

# Landscape Designing Practice for the Animal Show in China's Erdos Zoo

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*Abstract:* - The landscape practice for the animal show in zoos has a long history. Taking advantage of the large-scale construction of the animal show in Erdos Zoo, the author comprehensively summarized the experience and lessons available in the landscape of the zoo animal show, carefully listened to the detailed description of animal feeders, went deep into the practice field, and acquired some precious experience different from common exposition design. The paper introduces the concept of "Enrichment" of the zoo animal show to provide complex and various environments for captive animals and increase the possibility that captive wild animals express their behavior in the wilderness. The whole process of the landscape design for the animal show in Erdos Zoo always centers on the animal "Enrichment" to define the architecture function, generatrix, construction, decoration and equipment.

*Key-words:* - zoo; animal show; landscape design; enrichment

## 1 Introduction

Erdos Zoo is located in the west of Dongsheng district in the city of Erdos, Inner Mongolia, 5 kilometers away from the Central Square of the district, and covers an area of 9 square kilometers. In November, 2009, the government of Dongsheng District, Erdos city, began to plan the construction of the zoo. In the spring of 2010, the construction began. The overall planning of the zoo, landscape design, architectural design of animal houses and so on are undertaken by Architectural Design Institute of China Agricultural University(Beijing Oriental Imagination Architectural Design Co., Ltd. ); Fundamental Construction Department of Beijing Zoo and Architecture Design

Institute of China Agricultural University cooperatively undertook the design for animal houses enrichment ( it means providing captive animals with complex and diversified environment to increase the possibility for them to express their behaviors in the wild, including searching for food, establishing their own territories, building nests, avoiding disadvantageous environment, etc.). Thirty-four animal houses and their accessory buildings and landscape were finished, of which the total area was 60 thousand square meters, and they were put into use and open to the public on 28th July, 2012.

## 2 Key Points of Address Selection and Planning for Animal Show of Erdos Zoo

Compared with common Chinese city zoos, Erdos Zoo has larger covering area and comparatively low density of architecture. The animal premises are concentrated along three visiting routes, including tropical rainforest zone, African zone and Asian zone, with ornaments such as Australian kangaroo garden, wolf garden and small animal garden. The side length of every visiting area is 300 to 600 meters, in which one can visit by walk. It is better to use sightseeing buses in shifting sightseeing area. The entrance square of the zoo is large and used as an area of gathering tourists and buffering, and served as starting and terminal stations of sightseeing buses.

The landform of Erdos waves up and down. Most of the gradients of animal house building sites are higher than 25%. And most of them are on hillsides, which can not only avoid affecting the natural landform landscape as staying on the mountaintop, but also stay away from low-lying to guarantee dry fields, good drainage and ventilation. In addition, open trenches are used to drain rainwater from the ground field, which can combine well with the natural mountain landscape. Slope protections and barricades are built wherever outdoor ground level is lower than that of the natural ground by 2.5 meters.

The main entrances and exits of animal houses are normally 20 meters back from motor vehicle road line of the

garden, which retains enough evacuation places for audience. The support exits and entrances for feeders are located at concealed positions, and combined with those for animals, they are reserved as normative rotary field for vehicles. Carnivorous beast playground forbid the enter of firemen, fire protection roads of majority of animals architectures are hindered by animals outdoor activity fields and can not be mounted in circus, therefore are mounted along with architectures on the side of visit fields.

## 3 Classifications of Animals Show in Erdos zoo

In Erdos Zoo, the architecture where animals live is called the Animal House, in which the one with animal exhibition rooms and visit halls is the Animal Pavilion while the one without these exhibition rooms and visit halls is the Animal Hut. The Animal Houses can be grouped in terms of animals' raising and ornamental as follows: Carnivore House, Graminivorous Ungulate House, Graminivorous Pachyderm House, Primate House, Bird House, and so on and so forth.

