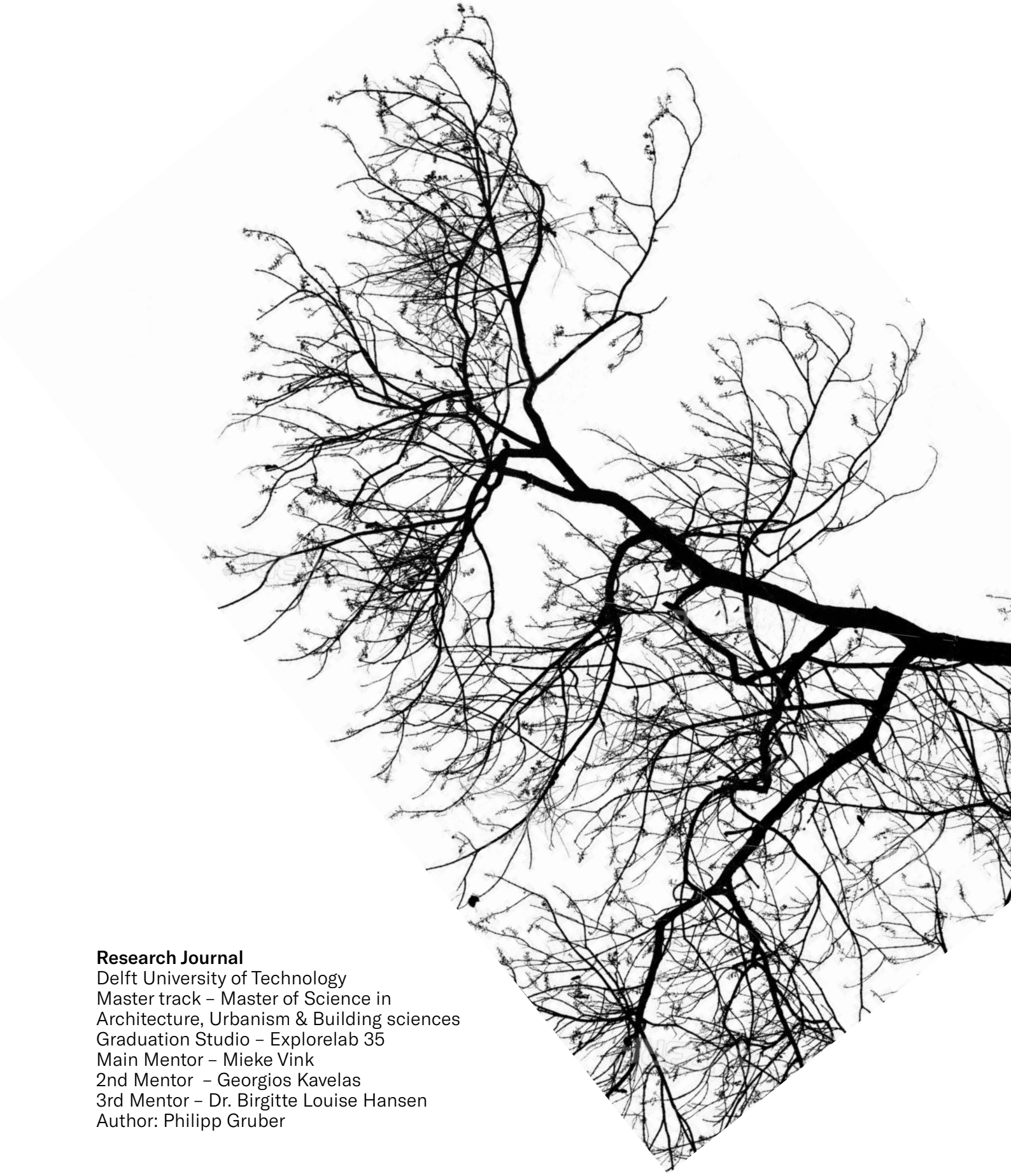
GROWING RESIDENCY

Towards a multi-species design practice in architecture based on affordances



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ABSTRACT

The thesis explores to what extent a multi-species design practice in architecture based on affordances informed by the act of human and non-human space-making help to achieve a symbiotic relation between architecture and biodiversity. For this purpose, a theoretical framework triangulating affordances, multi-species design and architecture was developed. This was done throughout different exploratory methods such as reviewing literature, as well as observing and sensing the abandoned ruin “Palácio Ford” in Porto, Portugal. First, affordances are opportunities for action to humans, animals and plants provided by an environment. In this context, it was investigated if the concept of affordances reveals to be a relevant system to read a multi-species environment such as the ruin. In the course of both a theoretical and practical research, several affordances were identified. It was concluded that the ruin is a relational landscape rich in multi-species affordances. It facilitates various types of human and non-human actions in response to existing or evolving affordances. Therefore, ruins can be regarded as valuable urban ecological assets that enhance the vitality, biodiversity, and affordances of the urban environment. Second, different methods were investigated to analyse existing affordances and to design new ones. For this, different nature-inclusive design guides and the Zöop-Methods brought helpful tools and information. Lastly, it was analysed how designers can stimulate symbiotic relations between architecture and biodiversity, which requires questioning the architectural object and the role of the architect. In a multi-species design practice in architecture based on affordances, the architectural object must be seen as a dynamic socio-ecological object with both physical and non-physical structures. Designers are asked to propose the envelope of the object as a profound relational space shared in cohabitation between humans, animals and plants. In this threshold between outside and inside, dynamic exchanges between the environment, the object and its multi-species users can be designed with the affordance to support the life of all beings.

