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Jan Aragall has specialised professional training in graphic design, technical construction, veterinary assistance,animal care, ergonomics-related outdoor practices, animal welfare, wildlife rehabilitation, ethology applied to conservation, and rewilding. His work is situated at the intersection of design research, ergonomics, and animal welfare science, with a focus on the spatial and systemic design of environments shared by human and non-human animals.

He has worked within wildlife rehabilitation centres, animal sanctuaries, and zoological institutions, contributing to the design, prototyping, and iterative adaptation of animal facilities, environmental enrichment systems, and care-related infrastructures. His practice also includes participation in rewilding and accessibility-focused projects, integrating inclusive design principles, practice-based research methodologies, and veterinary-informed welfare assessment. Jan Aragall is a founding member of the Design for All International Association.

Ergozoonomics: Designing with all Life in Mind.

Jan Aragall García de Sola

Abstract

The design of environments, products and systems has made significant progress in adapting to human diversity. However, these advances have been developed mainly from an anthropocentric perspective, leaving in the background other species that constantly share our spaces and routines. Ergozoonomics emerges as an integrative approach that combines principles of ergonomics, zoology, design, ecology, well-being and ethics, with the aim of creating solutions that take into account all living beings. Based on personal and professional experience in wildlife rescue, rehabilitation and management centres, this article draws on practice-based insight. It explores how the application of Ergozoonomics can overcome the limitations of designs that are either overly general or, conversely, too specific. Through the analysis of variables such as locomotion, sensory perception, social structure and daily routines, various case studies are presented that illustrate the adaptation of spaces to individual needs, rehabilitation processes, emotional well-being, management of heterogeneous groups and changes associated with aging. Finally, Ergozoonomics is proposed as an operational framework that can be transferred to other contexts of human-animal coexistence, including homes, urban environments, and rural areas. We defend the design of shared living systems as a technical and ethical responsibility.

Introduction

When we think about design, whether for products, services, spaces or learning systems, we have made great strides in adapting environments to different ways of living and experiencing the world. We have become particularly good at analysing human needs, largely thanks to specification. In-depth knowledge of a specific field allows us to dissect our needs with greater precision and offer optimised solutions for every little detail.

However, the very success of this process has brought us to a point where many of these fundamental needs are now being met, albeit with varying degrees of effectiveness. As a result, attention can shift toward issues that are less narrowly defined and that call for more general, integrative solutions.

Fig.1 Ergozoonomics knowledge areas

These contemporary problems tend to lie between fields of study that have traditionally operated in isolation, and addressing them requires working within these intermediate spaces, where knowledge does not belong to any single discipline. One such integration is proposed by Ergozoonimics; an approach that brings together ergonomics, design, animal biology, ecology, well-being and ethics to create solutions that benefit both living beings and the planet.Although related ideas have emerged in fields such as animal welfare science, ergonomic design, ecology, and ethics, these contributions have remained fragmented and discipline-specific. To date, no integrated framework has explicitly addressed the design of environments, products, and systems that take into account all species within a shared environment through a combined analysis of the ergonomics and biology of human and non-human animals. Ergozoonomics is presented here as a novel, practice-based field that systematizes this intersection, providing a conceptual and operational framework for interspecies design. Rather than expanding on existing human- or animal-centered models, it reframes design as a multispecies process based on coexistence, well-being, and ethical responsibility.

At its core, Ergozoonomics asks a simple but far-reaching question: ***What changes can be made so that a design includes all those who inhabit it? This question challenges anthropocentric assumptions, reframing design as an act that shapes relationships, behaviours, and opportunities across species.***

Where does ergozoonomy come from?

The term "ergozoonomy" comes from the combination of ergonomics, the science that studies how humans interact with their

environment, and zoology, the science that studies animals. The concept began to take shape with the design of facilities for animals in captivity. In this field, two opposing approaches are common. On the one hand, there are facilities designed in a highly functional and generalist manner, intended to facilitate human management and adapt to as many species as possible. These solutions, although practical, tend to be unstimulating and do not allow for the full expression of each species' natural behaviours. On the other hand, there are extremely specific facilities, designed almost exclusively with a particular species or even a typical individual in mind.

