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# The influence of visual stimulation on the behaviour of dogs housed in a rescue shelter

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## Abstract

*This study explored the influence of five types of visual stimulation on the behaviour of 50 dogs housed in a rescue shelter. These conditions were: one control condition (no visual stimulation) and four experimental conditions (blank television screen, and moving televised images of conspecifics, interspecifics [ie unfamiliar animal species] and humans). The dogs were exposed to each condition for 4 h per day for five days, with an intervening period of two days between conditions. The dogs' behaviour was recorded on days 1, 3 and 5 during each condition. Dogs spent relatively little of the total observation time looking at the television monitors (10.8%). They spent significantly more of their time looking at the moving images of conspecifics, interspecifics and humans than at the blank screen, although their interest in all experimental conditions declined over time. Dogs spent more time at the front of their enclosures during all of the experimental conditions than during the control condition. Images of conspecifics were more likely to attract the dogs to the front of their kennels than the blank screen. The conspecific and human conditions of visual stimulation attracted slightly more attention from the dogs than the interspecific condition, although not significantly. All of the experimental conditions encouraged significantly less vocalisation and movement than the control condition. Overall, the findings suggest that the behaviour of kennelled dogs is influenced by visual stimulation in the form of television programmes. Such animals, however, may not benefit from this type of enrichment to the same degree as species with more well-developed visual systems. The addition of other types of enrichment strategy for dogs housed in rescue shelters is advocated.*

**Keywords:** *animal welfare, dogs, enrichment, rescue shelters, television, visual stimulation*

## Introduction

Visual images have long been used in animal behaviour research. A wide selection of stationary photographs and dynamic video films have been utilised over the years to test animals' abilities on abstract tasks, as a replacement for mirrors in the study of 'self-recognition' and as alternatives for real stimuli, especially other animals (for a review, see D'Eath 1998).

Recently, some attention has been directed towards the potential value of visual imagery as a method of environmental enrichment for captive animals. Studies have explored the influence of two-dimensional videotape sequences, television programmes, computer-generated images and slide stimuli on the behaviour and welfare of several species, in particular birds (eg Jones *et al* 1996, 1998; Clarke & Jones 2000a,b) and primates (Bloomsmith *et al* 1990; Lincoln *et al* 1994; Brent & Stone 1996; Platt & Novak 1997; Harris *et al* 1999; Newsome & Portnoy 1999; Bloomsmith & Lambeth 2000).

To date, the potential value of visual stimulation as a method of enrichment for domestic dogs has been overlooked. Until recently it was assumed that visual imagery, particularly in the form of television broadcasts, held no enrichment potential for such animals. Dogs have a flicker fusion frequency of 70–80 Hz (compared to 50–60 Hz in humans) (Hart 1992), thus television programmes, which have a refresh rate of about 60 Hz, are believed to appear as rapid flickering to such animals (Coile *et al* 1989; Miller & Murphy 1995). The two-dimensionality of television presentation may also present some problems for dogs (Zeil 2000). Recently, however, it has been discovered that dogs will react to life-size, video-projected, two-dimensional moving images (Pongracz *et al* 2003). Furthermore, anecdotal reports indicate that some pet dogs appear to watch television, and even react to specific visual images (eg conspecifics) in the absence of auditory stimulation (Coren 1998). Indeed, videotapes have even been made with the explicit goal of entertaining dogs (eg 'Cool for Dogs' [Mia Video Entertainment Ltd 1993]). Visual stimulation may therefore hold more potential for enrichment in dogs than was once assumed.

The following study investigates the potential value of visual stimulation in the form of television programmes as a method of environmental enrichment for dogs housed in rescue shelters. Thousands of dogs are housed in rescue shelters worldwide, many for lengthy periods of time (Wells

**Table 1 Ethogram of dog behaviours recorded in the study.**

| Behaviour | Definition |
|---|---|
| **All conditions** | |
| Location | Dog is located at the front of the kennel, on view to the public |
| Standing | Dog is supported upright with all four legs |
| Sitting | Dog is supported by two extended front legs, two flexed back legs |
| Moving | Dog is walking, running, or trotting about the cage |
| Resting | Dog is reclining in a ventral or lateral position, eyes open |
| Sleeping | Dog is reclining in a ventral or lateral position, eyes closed |
| Stereotyping | Dog is performing repetitive behaviour |
| Vocalising | Dog is barking, whining or whimpering |
| **Experimental conditions only** | |
| Eye contact | Dog is looking directly at television monitor |

*et al* 2002a). Such animals are greatly influenced by their visual environment, reacting, for instance, to the mere sight of conspecifics housed in neighbouring kennels (Wells & Hepper 1998). Visual imagery may therefore have some potential as a method of enrichment for sheltered dogs. In this study, the behaviour of 50 sheltered dogs in response to five types of visual stimulation was examined. The influence of the exposure time of each visual stimulation condition on the dogs' behaviour was also explored.

