

Farmed foxes prefer a cage with an unobstructed view

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Introduction

Traditionally, farmed blue foxes (*Alopex lagopus*) and silver foxes (*Vulpes vulpes*) have been housed in cages without any furnishing. Recently, this method of housing has been questioned (*Commission of the European Communities* 1990). *European Convention* (1991) recommends that fox cages should be furnished to improve the welfare of farmed foxes. In response to this recommendation, various furnishing solutions have been studied (see a review by *Bakken et al.* 1994). In these studies, preference tests have been widely used. The cages have usually been furnished with nest boxes or resting platforms (or both) and the amount of time using these structures has been recorded to evaluate their importance for foxes and their welfare. However, it has been observed that the preferences of foxes may be strongly affected by features of the structures and other environmental factors that seem unimportant to man (*Mononen et al.* 1995).

European Convention (1991) states that if foxes are provided with no furnishing other than a resting platform, the platform should have solid walls. However, blue foxes clearly prefer resting platforms without walls to ones with walls (*Harri et al.* 1991, *Mononen et al.* 1993a). Silver foxes use resting platforms with two walls more if the platforms are situated in the cage in a way that there is an unobstructed view towards the entrance from which humans enter most frequently (*Mononen et al.* 1993b). Furthermore, silver foxes seldom rest on the cage floor if the cage is provided with a nest box on the floor. If they rest on the floor they choose a site from which the view of the surroundings is least obstructed by the nest box in their own cage and the nest boxes in the neighbouring cages. They do not rest inside the nest box, but rather on

the roof of it from which the view to the surroundings is least obstructed (*Mononen et al.* 1995). Thus, it seems that the obstructed/unobstructed view may be a key feature (*Nicol* 1994) that affects farmed foxes' preferences (especially the choice of the resting site).

In the present study, the effect of an obstructed view on farmed blue foxes' and silver foxes' behaviour was assessed in a preference test in which the animals had to make choices between cages with and without the unobstructed view.

Materials and Methods

The experiments were carried out at the Fur Animal Research Station of the University of Kuopio in Juankoski in eastern Finland in March (blue foxes) and May (silver foxes). The experimental animals were adult female blue foxes (N=4) and silver foxes (N=4). Before the experiments the animals had lived singly in an unheated animal barn in standard wire mesh cages (115 cm x 105 cm x 70 cm, WxLxH). The experiments were carried out in the same barn.

On the first day of the experiment the foxes were transported from their home cages to the experimental cages (one animal per cage) consisting of a combination of two standard cages. The foxes were able to go from one cage to the other through an opening (20 cm x 20 cm) in the wire mesh wall between the cages. The opening was 50 cm from the cage floor and could be reached with the aid of a wooden ladder (Figure 1).

The experiment lasted for 12 days in blue foxes and for 15 days in silver foxes. For the Days 1-6 of the experiment, the cages had wire-mesh walls, i.e. transparent walls. During the seventh and eighth day hardboard walls, i.e. opaque walls, were mounted on three wire mesh walls of the left

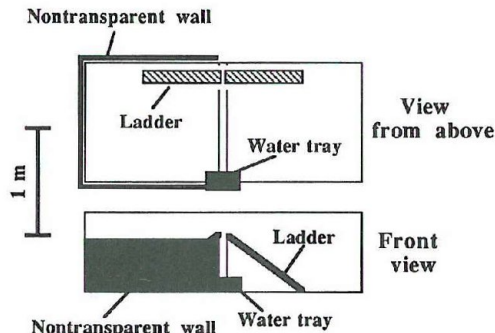


Figure 1. A schematic drawing of the experimental cage design during the days 7-8 of the experiment i.e. when the opaque (nontransparent) walls were in the left cage. The cage itself was made of wire-mesh and thus it was transparent.

cage. The wall between the cages was without a hardboard wall. As the hardboard walls were only 45 cm high the foxes could see over the walls while standing, walking or sitting but not while lying (Figure 1). During the ninth and tenth day the hardboard walls were transferred to the right cage in a similar way. From Day 11 both cages had transparent walls. The experimental cages were in one cage row and both adjacent cages were unfurnished standard fox cages with non-experimental animals of the same species.

The daily fresh feed portion was delivered once a day (in the morning) on the roof of the left cage on Days 1-8 and on the roof of the right cage from Day 9. Water was served twice a day (in the morning and afternoon) to a water tray in both cages. The artificial lighting in the barn was turned on at sunrise and off at sunset. During dark hours a dim red light was used (one 60 W red bulb per each double cage) to enable video-recording.