Although these could meet certain needs very well, they are difficult to adapt to other species, rare individual characteristics, veterinary procedures or routine cleaning tasks. Both extremes generate different but equally relevant problems. This led us to consider an alternative that did not prioritise a single point of view but rather integrated several. Designing from the individual and routine needs and expectations.

To address these limitations, we began to study the physical, cognitive, social and environmental characteristics of animals, both in the wild and in captivity, with the aim of ensuring adequate physical, social and cognitive development. This type of analysis was not too different from that carried out in highly specialised facilities.

The difference emerges when we systematically incorporate the study of human routines associated with these facilities. We can analyse daily and periodic tasks from an ergonomic point of view, taking into account the physical and cognitive abilities of the people responsible, the environmental conditions of the available space, and physical and biological safety aspects.

Once these two dimensions, animal and human, have been addressed, the next step is to bring them together using welfare and ethics as cross-cutting parameters (Morgan & Tromborg, 2007).

Key variables in ergonomic design

A common exercise within this approach is to compare species with very different characteristics. For example, let us imagine three animals: a king penguin, a scarlet macaw and an orangutan. The differences between them are obvious, especially in terms of locomotion. Penguins move by walking, swimming or sliding on their bellies; macaws combine standing, flying and climbing using their legs and beaks; orangutans use quadrupedal locomotion and brachiation, meaning swinging between branches.

Locomotion	Bipedal terrestrial, swim, slide	Fly, bipedal terrestrial, climb	Climb, brachiation, quadrupedal terrestrial, bipedal terrestrial
Activity	Day and night, low-active	Crepuscular, active	Day, mid-active
Senses	Vision, hearing, touch	Vision, hearing	Vision, touch
Feeding	Hunt, fish, seafood	Nuts, fruit, leaves, berries, seeds, invertebrates, clay	Leaves, fruit, vegetables, seeds, invertebrates, small vertebrates, flowers, bark
Social	High social, big groups	High social, couples, small families, big groups	Low social, solitary
Housing	ground nest, water	Static nests	Daily nest
Human interact	Fear, avoidance	Fear, aggression	Non-aggression, avoidance, interactive
Security	Non-dangerous	Neutral	Dangerous
Cleaning	Cleaning substrates, cleaning pool, cleaning windows	Cleaning substrates, cleaning nesting area	Cleaning substrates, cleaning nesting area
Feeding strategy	Scatter fish making sure everyone eats	Scatter or hang food items	Scatter or hang food items
Training	In group or solitary	In group or solitary	In group or solitary
Safety	Danger of tripping, slipping, temperature shock	Danger of tripping, slipping, fall from great heights, attacks	Danger of tripping, slipping, fall from great heights, attacks
Veterinary	Catch, isolation, quarantine	Catch, isolation, quarantine	Sedation, isolation, quarantine
Maintenance	Windows, pool, doors, ventilation, cooling system	Perch, nests structures, mesh, enclosure structure, doors	Structures, fences, electric fences, doors, heating system, ventilation, water systems

Fig 2: Simplified comparison table of needs for king penguins, red macaw and Bornean orangutans. Photo of the king penguins by Godot13, Photo of the red macaw by Quartl and photo of the orangutan by Thomas Quine.

The design of both horizontal and vertical plans must be adequate to allow for all of these (Alexander, 2003). Locomotion, diet, social group and sleeping arrangements are among the most obvious aspects to consider when designing a facility. Beyond these are aspects that are harder to identify, either because we cannot perceive them directly or because we are not present at all times. These include how animals receive and process sensory stimuli, and the activity patterns they follow when no workers are around.