Keywords Cohabitation, biodiversity, ruin, affordances, multi-species design practice, architecture

CONTENTS

PROLOGUE: Personal Interest

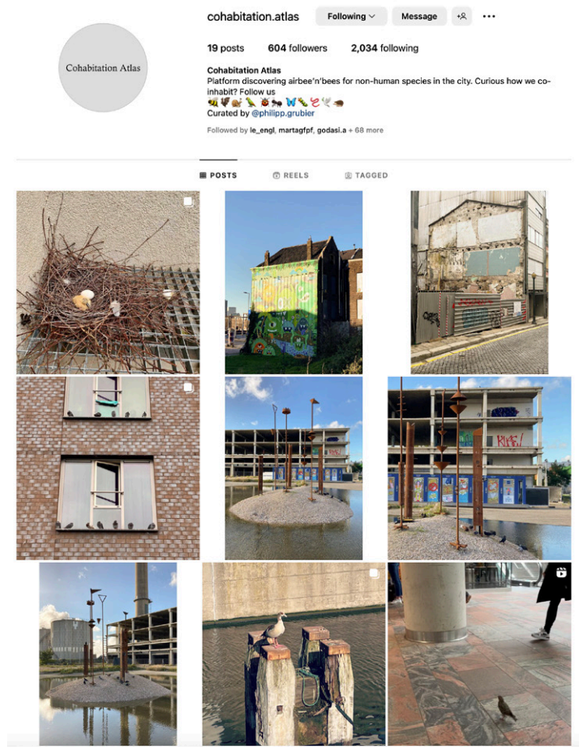
My personal interest in an architectural design practice for multi-species users increased when I was designing and building a hotel for biodiversity for Dakdorpen on the roof of DeKroon in Rotterdam by the beginning of 2022.

My personal interest in architectural design practices for multi-species users grew when I was involved in the design and construction of a biodiversity hotel for Dakdorpen on the rooftop of DeKroon in Rotterdam in early 2022. Since then, I have been extensively studying the city as a habitat populated by diverse life forms, exploring the possibilities of multi-species encounters, as well as the conflicts that arise among different beings.

Each species, whether human, animal, or plant, appears to live according to its own unique needs, interests, and life cycles. However, architecture often presents thresholds where species can either benefit or suffer. It is precisely these situations that have captured my attention, leading me to start an Instagram account called *Cohabitation-Atlas*, where I document and blog about my observations. In parallel with these activities, I have constructed several multi-species objects as real-time experiments within the urban environment.

These initiatives aim to actively support biodiversity and explore a potential flourishing coexistence between humans and non-human entities in the city. Through these actions, I have become aware of the potential that multi-species design holds for ecological architecture.

Within this thesis, I try to demonstrate how I as an architect from the human domain can understand complex existing multi-species situations and how they vice versa can teach me how to design for multi-species spaces and cohabitation. My objective is to investigate how architecture can stimulate a mutually benefiting relationship between mankind and the wildlife species interacting with the built environment.



1. “AirBees` n` Birds”, Hotel for biodiversity @Dakdorpen, Rotterdam (own work)
3. Instagram Blog “Cohabitation-Atlas” (own work)
2. “Wohnhülle”, Installation for birds @ Palácio Ford, Porto (own work)

1.0 INTRODUCTION

The city is a dynamic and diverse habitat both for people, plants and animals. However, the interaction between these different species is complex and is inherently intertwined with power relations. As humans, we often drive other creatures out from their natural habitats and compel them to adapt to our built environment. Consequently, our man-made cities become habitats for all beings, with façades, roofs, parks, cemeteries, backyards, vacant buildings, and ruins transforming into biotopes. Typically, we humans tend to allocate controlled and limited spaces for animals and plants, whether it is for their own benefit, our food supply, or for amusement.

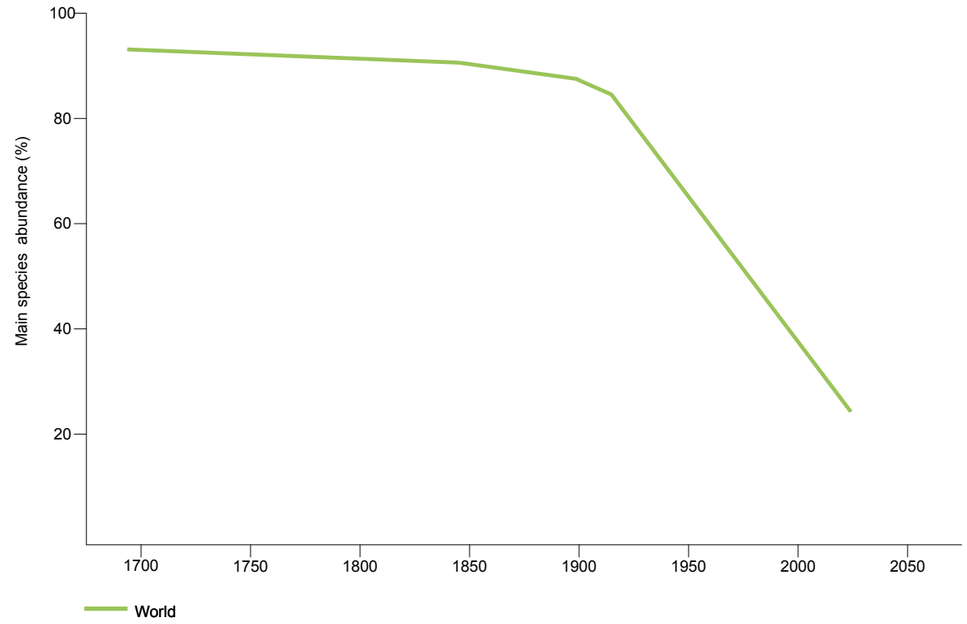
However, when considering abandoned ruins as vacant structures within the city, one can observe that through human abandonment, these spaces become unregulated by human intervention. Consequently, plants and animals are free to establish their own interspecies microcosms.