The exhibition architecture in Erdos Zoo contains 34 Animal Houses: (1) Carnivore House: Tiger House, Asia Leopard House, Lion House, African Leopard House, Bear House, Wolf House, Crocuta House, Dog House; (2) Herbivorous Ungulate House: Giraffe Pavilion, Kangaroo Pavilion, Zebra & Antelope & Ostrich Hut, Desert Animal Hut, Alpine Animal Hut, Dongshan Mutton Pavilion, White Ram Pavilion, Alpaca Pavilion, Pony Pavilion, Sika Deer Pavilion; (3) Houses of

herbivorous pachyderms: elephant houses, rhinoceros houses, and hippo houses; (4) Houses of primates: monkey houses, gorilla houses, mandrill houses, ring-tailed lemur houses and squirrel monkey houses. (5) Houses of birds: bird houses, flamingo houses, preying bird houses, waterfowl houses, peacock houses; (6) Other small animals' houses: Rat House, Rabbit House and Pig House.

## 4 Construction Enrichment of Animal Houses of Erdos Zoo

Compared with common residential buildings, the building construction of animal houses are special, such as the pavements, steps and ramps, stones, water, plant, rockery, artificial stones, fences, rails and so on. In particular, the building parts that can be touched by the animals need special construction process.

**4.1** The building's exterior wall of animal houses is usually reinforced by concrete frame commonly, which is conducive to fixing steel across the houses, fence, interior and exterior decoration and keel skeleton. It has 200 - 300 mm thick according to the type of animal power. The pattern of outer walls keeping warm always use outer warm-keeping, but the position of exposure of outer walls to animals playground must have protection process, the heavier and destruction of architecture outer walls need special isolation or protection parts and measures. Animals exhibition hall, especially the inside of outdoor animal playground outer walls need polish, protecting animals especially beasts climbing out to hurt visitors. The step ramps and climbing facilities of animal exhibition

halls, animal houses and animal playgrounds need more rough, to increase rub for animal climbing.

**4.2** The mat formation of zoo can be classified by various animals, and the mat formation materials also have differences. When considering the cleaning difficulties, we had better consider mainly the live states of animals. The ground coverings for mammals which are good at burrowing are sandy soil, while most of the animals' houses are made of concrete. Animal houses' floor coverings: most of the indoor animal houses' ground is covered by a layer of fine stone concrete. We should determine the thickness of the surface layer as well as if the floor needs to configure rebar mesh according to the weight and the destructive power of the animal. Normally there should be a vapor barrier and an insulation layer beneath the floor, except some houses of those who like natural soil. For most floors, we'd better place some dry movable wooden planks after the animals settle down. The floors of the houses raising tropical and subtropical animals should be insulated, so as to ensure the floor temperature and the room temperature of the animal houses.

**4.3** The seines refer to the facilities installed between animals and visitors for segregating them so as to ensure the safety of the animal as well as the visitors. The seines include ditches, plants, walls, fences, rails, grids and so on. Thus it can be said that animal seines are the essence of the zoos. Animal seines are the basic elements as well as key components of Erdos Zoo. For adapting to the applications of many new technologies, there appears various types of seines such as fences, glass walls, vertical walls, ditches and so on in Erdos zoo. Suitable fences were selected in accordance with the different habits of the animals during design, and different fence combinations were applied.

The strength and parameter of the fences were decided mainly by two factors - the animals' behavioral competence and the danger degree to show them. The higher danger degree of the animals' show means the animals have better moving abilities and are easier to escape, so the maintenance facilities of the animals should be stronger, with higher closure. The managing equipments of the zoo are also important. For animals which have strong exercise capacities while relatively low risks to human, the degree of isolation of showing maintenance equipments can be relatively reduced. As for the seines of the animal houses, we usually use rebar seines for carnivorous animals, seamless steel tubes for large powerful animals and fine steel wire meshes for small animals.

The door of entering into the animal exhibition halls and animal houses is always the double door, which side near animal is transparent steel rail, is beneficial for feeders to observe animals. The side near feeder access is always steel plate door and has observation hole. The sealing steel plate door ensure the safety of animal houses and the temperatures of environment, the door of animal passing in and out is always double-access and double-deck warm-keeping steel door, most are push-and-pull opening way, push closing and pull opening.

**4.4** In organizing the traffic and connecting the landscapes, the steps and ramps play an important role. From the perspective of the rights of animals, steps and ramps are equipments that fundamentally show the relationship between human and animals. Steps and ramp must be set at the same time where height difference is necessary. It is easy for animals to walk up steps but difficult to walk down steps.

