

POLAR BEAR HABITAT

This article explores the transformation of the polar bear habitat at Warsaw Zoo, a case study in integrating animal behaviour, neuroarchitecture, and respect for the site's historical context.

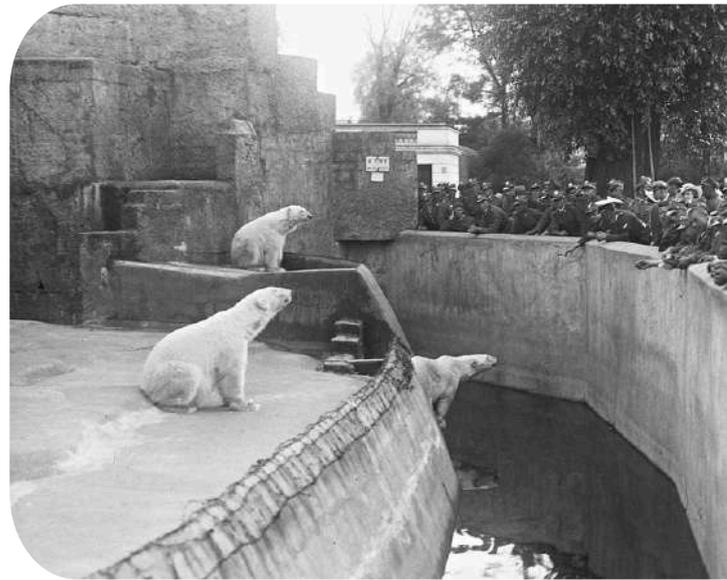


At Warsaw Zoo, a redesign of a polar bear habitat demonstrates how architecture can respond to animal agency. Designed inside a listed historic garden, the project unites animal architecture, neuroscience, and functional workflow to create a space that works for animals, staff, and visitors.

The project was developed within Warsaw Zoo, a place that functions both as an active institution and a protected monument. Established in 1928, the zoo carries a long cultural and historical legacy. During the war, it became a site of human courage and loss, and today it remains under the supervision of the Mazovian Voivodeship Conservator of Monuments.

Designing within a listed site required close coordination and formal meetings with the conservator to balance heritage protection with contemporary animal welfare needs.

Rather than replicating the past, the redesign interprets it through contemporary knowledge. Historical context becomes a framework for responsible decision-making, guiding how space, structure, and behavioural needs are integrated within a protected site.



To maintain continuity with the site's legacy, selected features from the original exhibit were integrated into the new design:

- Fragments of the original perimeter wall, preserved as a gesture to the site's historic boundary
- Three artificial rock formations from the mid-20th-century exhibit, retained in the outdoor landscape
- A section of vintage wall tiling composed of small glazed mosaics
- Reused translucent glass bricks incorporated into the new building's detailing

In addition to preserving selected physical features, the project maintained the character of the original site. The new habitat integrates into the historical context without dominating it. Its forms and materials draw from the surrounding landscape, creating continuity rather than contrast.

History and human experience

- **Our brains respond differently in places that carry visible history.**
- **When materials and forms connect to the past, they help us orient ourselves in time and space.**
- **This sense of continuity supports the parasympathetic nervous system, reducing stress and improving focus.**
- **In neuroscience, this alignment is described as coherence: when what we see, feel, and remember work together.**

Key behavioral principles in polar bear habitat design

COMPLEX TERRAIN

- Continuous walking space
- Changes in level and elevation
- Varied ground textures
- Clear movement routes
- Platforms and overview points

INTEGRATED ENRICHMENT

- Problem-solving opportunities
- Varied food opportunities
- Objects to manipulate
- Foraging pits and rock cavities
- Built-in puzzle feeding
- Space for training behaviours

FUNCTIONAL WATER ZONES

- Depth variation within pools
- Underwater features
- Floating enrichment elements
- Robust filtration systems
- Shallow water area for cubs

SOCIAL FLEXIBILITY

- Possibility to avoid other bears
- Clear escape routes
- Visual separation where needed
- Multiple pathways without dead ends
- Separate dens for each animal





Polar bears are neurologically complex animals with developed problem-solving skills, spatial memory, and emotional capacity.

OUTDOOR HABITAT 5.350 m²

Polar bears are intelligent, sentient animals. In low-performing habitats, their natural needs can turn into frustration, expressed through repetitive pacing, withdrawal, or over-dependence on feeding routines.

Today, we have sufficient scientific knowledge to design architecture that supports both biological and psychological needs. Animals have nervous systems same as ours. Their environment influences how they move, rest, adapt, and cope. In this case study from Warsaw Zoo, the outdoor habitat applies this understanding in built form.

- The semicircular layout of allows rotational zoning. Keepers can shift configurations or isolate individuals when necessary. This flexibility supports social dynamics, medical care, and breeding management.
- Two pools serve distinct functions. A deep pool in the main habitat, measuring 400 m², supports diving, physical stimulation, and visibility from the panoramic viewing window. A smaller and shallower pool, 230 m², designed for mothers and cubs, allows controlled water adaptation during early stages.
- Barriers vary across the habitat. A combination of mesh, solid walls, and glass elements allows air movement and scent exchange while maintaining safety and visibility.
- Two fenced exterior areas are located outside the public zone. These spaces allow safe separation for medical, social, or maternity reasons without removing animals from outdoor access.