## Methods

### Study site

Dogs Trust Rehoming Centre in Ballymena, Northern Ireland, UK, was used as the study site. Dogs were housed in three rows of line-block-style kennels. Each kennel consisted of a wire-mesh door, concrete walls, floor, and a front and a rear section. Kennel blocks faced each other and overlooked a paved quad around which visitors and staff could walk.

Each kennel was divided into two sections, referred to hereafter as 'front' and 'back'. From the front of their kennels (1.83 × 2.34 × 2.44 m, width × length × height), the dogs could view conspecifics, housed in opposite line blocks, and humans as they walked past the front of the animals' kennels. Whenever they were at the back of their kennels (1.91 × 1.57 × 1.83 m, width × length × height), the dogs were hidden from the view of the public, staff and other dogs.

Compatible dogs were kept in pairs, but most were single-housed in an attempt to reduce disease transmission and outbursts of aggression. All dogs were provided with a daily walk and a group 'play' session with other animals. The dogs' enclosures were cleaned thoroughly every morning and as needed throughout the course of the day. The animals were fed once per day in the afternoon.

### Subjects

Fifty randomly chosen dogs were used in this study and consisted of 32 neutered male dogs and 18 spayed female dogs. The majority of the dogs were cross-breeds, therefore preventing any valid analysis of breed differences. All of the dogs were healthy and between 6 months and 7 years in age. Dogs had been housed at the shelter for an average of 4.6 months (± 0.43 standard error [SE]). The sample was representative of dogs admitted to Dogs Trust in terms of breed, age and sex. All of the subjects were housed singly.

### Visual stimulation

Five conditions of visual stimulation were developed for the study. These included a control, during which the dogs were exposed to no visual stimulation other than that arising naturally from their environment (eg the sight of visitors, staff, dogs), and four experimental conditions: (1) blank screen (a television monitor that was switched off); (2) conspecifics (moving televised images of dogs); (3) interspecifics (moving televised images of other animals that were likely to be unfamiliar to all of the dogs in the sample group, eg penguins, polar bears); and (4) humans (moving televised images of people sitting in, and walking around, a typical home environment).

Each of the experimental conditions was presented to the dogs using a Philips 14″ TV/video unit (14PV200/07). A unit was positioned outside the front of each kennel, at the dog's eye level. As dogs are influenced by their auditory environment (Wells *et al* 2002b), the volume of each unit was turned off to eliminate the confounding effect that differences in sound between conditions may have on the animals' behaviour. Each videotape ran on a continuous loop for 4 h. The conspecific, interspecific and human videotapes were each 50 min in duration, hence there were 4.8 reiterations of these programmes during the 4 h presentation periods.

### Procedure

Dogs were exposed to each of the experimental conditions of visual stimulation for a 4 h period (1200h–1600h, the shelter's opening hours) for five consecutive days (Monday–Friday), with an interim period of two days between each of the conditions. The dogs were always presented with the visual stimuli at the same time of day to prevent any inconsistent exposure to extraneous events in the shelter environment, eg feeding, kennel cleaning. To control for any potential order effects, dogs were exposed to the five conditions of visual stimulation in a different order. Fifty different sequences were derived and each one randomly



