during the other conditions of auditory stimulation (see Figure 3).

The effect of length of exposure to auditory stimulation on the dogs' behaviour

The length of time for which dogs were exposed to each type of auditory stimulation had no significant effect on the dogs' position in their kennels, their activity or their vocalisation.

Discussion

The findings from the present study indicate that the behaviour of kennelled dogs is significantly influenced by the type of auditory stimulation to which the animals are exposed.

Classical music resulted in dogs spending more of their time resting than any of the other experimental conditions of auditory stimulation. This type of music also resulted in a significantly lower level of barking. Research suggests that calming music may have a beneficial effect on humans, resulting in diminished agitation, improved mood and lower levels of stress (eg Mockel *et al* 1995; Ragneskog *et al* 1996; Swartz *et al* 1989; Tabloski *et al* 1995). Although the specific effect of classical music on dogs remains unknown, the findings from this study suggest that it may, as in humans, have a calming influence.

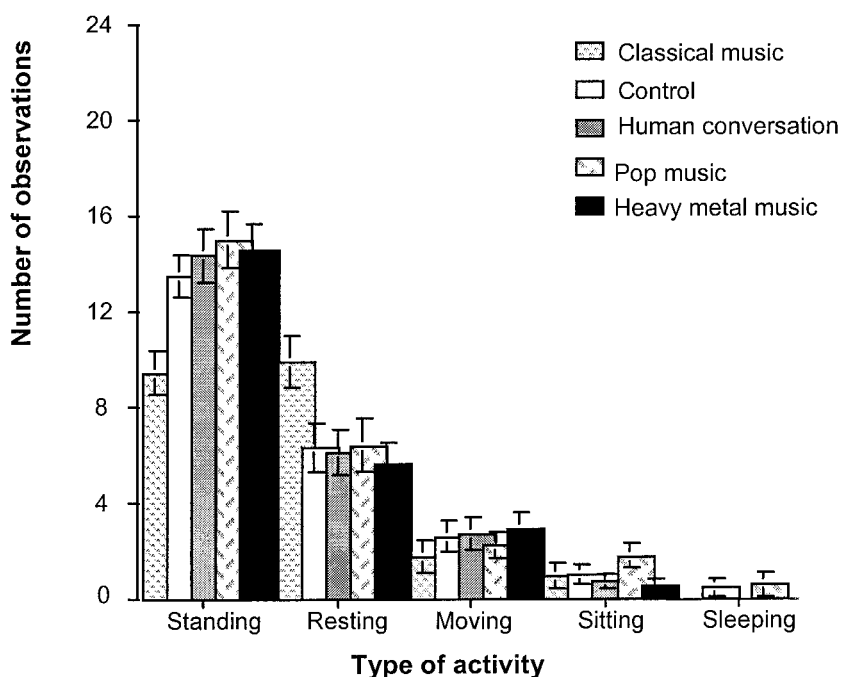


Figure 2 The mean (\pm SE) number of times that dogs were observed in each type of activity under five types of auditory stimulation.

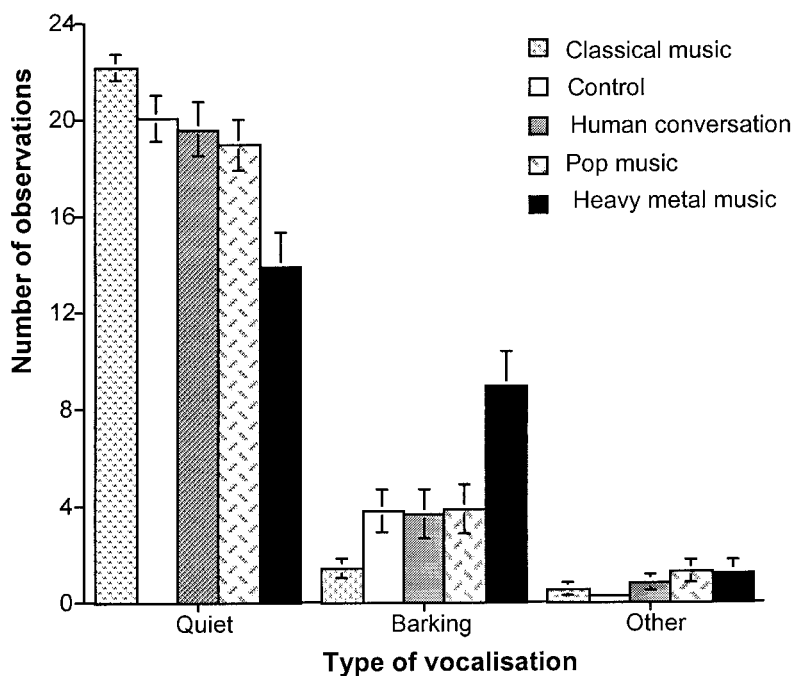


Figure 3 The mean (\pm SE) number of times that dogs were observed exhibiting each type of vocalisation under five types of auditory stimulation.