The behaviour of the blue foxes and silver foxes was video-recorded for the whole experimental periods. The video system has been described in detail in *Mononen et al.* (1996). The data from four 48-hour periods were used for general presentation of the foxes' behaviour. The periods were:

- Days 3-4, both cages with transparent walls;
- Days 7-8, the opaque walls in the left cage;
- Days 9-10, the opaque walls in the right cage;
- Days 11-12, both cages with transparent walls.

These periods were chosen to use equally long periods that represented days during which there was a similar amount of human activity on the farm. Data from the other days is included in the presentation of inter- and intraindividual variation.

The behaviour of the animals was analysed from the video tapes using instantaneous sampling method with 5 min sampling interval (*Martin & Bateson* 1986). Four behavioural categories were used: active/resting in left/right cage. Rest included lying still (awake or asleep) and activity included all other behaviours.

If the opaque walls do not affect the behaviour of the foxes, the animals should allocate both their active and resting time evenly between both cages. Thus, the percentage of time engaged in each behaviour (active/resting) in each of the two cages was compared to the expected 50 % by paired t-test. Friedman two-way analysis of variance was used for analysing the differences in the behaviour between the four 48-hour periods. Mann-Whitney U-test was used for analysing the behavioural differences between the two fox species (*Mäkinen* 1978).

Results

When the cages had transparent walls, both silver foxes and blue foxes allocated their active time equally between the two cage sections. Providing one cage with the opaque walls decreased active behaviours in that cage (Figure 2). Note that the foxes were always fed in the cage with the opaque walls, and, thus, they were forced to go there if they wanted to eat. During Days 11-12 (both cages with transparent walls) the animals spent less time in active behaviours than during the other three periods (Figure 3). The silver foxes spent more time on active behaviours than the blue foxes during the periods with the opaque walls in one or the other of the cages (Figure 3). This was the only statistically significant difference in behaviour between the species (Figure 2 and Figure 3). Both fox species avoided using the cage with the opaque walls as a resting site (Figure 2). The only exception was one blue fox, which spent 62 % of its total resting time in the left cage even in the situation when the left cage had the opaque walls. However, the opaque walls also influenced its behaviour, because during the periods with the

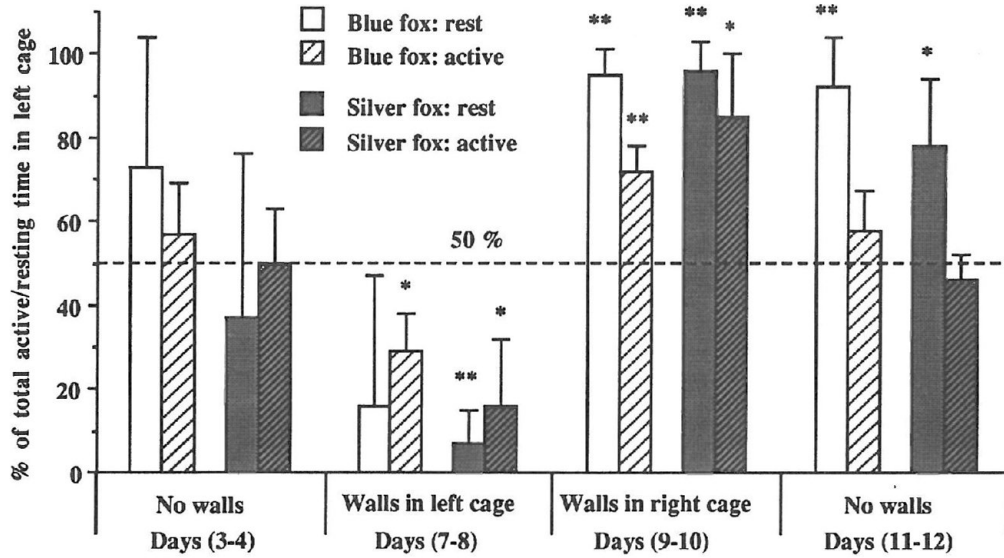


Figure 2. Percentages of the total active and resting time spent in the left cage (mean±SD) by blue foxes (N=4) and silver foxes (N=4). Each column includes data from a 48-hour period. Difference from 50%: *P<0.05, **P<0.01 (paired t-test). Differences between species are not significant: P>0.05 (Mann-Whitney U-test) for all eight comparisons. Walls=opaque walls.