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**Table 2 The mean (± standard error) number of times dogs were observed performing each behaviour according to condition of visual stimulation.**

| Behaviour | Condition of visual stimulation | | | | |
|---|---|---|---|---|---|
| | Control | Blank | Conspecific | Interspecific | Human |
| | Mean (SE) | Mean (SE) | Mean (SE) | Mean (SE) | Mean (SE) |
| Eye contact | – | 1.57 (0.25) | 3.21 (0.41) | 2.62 (0.34) | 2.97 (0.40) |
| Location | 11.59 (0.75) | 12.84 (0.84) | 15.51 (0.86) | 14.17 (0.82) | 13.69 (0.90) |
| Moving | 3.61 (0.45) | 2.34 (0.45) | 1.94 (0.44) | 1.64 (0.31) | 2.28 (0.45) |
| Vocalising | 3.78 (0.41) | 2.45 (0.32) | 2.24 (0.42) | 2.34 (0.38) | 1.94 (0.34) |
| Sitting | 1.73 (0.28) | 1.27 (0.24) | 1.92 (0.44) | 1.53 (0.34) | 1.77 (0.42) |
| Standing | 10.37 (0.82) | 11.14 (0.84) | 11.07 (0.96) | 12.38 (0.86) | 10.72 (0.93) |
| Resting | 8.22 (1.01) | 9.18 (1.02) | 9.01 (1.12) | 7.73 (0.98) | 9.81 (1.03) |

assigned to a dog; therefore, each of the 50 dogs experienced the same five conditions but in a different order.

The behaviour of each dog was recorded on days 1, 3 and 5 during both the control condition and each of the experimental conditions, in line with previous work of this nature (for a review, see Wells 2004a). Observations of the animals' behaviour commenced as soon as the TV/video units were switched on. The observer approached the front of each subject's kennel and recorded the dog's behaviour as soon as she saw the animal. The behaviour of each dog was recorded every 10 min over the recording period using a scan-sampling technique (eg Martin & Bateson 1986), providing 24 observations of each animal's behaviour per day. For each condition, at every sample point, the behavioural state of each dog was recorded according to an ethogram devised from existing work in this area (Table 1) (Wells & Hepper 1998, 2000; Wells *et al* 2002a,b). All of the behaviours recorded are known to influence public perceptions of dog desirability and are believed to be useful indicators of canine welfare (Wells & Hepper 1992; Wells 1996). In addition, for the four experimental conditions, the number of times that dogs were observed making eye contact with the television monitor (ie looking directly at the screen) was also recorded.

### Data analysis

The total number of times each dog was observed performing each behaviour was summed for each condition, providing an overall frequency count per animal per behaviour on all days of the study. For each behaviour (eg rest, stand), a repeated-measures ANOVA (eg Howell 1992) was carried out for the within-subjects factors of visual stimulation condition (control, blank screen, conspecific, interspecific, human) and the day of observation (day 1, day 3, day 5) to determine whether the dogs' behaviour was influenced by the various conditions of visual stimulation and/or the length of exposure to the various conditions.

For the experimental conditions, a repeated-measures ANOVA was carried out on the behaviour of eye contact, for the within-subjects factors of visual stimulation condition and the day of observation, to determine whether the amount of eye contact directed towards the TV screens was related to the condition of visual stimulation or the length of exposure to the visual stimuli. The mean number of times that the dogs were observed looking at the TV screens in total (ie across all experimental conditions) was also calculated by pooling the data for all dogs across all observed days, for each experimental condition, and dividing by the total number of sample points.

The assumptions underlying parametric analysis (eg Howell 1992) were sufficiently met in terms of population normality, sample independence, and homogeneity of variance (Mauchly's Sphericity test and Kolmogorov-Smirnov test, both non-significant).

## Results

### Eye contact with television

The dogs spent 10.8% of the total available viewing time (ie 31.14 times out of 288 sample points) looking directly at the television monitors. The amount of time that the dogs were recorded looking at the television monitors was significantly related to the condition of visual stimulation ($F_{3,147} = 6.54$, $P < 0.001$). Dogs spent significantly more of their time looking at the monitors during the conspecific, interspecific and human conditions than during exposure to the blank screen (Bonferroni test: $P < 0.05$) (Table 2).

There was a significant main effect of day of observation ($F_{2,98} = 52.55$, $P < 0.001$). Dogs spent significantly more of their time looking at the television monitors on day 1 (mean number of observations ± SE = 3.20 ± 0.31) than on day 3 (2.44 ± 0.24) or day 5 (2.14 ± 0.23).

### Location in kennel

The dogs' location in their kennels was significantly related to the condition of visual stimulation ($F_{4,196} = 5.29$, $P < 0.001$). Pairwise comparisons showed that the dogs spent significantly more time at the front of their kennels during all of the experimental conditions than during the control condition ($P < 0.05$). The dogs also spent significantly more of their time at the front of the kennels during exposure to the moving images of conspecifics than during exposure to the blank screen ($P < 0.05$) (Table 2).