Heavy metal music appeared to agitate the dogs, resulting in increased frequencies of standing and barking. The effect of heavy metal music on the behaviour of humans or other animals has been subject to relatively little empirical investigation. One study suggests, however, that heavy metal music has an arousing effect in humans (Gowensmith & Bloom 1997). The findings from this study suggest that heavy metal music also has a stimulating effect in dogs.

Neither pop music nor human conversation had any apparent effect on the dogs' behaviour. The reason for this is unknown. It may simply be the case that dogs are more accustomed to these types of auditory stimulation than others. Shelter staff, for instance, regularly listen to radio programmes involving a mixture of human conversation and pop music whilst undertaking their husbandry duties. Very few, however, listen to classical or heavy metal music within this particular working environment. It remains unknown whether the effects of these types of music would have remained significant over the other, perhaps more familiar, forms of auditory stimuli had the dogs been adapted to them in the same manner. Further work is still required to unravel the specific acoustic elements that dogs respond to. Such information may help to explain why the dogs in this study showed a difference in their behaviour across the various conditions of auditory stimulation.

The dogs' position in their kennels was not influenced by the type of auditory stimulation to which they were exposed. This finding suggests that dogs do not actively seek out the source of ecologically non-relevant auditory stimulation; if this were the case, one would have expected the dogs to have spent more of their time at the rear of their kennels, closer to the source of the music.

The dogs' behaviour did not change significantly over the length of time for which the animals were exposed to any of the types of auditory stimulation, suggesting a lack of habituation. It must be borne in mind, however, that the dogs in this study were exposed to the music for periods of only 4 h at a time. It is possible that a longer duration of auditory stimulation may have resulted in habituation. The influence of longer periods of exposure to auditory stimulation on the behaviour of sheltered dogs warrants further study, particularly considering the number of dogs that are housed long-term in kennel environments.

This study only explored the impact of auditory stimulation on the behaviour of singly housed dogs. Some rescue shelters, however, house their dogs in pairs or groups in a bid to provide social stimulation. Whether dogs housed together react to auditory stimulation in the same manner as those housed alone would be worthy of future investigation.

Animal welfare implications

The findings arising from this study suggest that certain types of auditory stimulation may be both directly and indirectly beneficial for the welfare of dogs housed in rescue shelters.

The welfare of sheltered dogs may be directly improved by providing the animals with an appropriate type of auditory enrichment. Exposure to classical music resulted in dogs behaving in a manner suggestive of increased relaxation. Rescue shelters are extremely stimulating environments. Dogs housed in kennels are exposed to a wide range of psychological stressors including noise, confinement, unpredictability and loss of control (Hennessy *et al* 1997; Tuber *et al* 1999). Playing classical music in shelters may result in a slightly less stressful environment.

Auditory enrichment may also have an indirect effect upon the welfare of sheltered dogs. Visitors are often deterred from adopting a dog from a rescue shelter because they consider the animal's environment off-putting (Wells 1996). Moreover, many potential buyers of dogs

from rescue shelters spend relatively little time touring the site or looking at the dogs housed there (Wells & Hepper 2001). Enhancing the auditory environment of rescue shelters may encourage visitors to spend more time touring the facility. This in turn may result in an increased amount of time spent looking at the animals housed there and a subsequent increase in the number of dogs that are adopted. To date, research has explored the impact of improving only the visual environment of rescue shelters on potential visitors' perceptions of the dogs housed there (Wells & Hepper 1992; Wells 1996). Further research is required, however, to explore the effects of background music on the adoption rate of sheltered dogs.

Overall, the findings from this study suggest that the behaviour of sheltered dogs is influenced by the type of auditory stimulation to which the animals are exposed, and that certain types of auditory stimulation may be beneficial for the animals' welfare. It is particularly important, from an animal welfare point of view, that an appropriate form of auditory stimulation is used in the shelter environment. Rescue shelters are extremely noisy environments. Adding further auditory stimulation, particularly of the type that causes agitation or increased stress, may actually do more harm than good and should ideally be avoided. Providing auditory stimulation that has a calming influence on the dogs' behaviour, however, may be advantageous, resulting in improved animal welfare, enhanced perceptions of dog desirability and an increase in the number of dogs that are re-homed.

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