**4.5** Normally, rails in dark and low-purity color are more "inconspicuous", which have less damage to the environment. The rails in Erdos Zoo are mostly used in accompany with pens, which is mainly intended to avoid visitors to get close to animals and hurt each other. The exterior color is designed for the natural style with dirt-color, gray and mixed dark green. The superficial texture accords with the natural style, which is easy to make some necessary cleaning.

**4.6** The stone landscape creates space for an equal dialogue between human and animals. Regarding the practical application of rockscape in the zoo, designers should take the animals' demands in real life as a starting point in order to design reasonable landscape in accord with animals' ecological habits. The stone scenery art not only realizes its own sustainable development, but also plays a part in many aspects, such as ecological environmental protection, wild life protection, etc.

**4.7** Any animal can not survive or live without water. The water in the zoo not only meets the needs to beautify the environment and adjust microclimate, but also satisfies some exhibited animals' needs for water. It is a boon for some animals such as the elephant and the rhinoceros. The design of their exhibition enrichment also needs water; The water design in some special animals exhibition houses, for example, the one corresponding to the animals' habitat in Waterfowl House and Hippopotamus House, can not only beautify the environment, but also give animals a natural living space to enjoy.

**4.8** The allocation of plants in Erdos Zoo is to combine coniferous trees with broad-leaved trees, evergreen trees with deciduous trees, exotic tree species with local tree species, matching the plants with the architectures in animal area and the

animals' habits. The zoo is a place to show various wild animals and different kinds of natural ecosystem landscapes, the environment and theme of plants configures should match with it. The coordination of buildings of the zoo and the garden plants gives people a sense of returning to nature. The plants in the zoo reflect the habits and characteristics of animals, basically achieving the effect of combining tourists' visiting, popularization of science and entertainment.

**4.9** Simulative trees can provide more comfortable and healthier living environment for animals and good place of recreation and entertainment for tourists, therefore, the zoo of Erdos uses simulative trees widely in and out exhibition buildings. Simulative trees are made of man-made materials and are not restricted geographically. With such advantages, simulative trees can be made to demonstrate regional scenes. For instance, the Bird House uses palms, roystonea regia and areca to form a southern tropical scene and the Tiger and Leopard House uses deciduous trees that are tall and big to produce the rugged northern scene. With such ability of simulative trees, we are able to cultivate trans-regional plants without paying much money and effort and reproduce scenes quickly to simulate the original living environment of the animals and in turn produce the garden scene that coordinates with the animals. Thus, we can keep the animals living healthily and multiplying normally. Meanwhile, this can add to the authenticity of exhibition halls and enrich tourists' knowledge. Simulative trees have some advantages like strong plasticity, are not likely to be affected by environment, easy maintenance, can provide plants greening for animal houses, simulating the original environment of animals, improving

the effect of exhibition halls and promoting the vitality of animals, preventing the natural effects such as putrid of plants. Artificial trees can also be used as shelves for animals to take a rest. This design increases the diversification of the equipments of animal houses, considering offering them more space and making them more active when they are not being fed. At the same time, we should change the position and shape of houses in raising environment randomly and creatively, making animals feel novelty and improving the vitality of animals.

## **5 Environment Control for Animal Houses in Erdos zoo**

The ventilation of animal houses, animal exhibition halls, raising accesses: animal houses will produce much dirty gases than toilets of civil architectures, these two regions must guarantee the adequate ventilation volume, having natural ventilation and mechanical ventilation. The animal houses in frigid zones should be sent hot wind to maintain indoor temperatures when send natural wind mechanically.

Animal houses heating: Normally the suitable temperature of animals' survival is between 18 and 22°, some animals in frigid zones can decline to 5°. Heating methods: the ground should not be covered by floor heater fully. Temperature gradients should be formed in houses. Location of animal homes radiator: Radiator is suitable to be arranged in feeding channel, with protective cover within the house generally.

Animal house drainage: The hydrant is set at the feeding channel, and

the drainage should be drained from house to the open trench of feeding channel along the slope, Floor drain should be set in the lower drainage. The grate should be set to prevent solid particles falling. The floor drain is prohibited to be built within animal house where raising the animals having large amount of animal manure, to prevent fecal blockage and leakage and for that it's difficult for the breeder to cleanup at any time. The capacity and position of septic tank: The large herbivores have large amount of waste, so the septic tank should be near to animal houses with big volume. The septic tank of the beast animal houses should not be within the outdoor animal sport field.