By stimulating decision-making, spatial memory, and proprioception, the habitat supports agency and reduces the risk of passive coping behaviours and long-term stress-related complications.

BUILD IN ENRICHMENT

In many zoological projects, enrichment is introduced after construction. Objects are added to the space and depend on staff routines and available time. Even with good intentions, this approach is difficult to sustain.

In this habitat, enrichment was integrated into the structure from the beginning. Sloped paths, a water stream, climbing areas, and sheltering niches create ongoing opportunities for micro-decisions. The environment supports the animal independently, without relying solely on daily intervention. Logs, climbing elements, and feeding points are embedded into the terrain. Enrichment here is infrastructure, not decoration. Play, foraging, and problem-solving occur as part of the landscape. Enrichment operates on three levels:

1. Passive: Changes in temperature, movement of light, and the presence of water.
2. Active: Scent systems, seasonal adjustments, and tools adapted by staff.
3. Animal-activated: Feeders and tactile elements that bears can trigger themselves.

Scattered substrate areas such as sand, bark, gravel, and rock encourage full-body movement and support thermoregulation.

5 FREEDOMS TO

VARIETY

COMPETENCE

CHOICE

CONTROL

COMPLEXITY





Indoor environments influence how polar bears rest, regulate, and respond to daily management.

INDOOR FACILITY 320 m²

In large carnivore habitats, the success of the facility depends on what happens behind the scenes. When indoor areas are poorly organized, daily routines become complex, stressful, and inefficient for both animals and staff.

The indoor facility was designed to support an easy and safe keeper routine. The layout is simple and clear: one linear corridor. Animal dens are located on one side. Auxiliary and technical rooms are located on the other. Security vestibules at both ends provide controlled access and full visibility. There are no blind spots. This organization makes daily work predictable and safer. Transfers, feeding, cleaning, and medical procedures can be carried out efficiently. The facility includes:

- Four insulated dens connected by adjustable gates. This allows separation, gradual introductions, medical management, and breeding control.
- A separate maternity unit with a sound-buffered birthing den and access to a secluded outdoor yard. Acoustic protection supports females during birth and cub rearing.
- A crash cage located between the dens, allowing safe medical procedures, protected contact training, and built-in weighing.
- A walk-in freezer, cleaning area, keeper rest space, offices, and a conference room. All functions are housed within one building.

The building supports routine work instead of complicating it. Clear organization improves safety, efficiency, and working conditions for both keepers and animals.

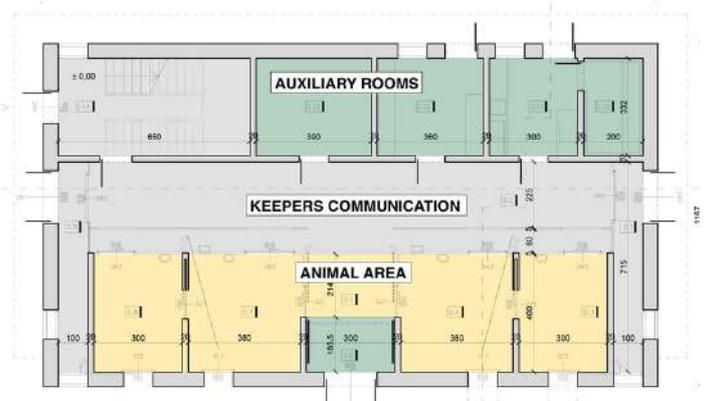
VISITORS

Cities have distanced people from direct contact with nature. Zoological gardens today carry a different responsibility. They are places where people can rebuild sensory and emotional connection to the natural world.

In this project, the visitor experience was shaped through neuroarchitecture principles of coherence, fascination, and hominess. Orientation is intuitive. The path moves naturally around the habitat, supported by gradual elevation changes and clear sightlines. Visitors understand where they are without confusion or visual overload. Observation points allow pause without pressure. Quiet areas support slower movement and contemplation. Glass domes are positioned so animals may approach if they choose. Underwater viewing at the deepest part of the pool makes diving behaviour visible from comfortable shaded seating area. The design emphasizes:

- Animal choice in encounters
- Learning through direct experience
- Spatial organization that supports nervous system regulation
- Reconnection to nature within the urban context

When spatial organization is coherent and the nervous system is not overstimulated, the experience improves. Attention becomes deeper, and connection becomes possible.





technical entrance

indoor facility

maternity facility

historical elements

technical entrance

technical road

maternity out door

out door off show

rest room

technical entrance

training area

vegetation buffer

resting area

feeding dispenser

feeding pole

connection open/close

different type of substrate

cave

different type of substrate

feeding dispenser

cave

cave

deep pool

observation point

resting area

feeding pole

cave

feeding pole

vegetation buffer

observation point

cub pool

observation point

observation point

resting area

Visitor path

Basen WdR (wg osobnego opracowania)

Basen WdR - 83.5

Basen WdR - 83.5

Wybieg mały: 2532,7 m²

Wybieg główny: 2811 m²