An analogy to understand complexity

To illustrate this difference between obvious needs and more subtle needs, I often use an analogy with the design of a human dwelling. In an empty flat, as a general rule, we know that there must be at least one bed, a kitchen and a bathroom with a shower, sink and toilet.

These are the obvious needs. Then come the more complex ones, such as which room is best to put the bed in so that the sound from the building's hallway does not wake you up, if possible. It is fine to be able to cook, but it is also nice to have a place to sit down and eat. It is also interesting to have a curtain in the shower so you don't splash around, and probably on the toilet, when you shower.

Similarly, when designing animal facilities, meeting basic needs is only the first step. Well-being emerges when attention is paid to those details that are not always obvious at first glance (Brumm, 2013).

From general analysis to the individual

Once basic questions such as how the animal moves within its environment, how it eats and drinks, where it sleeps, how it experiences the world, how it relates to others, and when and how it carries out its daily routines have been addressed, it becomes possible to move on to a deeper level of analysis focused on the individual.

Just as ergonomics studies the full range of human capabilities, Ergozoonomics seeks to do the same with other animal species, understanding that there are individual differences directly influencing well-being.

Case studies

Adaptation to individual needs

One of the first cases I encountered was that of a parrot with a physical disability caused by an old injury that prevented it from flying. Initially, the enclosure was adapted to ensure its access to basic resources by means of structures that allowed it to climb up to feeders, resting areas and its nest. Continued observation revealed that these adaptations were not enough.

Fig 3: Representation of the enclosure for disabled parrots before.

The animal remained highly motivated to fly, which resulted in it jumping into the void at the risk of injury. This behaviour was not due to a lack of learning, but to unmet psychological and social needs (Buchanan-Smith, 2011).

Based on this analysis, the enclosure mesh was reinforced to make it a functional surface for locomotion, the wooden walls were covered with additional mesh, and tensioned ropes were incorporated in such a way that they did not interfere with the flight paths of other individuals. These modifications significantly increased the animal's autonomy and improved its interaction with the environment and with the group (Spruijt et al., 2001).

Fig 4: Representation of the enclosure for disabled parrots after.

Functional rehabilitation

Another recurring theme in my career has been working with animals rescued from illegal pet ownership. In this context, I participated in the design of furniture for caracals rescued after being kept as pets in unsuitable domestic environments. These animals often arrive with physical and behavioural disorders

resulting from restricted movement, lack of stimulation and the inability to express behaviours typical of their species. The aim was to create structures that would allow them to gradually recover physical abilities such as walking, running, jumping, climbing and maintaining balance, while respecting individual limitations. In this case, I chose to equip the facility with several levels of difficulty, which allowed the use of the space to be adapted to each individual's pace and created a greater variety of hiding places, which are essential for animals experiencing high levels of fear (Young, 2003).

Emotional wellbeing

I have also worked with animals whose past history had profoundly altered their behaviours, not doing the things we would expect from a fox. A representative case was that of a fox who, after years of domestic captivity, had developed an excessive dependence to human interaction. To address this situation, a structured environmental enrichment plan was designed.

Environmental enrichment is the practice of improving an environment to stimulate natural behaviours, such as hunting, exploring or digging. It improves physical and mental well-being. Some examples of this include: adding new objects to the enclosure such as logs, rocks, and natural vegetation; preparing areas where they can create burrows or, if that is not possible, providing spaces similar to burrows human-made; varied terrain; scents; hidden food or changing the presentation of food, such as giving bones, cutting food into smaller pieces and putting it in packages, and freezing food in summer.

Thanks to this plan, there was a significant increase in natural behaviours such as active foraging, digging, using their sense of smell and playing, gradually reducing their dependence on human interaction, and increasing their natural behaviours.

Heterogeneous groups

Working with large social groups poses additional challenges. In these contexts, the design must avoid both under-stimulating younger or more capable individuals and excluding those with greater limitations.