Ruins, therefore, serve as compelling examples of how nature reclaims spaces from human influence. Nevertheless, as we plan to reintroduce human activity to such places due to the rapid expansion of our cities, the question arises of what kind of architectural design practice is needed to acknowledge the presence, life forms and needs of multi-species inhabitants. Simultaneously, it is evident that our built environment has a serious impact on the alteration of the climate and the loss of biodiversity.

In the search for ecological solutions to the challenges of our time, an attentive and sensitive architectural approach to existing other forms of life in our cities is asked. Such an approach may enable the establishment of symbiotic relations between architecture and nature, ultimately fostering cohabitation between humans and non-human entities.

Ruin Palácio Ford, Porto (own work)

Ruin Palácio Ford, Porto (own work)



Global main species abundance (Stiphout van, M., 2019, p.20)

ACADEMIC CONTEXT

According to Benjamin Baldenius-Förster, Professor for *Cohabitation* at Städelschule Frankfurt, in his talk *"Cohabitation Translation Pilikia"*, Cohabitation means that we humans share a space with other life forms. This requires us humans to rethink our relation with other species. For architects, this entails reconsidering their position and role, which requires thinking in a multi-species design practice. To achieve this, new approaches to reading and understanding the environment are necessary, enabling designers to consider the needs of other species and to mitigate conflicts among them.

Förster-Baldenius advocates for alternative approaches of spatial negotiation and communication with other species in our cities, aiming for a symbiotic relation between building and nature, or humans and non-humans. Design parameters for other species in architecture should be informed by existing knowledge, actions, observations, and interpretations of their behaviours, interests, and needs. Baldenius refers to this approach as "improvisation as a form of retroactive sense-making" in architecture, which requires architects to work on the basis of a given system related to space, materials, time and socio-cultural behaviour (Förster-Baldenius, 2022).

This thesis investigates to what extent the notion of affordances can represent a potential system for multi-species design in architecture facilitating symbiotic relations between architecture and biodiversity. This exploration is significant because the notion of affordances allows for an understanding of the urban fabric from a phenomenological and socio-cultural multi-species perspective, shifting the discourse from a purely technical and object-oriented perception of architecture to a social and action-oriented one.

The concept of affordances to living bodies is solely explained as theoretical notion about the relation between the environment and its actors in the paper titled "A Rich Landscape of Affordances", written by the authors Rietveld and Kiverstein: "Affordances (Gibson, 1979/1986) are possibilities for action provided to an animal by the environment— by the substances, surfaces, objects, and other living creatures that surround it" (Kiverstein & Rietveld, 2014, p.325).

In this investigation, the concept of affordances is particularly used to bridge the academic gap between multi-species design and architecture, aiming to explore a potential multi-species design practice in architecture based on affordances.

Kuhnert, N., & Ngo, A. (Eds.). (2022). ARCH+ Zeitschrift für Architektur und Urbanismus, Heft #247: Cohabitation.

RESEARCH QUESTION

How can a multi-species design practice in architecture based on affordances informed by the act of human and non-human space-making in abandoned ruins help to achieve a symbiotic relation between architecture and biodiversity?

1. What is the relation between architecture as spatial facilitator and biodiversity as spatial users in the urban environment?

2. Is the concept of affordances a relevant system to read a multi-species environment such as the ruin?

3. How can architects be informed to design affordances in a multi-species design practice?

4. How can designers stimulate symbiotic relations between architecture and biodiversity, and between multi-species users?

METHODS AND OUTLINE

According to Prof. Förster-Baldenius, architects designing for multi-species contexts must make design decisions based on existing knowledge, real-world experiences, a nuanced understanding of the surrounding reality, and the ability to observe and interpret the signals of other beings. Hence, the methodology of this work is a combination of different exploratory methods.

Firstly, as the primary research method for acquiring existing knowledge, a literature review was conducted. This process led to establish a theoretical framework triangulating architecture, multi-species design and affordances. Additionally, as Förster-Baldenius emphasizes the limitations of relying solely on theory, the research is also based on an ontological and phenomenological approach to grasp the human and non-human realities of both ruins and urban spaces through observation and sensory perception. In her lecture on the research plan in September 2022, Prof. Klaske Havik explains the relationship between methodology, ontology, and phenomenology. Ontology involves making sense of what exists by examining the nature of reality, while phenomenology focuses on the quality of sensory perception and experience within specific realms (Havik, 2022). In the case of this thesis, this approach is relevant for investigating and understanding the affordances present in different multi-species environments. During this process, the industrial ruin “Palácio Ford” and its surrounding urban spaces in Porto, Portugal, were observed to interpret the actions and behaviours of other species facilitated by the local affordances embedded in the landscape. The findings of this field trip were documented through photographs and translated into drawings.