### Moving

The amount of time that the dogs spent moving (and specifically walking for all occurrences) was significantly related



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to the condition of visual stimulation ($F_{4,196}$ = 6.85, $P < 0.001$). Dogs spent significantly more time moving during the control condition than during all other conditions of visual stimulation (Bonferroni test: $P < 0.05$) (Table 2).

The amount of time that the dogs spent moving fluctuated significantly across the three days of observation ($F_{2,98}$ = 5.77, $P < 0.05$), with the animals spending significantly less of their time moving on day 1 (mean number of observations ± SE = 2.26 ± 0.34) than on day 5 (2.49 ± 0.34).

### Vocalisation

There was a highly significant effect of visual condition on the dogs' vocalisation ($F_{4,196}$ = 7.27, $P < 0.001$). Pairwise comparisons indicated that the animals were significantly more vocal during the control condition than during any of the experimental conditions ($P < 0.05$) (Table 2).

Vocalisations differed significantly across the three days of observation ($F_{2,98}$ = 41.44, $P < 0.001$). Dogs spent significantly less of their time barking on day 1 (mean number of observations ± SE = 2.27 ± 0.28) than on day 3 (2.47 ± 0.29) or day 5 (2.91 ± 0.30) (Bonferroni test: $P < 0.05$), and significantly less time barking on day 3 than on day 5 (Bonferroni test: $P < 0.05$).

### Other behaviours

There was no significant relationship between the amount of time that the dogs spent sitting ($F_{4,196}$ = 0.79, not significant [NS]), standing ($F_{4,196}$ = 2.12, NS) or resting ($F_{4,196}$ = 1.93, NS) and the conditions of visual stimulation (Table 2). The dogs were never recorded sleeping or stereotyping and thus these behaviours were omitted from the statistical analyses.

## Discussion

The findings from this study suggest that the behaviour of kennelled dogs is influenced by visual stimulation in the form of television programmes. The dogs' interest in the visual stimulation differed across conditions, but only slightly. The programmes depicting conspecifics, interspecifics and humans attracted more attention from the dogs than the blank screen, suggesting that moving images are of more interest to dogs than static ones. The conspecific and human conditions of visual stimulation attracted slightly more attention from the dogs than the interspecific condition, although not significantly. A preference for visual images of familiar animals and humans has been noted in other species (eg Wilcoxon *et al* 1969; Bloomsmith *et al* 1990), and it appears that dogs may have a similar preference for moving images of these more 'meaningful' stimuli to those that have no biological relevance (eg penguins, polar bears), although further work is needed to explore this in greater depth.

The amount of attention that the dogs directed towards the television monitors decreased significantly across the three days of observation, raising questions over the value of visual stimulation as a sustainable and practical method of enrichment within the shelter environment. Other studies in this area have produced conflicting results with regard to rates of habituation. While some authors have reported habituation in some primates exposed to moving visual images (Platt & Novak 1997; Bloomsmith & Lambeth 2000), others have revealed no loss of interest in monkeys presented with similar types of stimulation (Swartz & Rosenblum 1980; Brent *et al* 1989). Unfortunately all studies, including the present one, have differed greatly in factors including emission of videotape audio component, frequency of scene change and activity level of subjects in the television broadcasts. More controlled experiments need to be undertaken to explore whether any of these factors influence rates of habituation before conclusions can be drawn regarding the long-term value of video stimulation as a method of environmental enrichment for confined animals.

Visual stimulation had an effect on certain components of the dogs' behaviour, including location in the kennel, movement and vocalisation. Dogs spent significantly more time at the front of their kennels and less time moving and vocalising during all of the experimental conditions than during the control condition. Interestingly, exposure to the blank screen was, in some cases, as effective at altering the amount of time the dogs spent moving or vocalising as the moving images, suggesting that the nature of the visual broadcast may not be as important as the mere presence of a novel object (ie TV monitor) in their environment. However, moving images of conspecifics were more successful at enticing dogs to the front of their kennels than the blank screen. Earlier work on enrichment for kennelled dogs has failed to report an effect on the dogs' location within their kennels using different stimulatory strategies, eg olfactory (Wells 2004a) and auditory stimulation (Wells *et al* 2002b), and the introduction of toys (Wells 2004b), presumably because such stimuli are transient in nature and not fixed in one spot. The findings from this study suggest that certain fixed enrichment devices may serve some value in enticing animals to a specific area of the enclosure; this may be of particular benefit for sheltered animals that are available for adoption (Wells & Hepper 1992).