Lighting and electricity using of animal house and exhibition hall: Setting up skylight to gain light, laminating and tempering glass for security sake, and protective net under the skylight whose window should be manually opened or by electricity.

Visiting hall: the visiting hall with glass walls shouldn't set up natural lighting windows in case of reflections, which will make the visitors unable to see the animals in the exhibition hall clearly.

Electric wire installation: According to the animal raising experience, the electrical equipments of animal houses and raising space should be frequently replaced and overhauled, thus it will be easy to change and repair the electrical boxes and other devices if they are surface mounted.

## **6 Habitat Landscape of Animal Houses in Erdos Zoo**

The principle of building habitat and landscape in the animal houses of the zoo is "animal-oriented". Animal house building is a complex system including animal behavior, feeder behavior, audience behavior and many technical levels above. How to construct animal habitats through simple rules, to represent or imitate the environmental landscape of the animals' habitats? Animal houses generally are storey building, within a appearance of continuous interface and body, combined with the visit movement to form a continuous structure and strengthen the induction space, visually and psychologically weakening the sense of volume of Architecture and avoiding interruption original continuous natural landscape of zoo.

In terms of functions, the art form of the animal house' public space as well as its complex and rich functions are pursued. The landscape space of the zoo and the architectural space of animal houses are integrated into a whole. In terms of type, the internal space of animal house and the natural mountain space inscape of the zoo are linked together, which form the zoo's core space bones and character. The bottom, top and side interface of interior and outdoor in animal house usually needs to pursue continuity design. Form, texture and color all reflect continuity. Pay attention to the isomorphism of construction interface and the zoo landscape space, as well as the isomorphism of the interface of building itself. More attention is paid to the integrated isomorphism of the architecture itself. Not only bottoms, tops, and side interfaces share integrated forms, but also indoor composite walls,

suspended ceilings, ramp rails and display background all show the features of continuity, nonlinearity, and unity.

After the completion of the landscape of the above-mentioned animal habitat, the main facility for Erdos Zoo to implement the interior and exterior of the animal display architecture is through the GRC rockery design. In the designing stage, the creativity of the animal habitat is understood, but the recess where animals like to hide for rest in the visitors' hall is just where it is hard for the feeder's faucet to reach and where the visitors can not see clearly. Here "Animal First" has to give way to the raising security. For visitors to clearly appreciate the behavior of animals, animals have to be exposed to their sight. In the course of the enrichment of the animal habitat of Erdos Zoo, the contradiction among these three function requirements is quite obvious. Therefore the middle way has to be taken reluctantly. For example, the illumination of the hall is reduced to create an atmosphere for visitors to peep at animals so as to reduce the intervention of animals on the premise of comfortable visiting. The fully enclosed facilities segregated from the visitor's hall are adopted for most of the animal exhibition halls, by using double-layered laminated tempered safety glass so that visitors can see animals at a close range in sight, which is exciting yet safe. The outdoor animals' playground adopts ditch segregation, which keeps audience far away from the animals.

## **7 Observe Chinese Animal Show**

### **Design Through Erdos Zoo.**

The history of zoo begins from initial zoo collection, to caged zoo and to modern zoo three stages. City zoo has a history of more than 240 years. Currently, on the premise that there is no animal house building and designing standard in China, the animal house in the zoo is temporarily classified as a kind of showing public building which mainly shows animals, and expresses animal related knowledge and information by means of photos, films and digitization. Species protection, scientific education, scientific research, relaxing entertainment, comprehensive protection, protection education, as well as natural source have become the core duty that zoo designing must follow, which is the principle line through zoo venue designing. The using situation of every animal house and equipment in the zoo directly affects the animals' health, the visitors' watching and educating as well as the employees' raising management, etc.