An insightful tool for reflecting on the research outcomes is the exploration of the advantages of imaginative and creative thinking as an artistic research method. For instance, observations and perspectives were translated into poems. These poems introduce a first-person element to the work, allowing for nuanced additions that are challenging to incorporate in academic writing, such as the perspectives of wildlife in the city or the relationships between different species. Thus, this approach enlarges the picture and simultaneously highlights the human and non-human relation from a subject position. Furthermore, this reflective method facilitates the development of new narratives that make the research outcomes more accessible.

The thesis will begin by analysing the relationship between architecture and biodiversity. Thereby, existing approaches in architectural practice are problematized towards multi-species design. The subsequent main section will investigate how a multi-species design practice in architecture based on the concept of affordances, can contribute to establishing a symbiotic relationship between architecture and biodiversity, thereby fostering mutual connections and cohabitation among different species.

This section starts with a definition of affordances, originally introduced by James Gibson in 1986 and further developed by Erik Rietveld and Julian Kiverstein in their paper “A Rich Landscape of Affordances” published in 2014. It then delves into Tim Edensor’s perspective on ruins as urban multi-species spaces, as highlighted in his book “Industrial Ruins - Space, Aesthetics, and Materiality.” A reflective segment explores how ruins can be interpreted as rich multi-species landscapes of affordances. Subsequently, various contemporary design concepts for non-human users in architecture, sourced from literature such as “First Nature-Inclusive Design Guide” by Maike Van Stiphout, “Making Urban Nature” by Jacques Vink, Piet Vollard, and Niels de Zwarte, and “Animal-Aided Design” by Prof. Dr. Thomas E. Hauck and Prof. Dr. Wolfgang W. Weisser, will be translated into a multi-species design practice based on affordances.

The concluding section on the relation to architecture will define the architectural object and its symbiotic relationship to multi-species users, as well as the role of the architect in a multi-species design practice based on affordances.

Knowledge:
Research

Action:

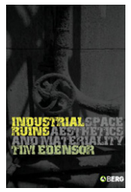
Observation:
Observing, Sensing

Retroactive sense-making:
Interpreting, Reflecting

Theoretical Framework:

Cohabitation

Ruins



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Affordances

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Multi-species design

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Architecture

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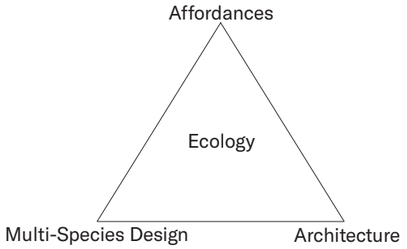


Literature analysis

Discussion

Position

Limitations, interpretation

JACK SPARROW
House Sparrow, *Passer domesticus*

Artistic research:

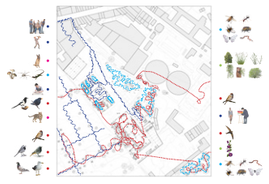
Reflection, New narrative

Creative writing: Poems

Improvisation: Installation

Design position & experiment

Design research:

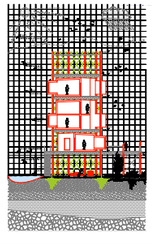


Ruin: Site + context analysis

Zoöp-Methods: Demarcating, observing & sensing, mapping, images

Interviews, workshops

Design goals



Design:

Concept, objects, configuration, composition

Multi-species residency

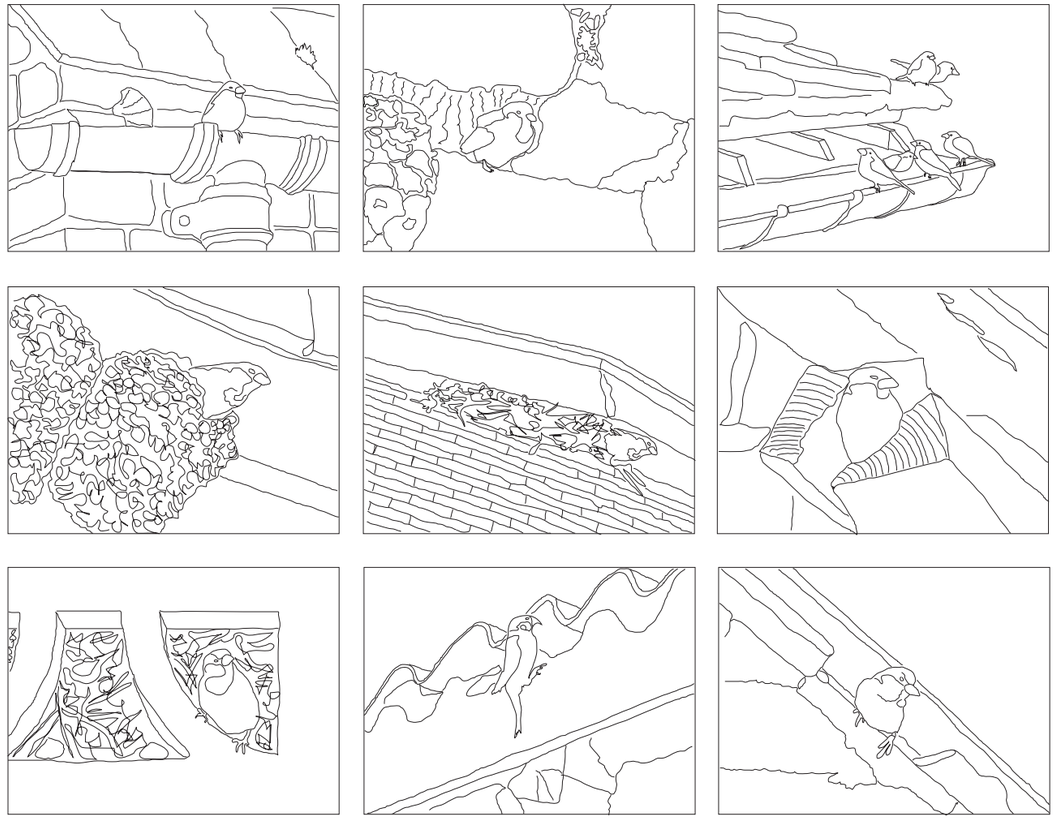
2.0 THE ARCHITECTURE DESIGN PRACTICE AS EXCLUDER FOR NON-HUMAN SPECIES

In their paper titled “Non-anthropocentric design as an experiment in multi-species care,” researchers and architects Agata Szydłowska and Monika Rosinska argue that architecture is primarily a human-centered design practice focused on aesthetics and functionality for human users. Consequently, human needs and proportions serve as the primary consideration, as exemplified by Le Corbusier’s design parameters in “Le Modulor” (Rosinska & Szydłowska, 2019, p.1). As a result, urban environments, designed and constructed as human-made structures, are not intentionally planned to accommodate non-human spatial parameters or facilitate the coexistence of humans and non-humans.

However, the Arch+ Magazine’s publication “Cohabitation” highlights that animals and plants have migrated to cities due to improved breeding and food conditions. This migration is a consequence of humans depriving other species of their natural habitats in rural areas through extensive land use, depletion of natural resources, pollution, and the monocultural practices of the agricultural industry, which also contribute to the biodiversity loss (Kuhnert et al., 2022, p.4).

Thus, the architectural practice predominantly serves human purposes, resulting in homogeneous urban structures that exclude other species. Nevertheless, architecture has inadvertently created numerous habitats for animals and plants, often without planners and builders being consciously aware of it. In his book “Darwin Comes to Town,” evolutionary biologist Menno Schilthuizen illustrates this phenomenon using the example of the House Sparrow. According to Schilthuizen, this bird species became dependent on human habitation during the agricultural revolution, abandoning its natural habitat to feed on human waste, such as leftover grains, and seek shelter in roofs and stables. He explains that the urban environment coincidentally provides conditions that resemble one or more characteristics of the birds’ pre-urban way of life. “In other words, Passer domesticus has become an urban species because it was already adapted to a lifestyle that, purely by accident, prepared it for the niches that we have created in the city” (Schilthuizen, 2018).

Relationship between traditional architecture as facilitator and the House Sparrow as spatial user (own work)



The architects and urban ecologists Jacques Vink, Piet Vollard, and Niels de Zwarte, authors of the book “Making Urban Nature,” state that nowadays more and more unintentional habitats in the built environment are diminishing, leading to negative impacts on urban biodiversity. For instance, the population of House Sparrows has experienced a significant decline, and the species has now been listed as endangered.

The authors identify several reasons for this decline. Firstly, increased construction activity and urban densification have limited nesting opportunities, as modern buildings often lack eaves and niches for the birds. Secondly, existing habitats in old buildings are being destroyed during renovation processes, where insulation measures result in sealed façades and roofs. Traditional houses, which typically offer various shelter options through air cavities, tiled roofs, open timber structures, and spacious attics, are losing these features due to the need for insulation in current sustainability practices. Lastly, and most importantly, the authors emphasize that planners and architects are not incorporating habitats for other species into their designs (Vink, Vollard, De Zwarte, 2022, p.79 and 159).

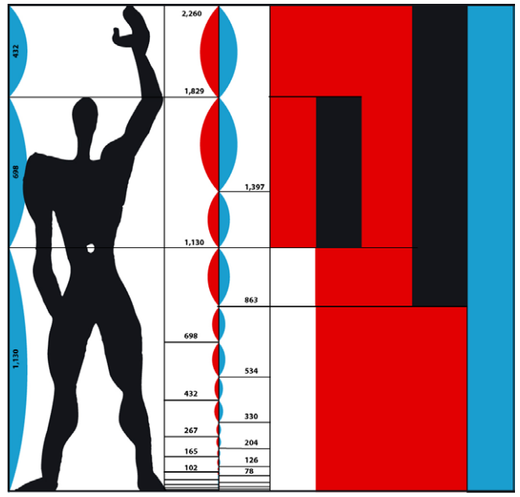
New construction (own work)

Densification (own work)

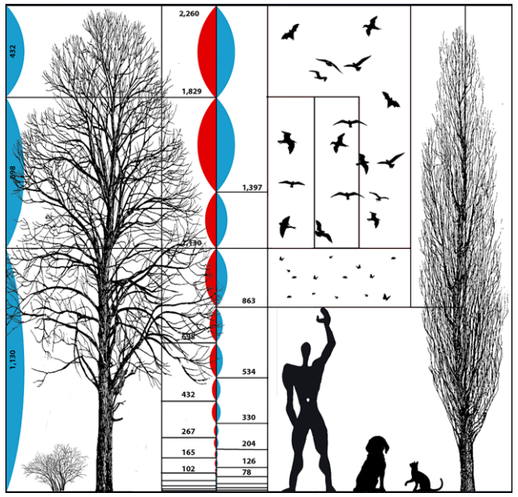
Renovation (own work)