One example was working with a group of capuchin monkeys of different ages and abilities. For this case, I designed an adaptable enrichment item that could be edited to generate up to nine different variants, integrating nutritional, sensory, cognitive, and physical stimulation. This type of design promotes more balanced participation and reduces the occurrence of undesirable behaviours (Meehan & Mench, 2007).

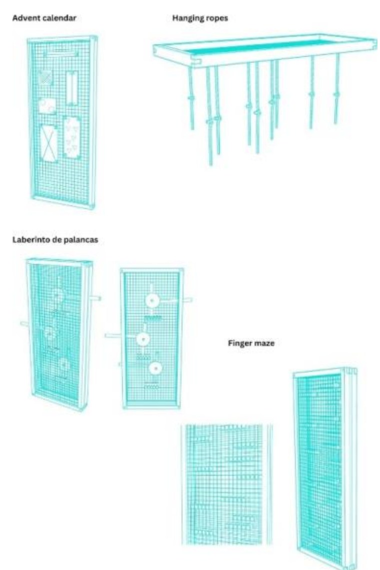

Fig 5: Enrichment for a group of capuchin monkeys

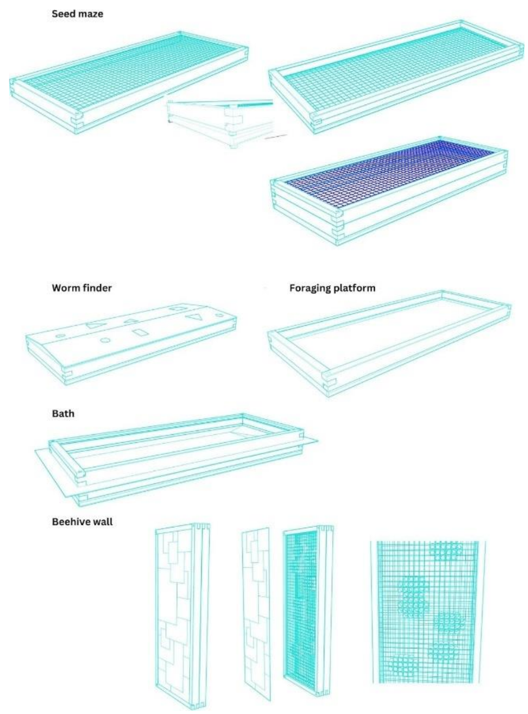

Fig 6: Enrichment for a group of capuchin monkeys

Adaptations over time

Finally, one of the cases that best reflects the importance of continuous assessment is aging and changes over time. I encountered a lion that began to show changes associated with age. In the wild, lions live for around 12 years, but in captivity they can live up to 25. That is why care in the geriatric stage, which is significantly longer, becomes key to ensuring their well-being over time.

Based on an assessment of these new needs, modifications were made to the facility, such as the addition of intermediate platforms to reduce the need for jumping. Other options can be considered depending on the condition of the animal and the species, for example, continuing with terrestrial animals, some examples that

can be considered, are: ramps to facilitate movement and more comfortable resting areas.