From the point of display design, combined with ethology, zoecology, zoophysiology and the behaviors and mental features of visitors, research the display space of many species of animals and plant selection and application again, and reach a systematic conclusion on forefront and scientific theories of display design of animals in zoo. Animals in the zoo are living special exhibits. Display design is the core of the zoo and the key point of the design of the zoo. Besides, whether the show environment will pose a threat to the survival of the animals is also an

important aspect. For example, we must make sure whether the breadth and depth of the ditches in the show environment are appropriate, whether the pulse electrified wire netting has been set up close to show areas, and whether ropes for primates to climb with, which are exposed outside for long, have been replaced regularly. Whether the chosen plants are toxic to animals? Different from the general display design, animal exhibition design can not be stored permanently like exhibition design of museum. When conditions permit, new elements should be transfused into it, to avoid the stress response of physical and mental caused by longtime and dull environment, and to show a dynamic environment for the animals.

In terms of animals, how to make sure that they can keep healthy and reproduce successfully is what the zoo should be especially concerned about. There should be enough room and necessary facilities in their living areas, to cater for the animals' natural behaviors and meet their demands for free activities, thus making them keep healthy and reproduce as hoped and really turning the zoo into a happy homeland for animals.

In terms of the breeder, they charge daily observation of animals, feeding, hygiene and medical care, as well as avoiding damages to tourists caused by animals due to some of the problems. In the zoo, they are most closely related with animals, and also best understand the lives of animal habits and behavior habits. A safe, sanitary and efficient work environment is essential, where breeder can easily observe the animals, better feed animals, and, when

conditions permit, guide visitors and provide visitors with various types of relevant knowledge.

From a viewpoint of tourists, we should teach them to have a deeper conceptual knowledge about animals' natural behaviors and living environments through lively activities, to spark their interest in protecting and caring for animals. Necessary leisure facilities and recreational equipment such as seats and pavilions should be provided for tourists.

As for the aspect of show environment, we'd better take advantage of original terrain and plants, building an ecological environment. For example, we may plant some trees in and around the animal houses, which can not only provide a good visual environment, but also clean up the environment, eliminating bad odors. Taking energy-efficient and environmental friendly materials into consideration as much as possible in the design and setting up recycle posts in tourists and feeder working places to utilize natural resources effectively.

## 8 Conclusion

As Chinese Ministry of Construction hasn't introduced the design standard of animal show buildings, and the animal exhibition halls are totally different from normal ones, we consulted the expo building design standard and considered the experience of the raisers of corresponding animal houses of the zoo in the process of designing the animal show buildings in Erdos zoo. From construction program to construction working drawing, from animal playground to house enrichment, from using function to construction structure, from structure safety to water and electricity equipment,



especially in the aspects of design method and design procedure, this animal show building design and landscape design practice have accumulated precious data for the research of this kind of public buildings, done the necessary paving work for Chinese government to introduce animal show building design standard in the future and opened a new perspective of animal show landscape of zoos in highland boreal regions.

*The article use illustrations:*

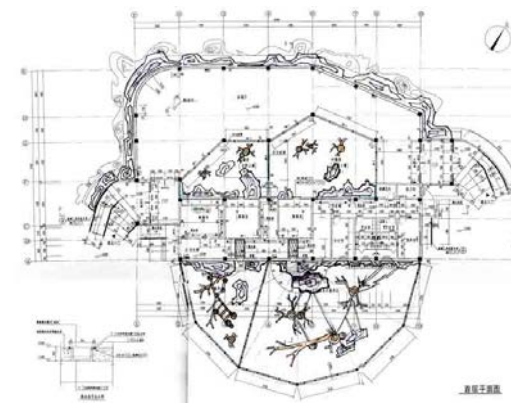
[1] Design drawings and models:



Erdos Zoo general layout

*References:*

- [1] Zhang Enquan, *Zoo Designing*, Beijing: China Building Industry Press, 2011.
- [2] Liu Ran, *Study on the Large-scale Cats Exhibition Design in Zoo*, Beijing: China Agricultural University, master thesis, 2012.
- [3] Zhao Hengqia, *Study on the Exhibition Design for the Primates in Zoo*, Beijing: China Agricultural University, master thesis, 2012.