In her book “First Nature Inclusive Design Guide”, landscape architect and teacher Maike Van Stiphout pleads for architects and designers to acknowledge the presence of other species in the city. Ideally, in an architecture practice, we should actively design for both human and non-human by simultaneously considering needs and backgrounds of both. Given the decreasing availability of habitats, architects and city planners should intentionally plan and incorporate nesting opportunities for other species. Van Stiphout emphasizes this point by stating, “To design for rich, biodiverse urban ecosystems means to embrace every opportunity to contribute something for the benefit of other species” (Van Stiphout, 2022, p.79).

Building upon her argument, one could argue that it is necessary to reassess design guidelines such as Le Modulor by Le Corbusier mentioned earlier in this paragraph, and to expand the set of design parameters to include others. This could potentially lead to a multi-species design practice in architecture, resulting in a nature-inclusive, biodiverse, and diverse built environment that accommodates the needs of non-human beings. However, a crucial question arises of how do we gather knowledge about the needs of other species that can serve as a foundation for defining design parameters.



Le Modulor (by Le Corbusier, 1948)



Multi-species design parameters (own work)

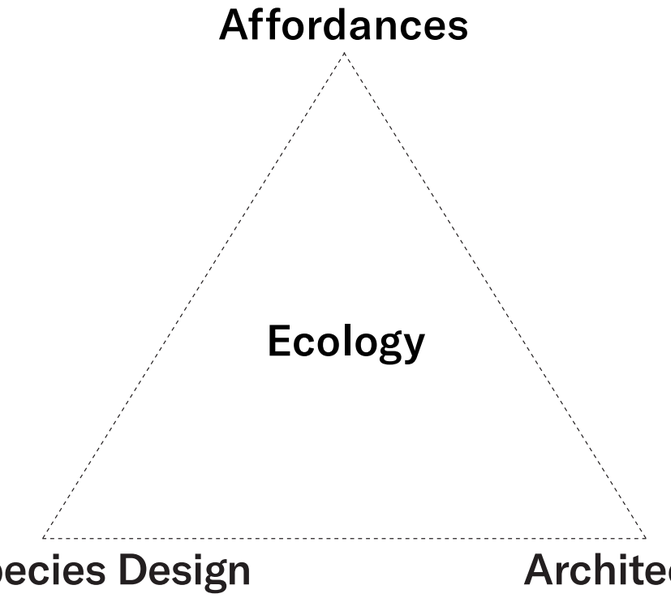
JACK SPARROW

House Sparrow, Passer domesticus

JACK IS LOOKING FOR A HOME

I am Jack Sparrow and I speak for the birds,
as we used to spread out in big and small herds,
I speak for the birds, for a bird sings and flies,
I came from far away to the city of the beautiful tiles.
We birds don´ t have living rooms, but in shrubs and trees we like to chat.
We don` t have sleeping rooms, but spend the nights in a little crack.
Or in voids of a rock, or in a roof of a human house,
old and porous, we take it, just like a little mouse.
We don` t have bathrooms, but roll around in the dusty sands.
We don` t have supermarkets, but collect food without hands.
We ain` t no gardeners, but distribute seeds,
you might not know, but we are the ones who plant trees.
Today there is less food and less little cracks to stay,
so most of my brothers and sisters, they left or passed away.
Please, you humans, be so kind and leave us a crack,
so one day, my friends and family all may come back.
With pride and honour they would distribute seeds,
because trees and plants are what everyone needs.

3.0 A MULTI-SPECIES DESIGN PRACTICE IN ARCHITECTURE BASED ON AFFORDANCES



According to Benjamin Förster-Baldenius, , a co-inhabited space is characterized by ongoing negotiation and communication among different beings. For example, since we cannot communicate directly with birds, design parameters for other species in architecture must be based on action, observing their behaviours, and interpreting the gathered data to identify their interests and needs. Therefore, when designing for multi-species contexts, architects should base their decisions on real-world experiences, an understanding of the surrounding reality, and the ability to interpret the signals of other beings. Baldenius refers to this approach as “improvisation as a form of retroactive sense-making.” It means that based on our observations and interpretations, we improvise architectural actions. Thus, the architectural practice becomes a continuous process of improvisation, as Christopher Dell states: “I call deciphering the city as a space for action, improvisation in a technological mode, and this is nothing else than action that receives its meaning retroactively.” Förster-Baldenius emphasizes that this approach requires working within an existing system, observing how multi-species actors perform in relation to space, materials, time, and socio-cultural behaviour (Förster-Baldenius, 2022). In this section of the thesis, the extent to which the concept of affordances can serve as a potential system for a multi-species design practice in architecture is analysed. Taking a phenomenological approach, it shifts the discourse from a technical and object-focused perspective to a social and action-oriented perception of architecture.