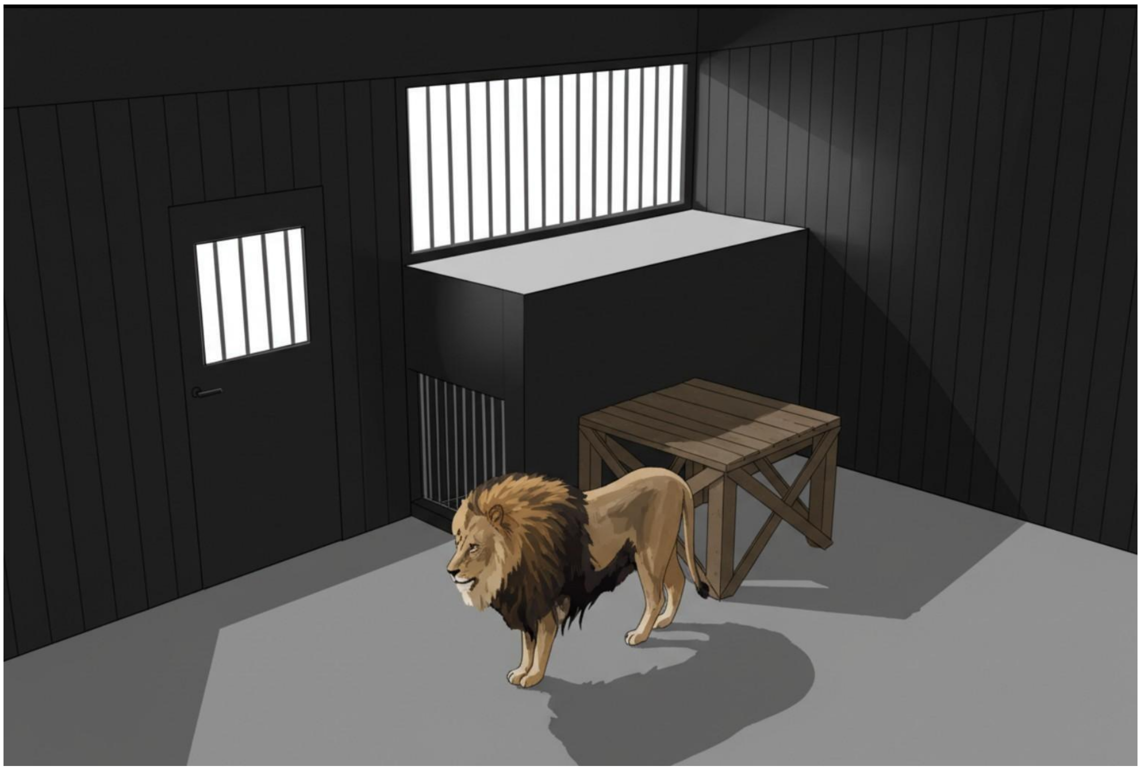

Fig 7: Representation of adaptation of a platform for a geriatric lion.

These adaptations allow the animal's functionality and comfort to be maintained, demonstrating that the design of the environment must evolve in parallel with the physiological changes associated with age (Whitham & Wielebnowski, 2013).

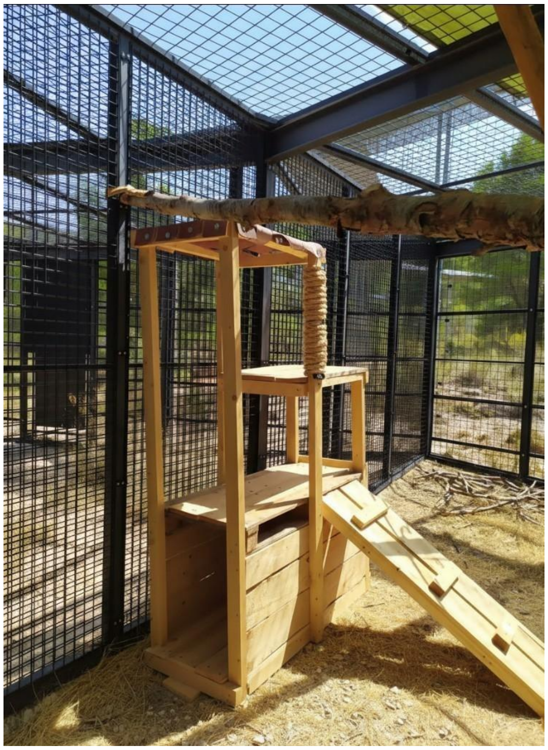

Fig 8: Adaptation for reduced mobility using a ramp.

Fig 9: Adaptation for reduced mobility using wide ramp-shaped walkways.

Beyond captivity

The presented cases are not to be understood as isolated situations. Principles of Ergozoonomy transcend specialised centres and can be applied wherever humans and other animals share space and routines.