Overall, the dogs' interest in the visual stimulation, as assessed by the number of times the animals were recorded looking at the television monitors, was relatively low (10.8% of all observations). Similar studies with other animals have revealed a considerably higher degree of television-directed eye orientation. For instance, Old World monkeys have been reported to spend 14–75% of the available viewing time looking at images of conspecifics, interspecifics and humans (Swartz & Rosenblum 1980; Capitanio *et al* 1985; Levin *et al* 1986; Brent *et al* 1989; Bloomsmith & Lambeth 2000). The discrepancy between the findings of the present study and the earlier primate research may be related to the visual systems of the species under investigation. Old World primates are well renowned for their well-developed visual systems, perceiving images in much the same way as humans (Napier & Napier 1986). In contrast, dogs rely less on their sense of vision and more on other sensory systems, eg olfaction, and have an inferior



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visual system to humans' in aspects including colour perception, accommodative range and visual acuity (Miller & Murphy 1995). Bradshaw (1992) has noted that dogs are poor at focusing on nearby objects and cannot see as much detail as humans. The animals in this study may thus have had some difficulty in perceiving some of the video images, particularly those that moved quickly.

The stimulating nature of the rescue shelter environment may also explain the relatively low amount of interest that the dogs directed towards the television monitors. The external environment of a captive animal can greatly affect the efficacy of any enrichment method (Schapiro & Bloomsmith 1995). The sight of visitors, staff and other dogs may have served as more interesting stimuli to the animals in this study than the sight of a silent video broadcast. This raises questions over the value of visual imagery as a method of environmental enrichment for dogs housed in such stimulating situations.

It must be remembered that a scan-sampling technique was used in this study, in line with the previous published research in this field (for a review, see Wells 2004a). Different sampling methods (eg focal, behaviour-sampling), and indeed different recording methods (eg continuous instead of time-sampling), may have yielded different results with regard to the recorded amount of attention directed towards the television screens. Further work is needed to elucidate the most appropriate sampling and recording methods for this type of research.

### Animal welfare implications

The dogs in this investigation directed relatively little attention towards the television monitors and habituated to their presence within a short period of time. This raises questions as to the value of visual stimulation as a method of enrichment for sheltered dogs. One could argue that a lack of interest in this enrichment strategy reflects a lack of enrichment. Nonetheless, one cannot overlook the fact that the addition of the television monitors resulted in significant changes to the animals' behaviour: the dogs spent more of their time at the front of their kennels and less of their time moving and vocalising following exposure to all types of visual images. These behavioural changes are indicative of increased relaxation, although whether they are synonymous with improved welfare remains open to speculation.

It seems unlikely that dogs will ever benefit from visual stimulation in the form of television programmes to the same degree as primates given the differences in their sensory perception. For this reason, along with the relative lack of interest that dogs show in television and the practical problems inherent in the implementation of this rather costly approach, staff in rescue shelters might be better advised to adopt alternative types of enrichment strategy for the animals in their care.

The dog is an animal that needs a complex environment featuring both animate and inanimate objects (Morris 1964; Fox 1965). The provision of social contacts, both with other dogs and with humans, is essential and should be considered the most important form of environmental enrichment for confined dogs (Wells 2004a). At the very least, dogs should be provided with visual conspecific contact (Wells & Hepper 1998). The provision of a complex and stimulating inanimate environment is also important to ensure adequate psychological well-being in kennelled dogs. The introduction of appropriate toys, music, scents and cage furniture can all help to enhance an otherwise relatively routine environment (for a review, see Wells 2004a). The regular rotation of such items is considered particularly important in preventing habituation.

Many institutions housing dogs are now paying more attention to the animals' environment and the important relationship between kennel design and canine welfare. The ongoing research in this area will, we hope, ensure that developments continue to be made in our understanding of how to ideally house kennelled dogs in order to promote both their physical and their psychological well-being.

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