In contrast to normative organized and homogeneously ordered urban spaces, in his book “Industrial Ruins - Spaces, Aesthetics and Materiality”, the cultural geographer Tim Edensor investigates particular urban spaces such as brownfields, wastelands, vacant structures and abandoned ruins as valuable multi-species places. Edensor claims that the impacts of affordances of ruins on living beings promote scope for reflexive improvisation (Edensor, 2005, p.49). In the case of this thesis, these situations are seen as relevant for architects, as they can learn from the act of interspecies space-making in vacant buildings to design affordances. This main part of the thesis analyses how examining the ecological and socio-cultural realms of ruins helps define a multi-species design practice in architecture based on affordances. For this purpose, a theoretical framework was developed triangulating the concept of affordances, multi-species design and architecture.

3.1 AFFORDANCES: RUINS AS MULTI-SPECIES LANDSCAPES OF AFFORDANCES

Affordances

To begin with, it is important to clarify the concept of affordances. Affordances originate from the field of ecological psychology and were initially introduced by James Gibson in 1986. Erik Rietveld and Julian Kiverstein further developed the concept in their paper titled “A Rich Landscape of Affordances” published in 2014. Erik Rietveld is a Socrates Professor and Senior Researcher at the University of Amsterdam, as well as a founding partner of RAAAF (Rietveld Architecture-Art-Affordances). Julian Kiverstein is an Assistant Professor of Neurophilosophy at the University of Amsterdam. Their interpretation of affordances is as follows: “Affordances (Gibson, 1979/1986) are possibilities for action provided to an animal by the environment - by the substances, surfaces, objects, and other living creatures that surround it. A common assumption has been that affordances primarily relate to motor actions, such as locomotion and manual behaviours like reaching and grasping. We propose an account of affordances that extends beyond these traditional notions. We argue that the affordances an environment offers to an animal depend on the skills possessed by that animal” (Kiverstein & Rietveld, 2014, p.325).

The authors emphasize that in their design practices, architects must understand the environment of a project, which consists of physical elements such as substances, surfaces, objects, living beings, and the resources available within the landscape of affordances. In this context, these physical conditions represent possibilities for action for humans, animals, or plants. However, the concept of affordances also requires the consideration of non-physical aspects, such as the skills and abilities specific to each species, as they define the actions that species can perform. The authors argue that non-human beings should also be seen as embedded in socio-cultural practices, which encompass patterns of behavior and ways of coexisting with others. Thus, the concept of affordances represents a socio-ecological system-thinking approach, as affordances are embedded within an environment consisting of ecological and social cycles. This perspective aligns with the broader concept of ecology, which “is the science that studies the relationship between living organisms and their interactions with the environment” (Vink, Vollard, De Zwarte, 2022, p.31). Ecology fundamentally focuses on connections, interactions, and processes involving multi-species actors and their resourceful environments, all essential for living and taking action.

Viewing the concept of affordances through the lens of ecology explains how human and non-human actors perceive, make sense of, and utilize opportunities present in the environment for individual or collective action. As a phenomenological approach, it allows for gaining knowledge directly from the given phenomena of the environment, shifting the discourse from a technical and object-oriented perspective to a social and action-oriented perception. Rietveld and Kiverstein assert that each species has its own distinctive form of life, which aligns with Gibson’s notion of an ecological niche. They expand their definition with the following quote: “Affordances are possibilities for action that the environment offers to a form of life, and an ecological niche is a network of interrelated affordances available in a particular form of life based on the abilities manifested in its practices - its stable ways of doing things. An individual affordance is an aspect of such a niche” (Kiverstein & Rietveld, 2014, p.330).

This implies that a landscape can be viewed as a network of interconnected affordances, and the level of connection is determined by how humans, animals, or plants live within their specific ecological niche. Additionally, the authors argue that an animal’s dynamically shifting skills and abilities influence its ability to respond to affordances in a given scenario. The specific affordances utilized by an actor in a particular setting will vary based on their current activities and concerns. Therefore, it is essential to consider the temporal processes such as the daily and life cycles of humans, animals, and plants.

In another essay titled “Architecture and Ecological Psychology - RAAF’s Exploration of Affordances” by Rietveld and Martens, which is part of the book “Habitat - Ecology Thinking in Architecture” published in collaboration between Het Nieuwe Instituut and TU Delft in 2020, Rietveld emphasizes that all species actively modify their niches over time. These modifications range from creating nests, holes, burrows, and webs to designing squares, streets, buildings, and cities. He places particular emphasis on the materiality of the environment that provides affordances, stating that species modify the material environment to create opportunities for action that can enhance their position in a particular place (Martens & Rietveld, 2020, p.129).