For instance, millions of people around the world share their lives with companion animals such as dogs, cats, rabbits, birds, and small mammals. Yet within the field of companion animals, environmental design remains largely anthropocentric: homes designed exclusively for humans are only superficially adapted to animals, typically though the addition of isolated accessories such as beds, scratching posts, cages, or toys. This approach does not question the basic

structure of the space and how it conditions the animal's behaviour, mobility, cognitive stimulation or autonomy.

Ergozoonomics proposes going one step further, analysing the home as a shared ecosystem, in which every design decision affects both the people and the other animals living in it.

Applying ergozoonomic principles to these contexts means asking questions similar to those presented before, yet adapted to domestic realities. For instance, how does the animal move around the home, what limitations does the space present, what needed stimuli does the animal get and which ones lack, how are their daily routines organised in relation to humans', or which conflicts arise between the needs of both parties. These questions can lead to integrated solutions, such as the creation of three-dimensional pathways for cats that do not interfere with human use of space, rest areas for dogs strategically located to promote calm, or modular spaces that allow small mammals to explore, hide and choose when to interact (Ellis et al., 2013).

Fig 10: Human livingroom, Anthropogenic livingroom and Ergozoonomic livingroom.

Shared urban environments: coexisting in the city

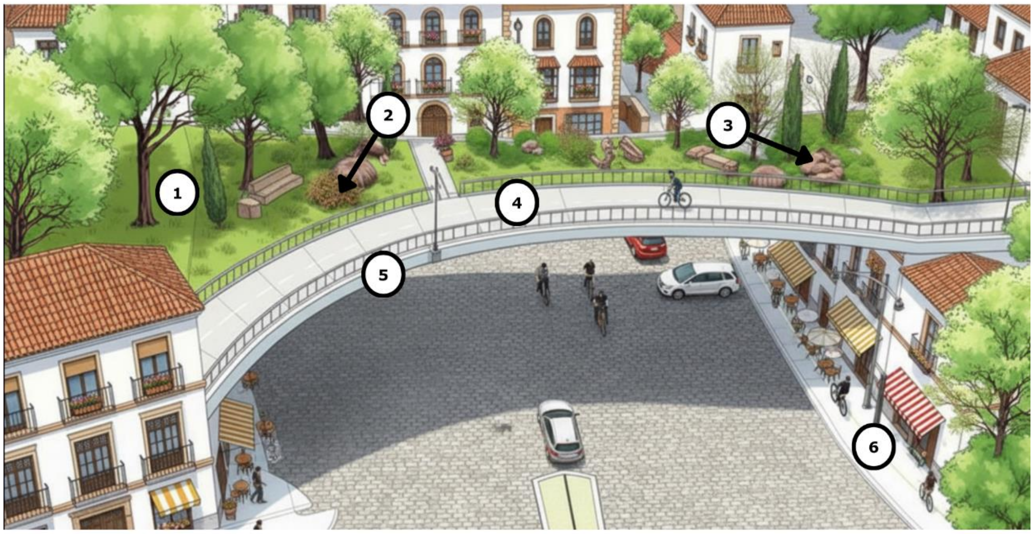

Fig 11: Ergozoonomic City: 1. Grass & green corridors connect the city's green areas, increasing shade and reducing heat buildup. 2. Plants prioritize native species and biodiversity over ornamental flowers, strengthening local ecosystems. 3. Rocks provide natural hiding spots and micro-habitats for urban wildlife. 4. Cycle lanes & pedestrian paths ensure safe, comfortable movement for people through the city. 5. Bridges & walking zones are designed to minimize street crossings, reducing risk and improving accessibility. 6. Pavements are made with materials that absorb less heat, helping cool the urban environment.

This same desire to create shared environments can be extrapolated to the design of urban spaces. Cities, traditionally conceived for human transit and activity, are also habitats for a wide variety of domestic and wild species. Birds, insects, small mammals, reptiles and plants coexist daily with people and pets, often in suboptimal or downright hostile conditions.