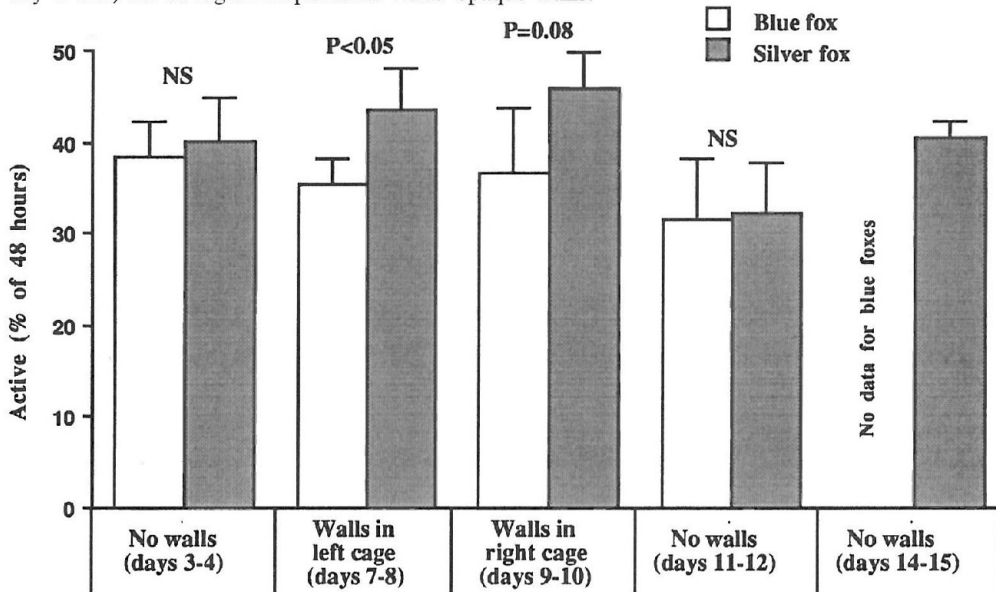


Figure 3. Percentage of active time of 48-hours (mean±SD) in blue foxes (N=4) and silver foxes (N=4). Differences between species (Mann-Whitney U-test) are indicated above each pair of columns. There are differences in the activity between the 48-h periods within each species: P=0.050 for blue foxes and P<0.05 for silver foxes (Friedman two-way analysis of variance). Walls=opaque walls.

transparent walls in both cages, it preferred the left cage exclusively as a resting site. During Days 3-4 (transparent walls in both cages) both cages were used equally for resting but during Days 11-12 (i.e. following the period when the opaque walls were in the right cage) the foxes rested almost exclusively in the left cage although both cages then had transparent walls (Figure 2). There were both inter- and intraindividual variation in the use of the two cages for resting when both cages lacked the opaque walls. However, during the periods with the opaque walls in one or the other of the cages these variations were considerably reduced (an example in Figure 4).

Discussion

The opaque walls clearly affected silver foxes' and blue foxes' behaviour. The foxes rested almost exclusively in the cage with the unobstructed view. During active behaviours they also used the cage with the opaque walls less than the cage with the transparent walls. These findings

support earlier observations that foxes prefer those cage parts from which the view is least obstructed. They use resting platforms placed high up in the cage more if the platforms lack walls (Harri *et al.* 1991, Mononen *et al.* 1993a) or if the open view from a platform with two walls is towards human activities (Mononen *et al.* 1993b). The obstructed view at the cage floor level may make silver foxes seek a resting site with an unobstructed view (Mononen *et al.* 1995). Farmed foxes also generally prefer higher sites to lower sites independently of the material and dimensions of these sites (Korhonen & Niemelä 1994a, b, Mononen *et al.* 1996). Usually, the highest place in the cage environment also means the place with the least obstructed view.

The foxes rested less frequently in cages that previously (Days 9-10) contained opaque walls, despite the fact that these were removed during Days 11-12. This might be caused by prolonged aversion towards the cage which previously had solid walls (the right cage). However, it may also