The gorilla house floor plan

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Monkey hill sketch



Raptor mount model



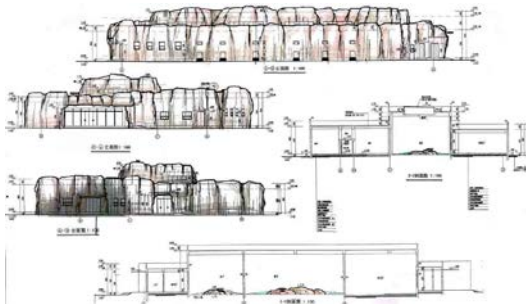
The monkey pavilion model



The Alpine Animal Housing sketch



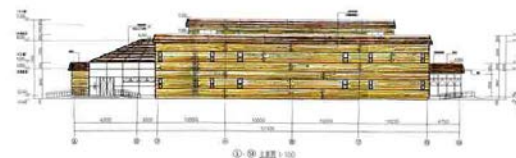
The Bird House rendering



The Bear Pavilion profile

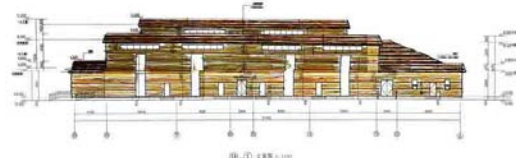


The Wolf landscape rendering



The Kangaroo Pavilion rendering

The Giraffe Pavilion facades



The Kangaroo Pavilion courtyard rendering



[2] Landscapes in Erdos Zoo have been built:



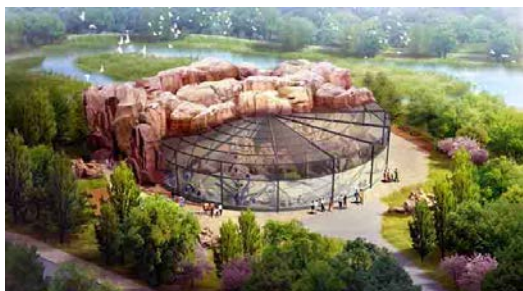
The Spot Hyenas Housing rendering



The Alpine Animal Housing rendering



Elephant - visit hall rendering



The Gorilla House rendering



The Bird House



The Bird House bridge landscape



The Bird House fall





The flamingo outdoor activity space



Monkey museum hall



The Water Birdhouse



The monkey hall



Raptor garden



Chimpanzees show



The monkey field

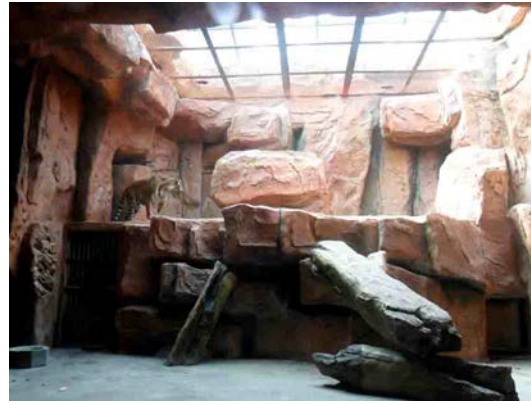


Orangutans activity field





Ring-tailed lemur exhibition hall



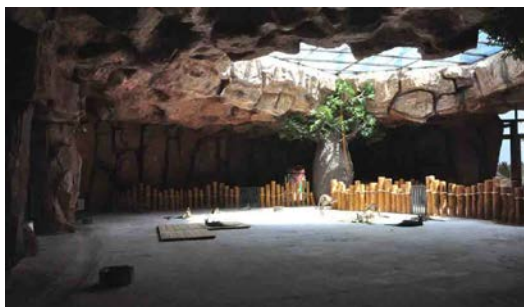
Tiger exhibition hall



The Tiger and The Leopard Pavilion



The black bear activity field



The Tiger Hall Indoor



The bear hall



The Tiger Museum audience hall



The Wolf field



The first floor of The Giraffe Pavilion hall



Alpine Animals Shed



The second floor of The Giraffe Pavilion hall



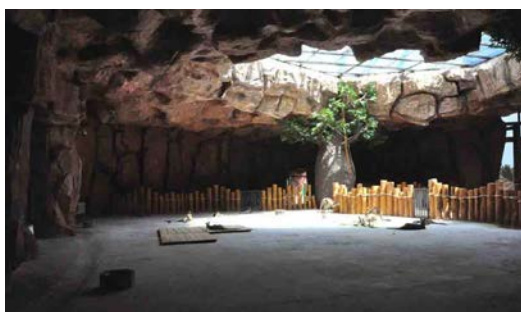
The Small Animals Pavilion



The Kangaroo Pavilion exterior



The Pets Pavilion



The Kangaroo Pavilion indoor