From an ergozoonomic perspective, urban design can be transformed to promote conscious and beneficial coexistence. Parks, squares and green areas can be conceived as multifunctional spaces that take into account patterns of human use, but also the needs of

other species for shelter, food and movement. Elements such as green corridors, vegetation cover, water sources accessible to urban wildlife, and street furniture that minimises risks to animals contribute to creating more resilient and vibrant cities (Rosenzweig, 2003; Hilty et al., 2019).

The presence of domestic animals in the city also poses specific challenges. Dog parks, safe walking routes, materials that reduce impact on joints or overheating, and adequate rest areas are design decisions that directly influence animal health and social coexistence. At the same time, these measures benefit people by reducing conflicts, improving the quality of public space, and fostering more respectful relationships with the environment.

Integrating wildlife into urban design does not imply naive idealisation, but rather informed planning. Understanding which species inhabit or can inhabit an area, how they move and what resources they need might prevent conflicts and encourage positive indirect interactions. In this way, the city ceases to be an exclusive environment and becomes a space for interspecific coexistence.

Rural and natural areas: designing with and for the communities

In rural and natural environments, applying these principles requires particular sensitivity. These areas are often home to human communities that depend directly on the land, as well as home of complex ecosystems with their own dynamics. In this context, Ergozoonomics can act as a tool to support peaceful coexistence between human activities, domestic animals and wildlife.

Measures such as the design of livestock infrastructure compatible with local fauna, non-invasive livestock protection systems, or land use planning that takes ecological corridors into account can reduce conflicts without compromising the economy or cultural identity of communities (Burkholder et al., 2018). At the same time, respect for local knowledge and the active participation of the people who inhabit these territories are essential for any intervention to be sustainable and ethical.

In protected natural areas, Ergozoonomics can contribute to the design of trails, viewpoints, or facilities for human use that minimise environmental impact and stress on wildlife, without compromising visitor education and experience. Once again, it is a matter of seeking balance, understanding that effective conservation involves integrating people as part of the system, not as external agents.

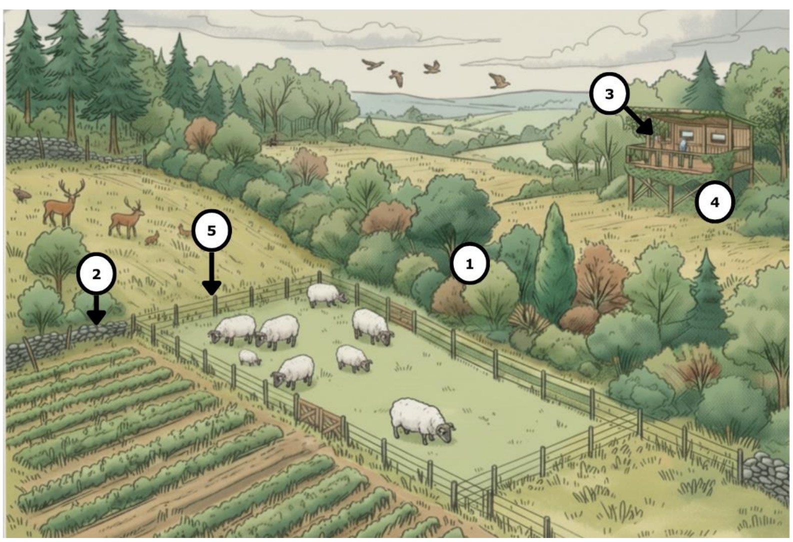

Fig 12: Ergozoonomic Rural Area: 1. Biological corridors connect natural areas while allowing human use without disrupting ecological flows. 2. Fences are strategically placed and permeable, guiding movement without blocking wildlife. 3. Tourism activities respect local culture and ecosystems, working in harmony with the environment. 4. Construction follows low-impact principles, minimizing land disturbance and resource use. 5. Animal separation maintains clear boundaries between domestic and wild species, protecting both ecosystems and livelihoods.