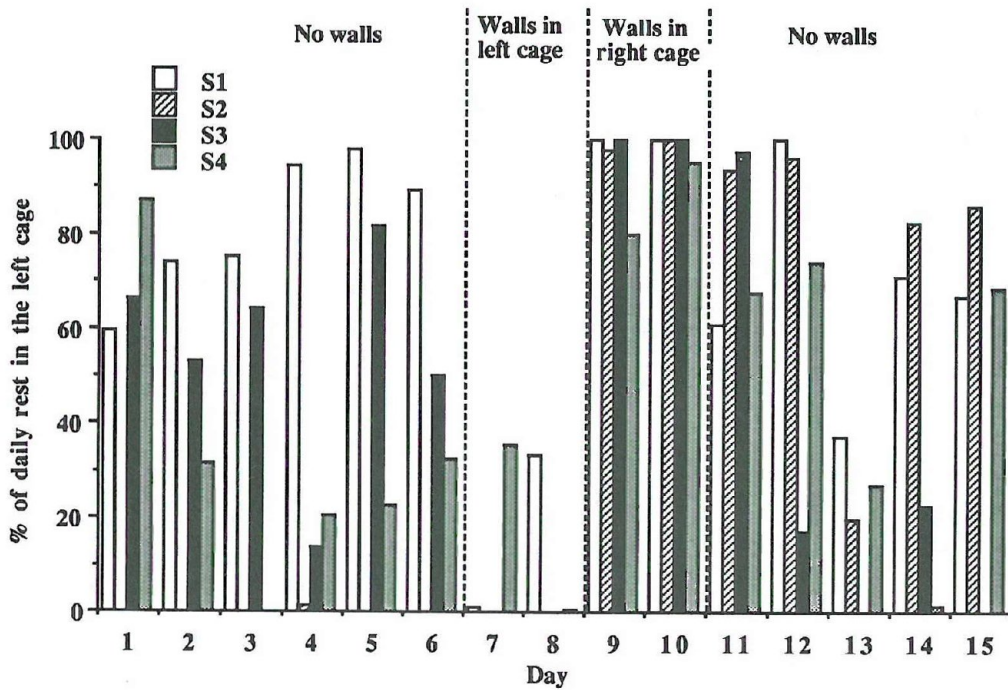


Figure 4. Percentage of total daily rest spent in the left cage by the four individual silver foxes (S1, S2, S3 and S4). Walls = opaques walls.

be due to the fact that the foxes' preferences for cages seem not to change very quickly once established, unless there is a major structural change (e.g. the opaque walls). The silver foxes recommenced using the right cage on Days 13-15 (Figure 4).

Removal of the opaque walls decreased the foxes' activity (Days 11-12) below that recorded when walls were present (Days 7-10) for both species (Figure 3). The silver foxes tended also to be more active in the situation with the walls (days 7-10) than before the wall periods (Days 3-4, Figure 3). These findings may indicate a novelty effect: the new and changed environment needed to be explored more, and after having been more active for some days the foxes needed more rest.

Traditionally farmed foxes are housed in open sided shed houses in unfurnished wire-mesh cages that are lifted 60-100 cm above the ground level (*Commission of the European Communities* 1990). In these systems the view from the cage is largely unobstructed to any direction. Unfortunately, several suggestions to provide the animals with environmental enrichment include structures that obstruct the animals view of surroundings (e.g. *Mononen et al.* 1995). Foxes' preference for the unobstructed view may outweigh the possible enrichment value of the added furniture. On the other hand, the lack of a hiding place has been claimed to be one major deficiency in barren fox cages (*Commission of the European Communities* 1990, *European Convention* 1991, *Bakken et al.* 1994). The present results indicate that partial visual isolation does not necessarily satisfy the foxes' possible need of a hiding place.

It has been suggested that visual and spatial isolation of silver fox vixens during the breeding season should be provided to reduce social competition between the vixens in neighbouring cages. In one study, the isolation has been shown to improve the reproductive performance of the subordinate vixens (*Bakken* 1993). However, *Jeppesen & Pedersen* (1988) report that visual isolation by cardboard partitions between the cages in the cage rows did not have any positive effects on the reproduction of silver fox vixens. The present results indicate that visual isolation by means of solid walls may even be a threat to foxes' welfare.

In the present study the preference of the farmed blue and silver foxes for the cage with unobstructed view was almost exclusive and the unobstructed view may be of importance to foxes' welfare. The obstructed/unobstructed view is a key feature of the environment that should be taken into consideration when designing housing systems for farmed foxes and when interpreting results from preference studies and other studies dealing with foxes' welfare.

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Summary

We have observed earlier that farmed blue foxes (*Alopex lagopus*) and silver foxes (*Vulpes vulpes*) tend to avoid resting at those sites in their cages from which the view to the surroundings is obstructed. In the present study this hypothesis was tested in a preference test in which the foxes could choose between a cage with an unobstructed view and a cage with a partially obstructed view. Both blue foxes and silver foxes spent a smaller percentage of their daily active time in the cage with the obstructed view than in the cage with the unobstructed view. They almost exclusively preferred the cage with the unobstructed view as a resting site. Obstructed/unobstructed view is a key feature of the cage environment that should be taken into consideration when designing housing systems for farmed foxes.

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