Conclusion

Ergozoonomy proposes a fundamental shift in how we understand design, away from solutions conceived for a single species, and toward environments understood as shared living systems. Rather than asking how spaces can be adapted *for* animals, it invites us to consider how they are experienced *with* them, by humans and non-human animals alike.

Throughout this article, we have seen how traditional design approaches tend to oscillate between two extremes. Highly generalised solutions prioritise efficiency and manageability, yet often fail to provide meaningful stimulation or autonomy. At the opposite end, highly specific designs may respond well to certain needs but lack the flexibility required to accommodate individual differences, changing routines, or long-term adaptation. Ergozoonomics emerges as a response to this, offering a framework that integrates ergonomics, design, animal biology, ecology, well-being, and ethics to produce environments that are both functional and responsive.

Central to this approach is the recognition that well-being does not arise solely from meeting basic needs. It is shaped by subtle factors like locomotion, how sensory information is received, how social interactions unfold in different animals, and how routines change over time. Designing for animals, much like designing for humans, therefore requires attention not only to species-level characteristics but also to individual differences, life histories, disabilities, and aging. The case studies presented, from rehabilitation enclosures to domestic interiors, illustrate how design must remain open-ended, capable of evolving alongside those who inhabit it.

Importantly, the relevance of Ergozoonomics extends far beyond captive or specialised settings. Homes, cities, rural landscapes, and protected natural areas are all spaces where multiple species coexist yet are shaped daily by human decisions. Whether through the configuration of a living room, the layout of an urban park, or the planning of agricultural infrastructure, design choices influence movement, behaviour, conflict, and opportunity for a wide range of species. Viewing these environments as shared ecosystems allows more integrated, resilient, and equitable solutions to emerge.

Ultimately, Ergozoonomics is not merely a technical issue, but an ethical one. To design is to intervene in the lives of others, often invisibly. Accepting this responsibility means recognising that well-being is not a limited resource to be distributed competitively, but a collective outcome that grows when systems are designed holistically. By embracing coexistence as a design objective, Ergozoonomics offers a path toward environments in which humans and other animals do not simply tolerate one another, but thrive together through mutual adaptation, respect, and care, thus creating richer, fairer, and more functional environments for all.

References

Alexander, R. McN. (2003). Principles of animal locomotion. Princeton University Press.

Brumm, H. (2013). Animal communication and environmental noise. Springer.

Buchanan-Smith, H. M. (2011). Agency and control: The psychological well-being of captive animals. Applied Animal Behaviour Science, 135(1–2), 1–9.

Burkholder, B. O., et al. (2018). The effect of fencing on wildlife.

Wildlife Society Bulletin, 42(1), 50–58.

Ellis, S. L., et al. (2013). AAFP and ISFM feline environmental needs guidelines. Journal of Feline Medicine and Surgery, 15(3), 219–230.

Hilty, J. A., et al. (2019). Corridor ecology: Linking landscapes for biodiversity conservation and climate adaptation. Island Press.

Meehan, C. L., & Mench, J. A. (2007). The challenge of challenge: Can we provide optimal levels of stimulation for animals? Animal Welfare, 16(S), 75–80.

Morgan, K. N., & Tromborg, C. T. (2007). Sources of stress in captivity. Applied Animal Behaviour Science, 102(3–4), 262–302.

Rosenzweig, M. L. (2003). Win-win ecology: How the Earth’s species can survive in the midst of human enterprise. Oxford University Press.

Spruijt, B. M., et al. (2001). Humour, anticipation and the feeling of well-being: The role of the animal's choice. Physiology & Behavior, 73(1–2), 85–94.

Whitham, J. C., & Wielebnowski, N. (2013). Animal welfare monitoring: Bridging the gap between applied and basic research. Zoo Biology, 32(5), 443–452.

Young, R. J. (2003). Environmental enrichment for captive animals. Blackwell Publishing.

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