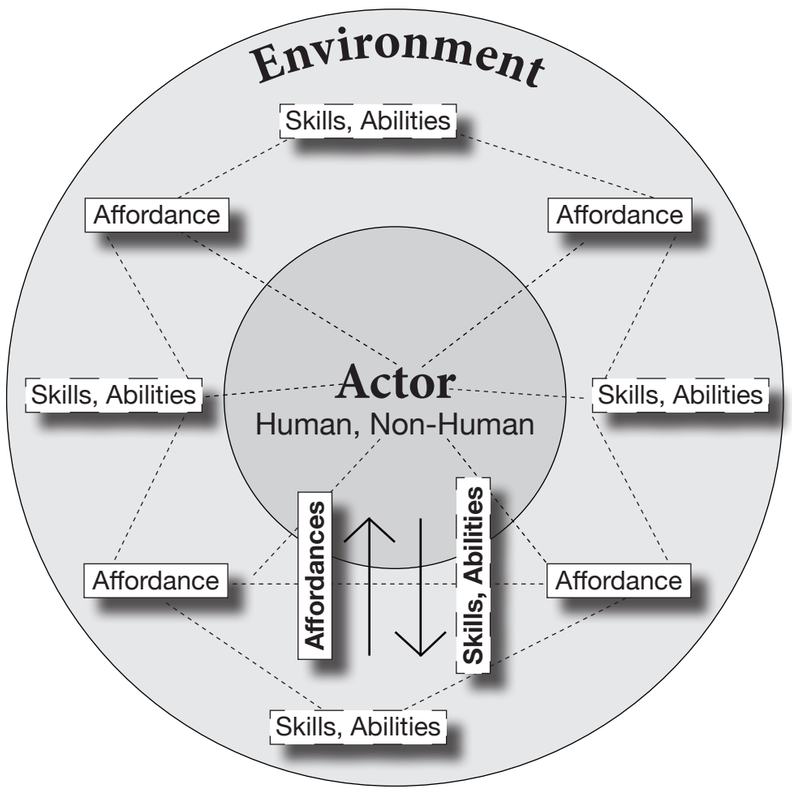


Diagram of Affordances (own work)

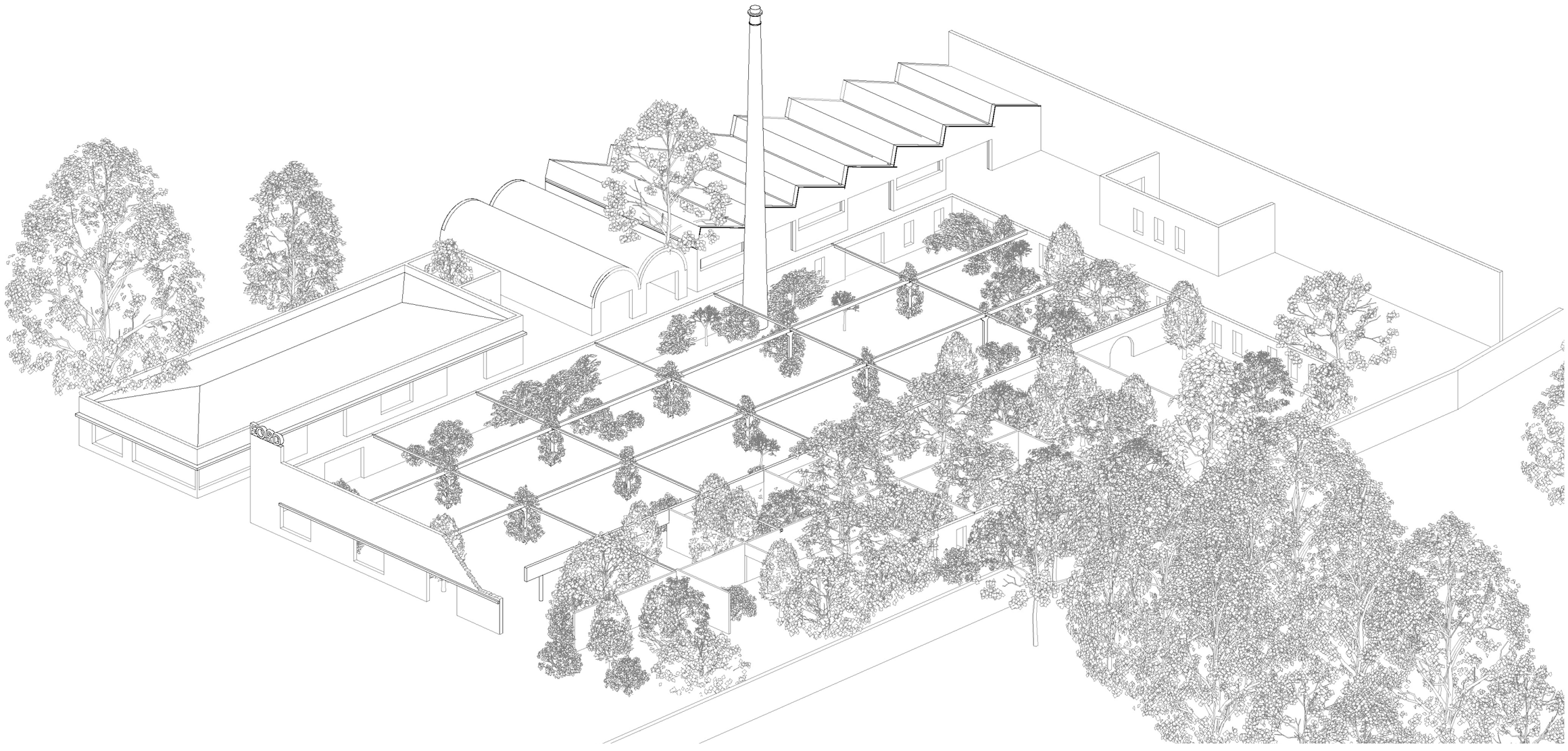
Philipp Gruber

THE ENVIRONMENT OF PALÁCIO FORD

1) Ruin - Palácio Ford (since 1970)

2) Cemetery - Prado do Repouso (since 1839)

3) Forest Park - Parque das Agúas (older)



Environment: Spatial bodies of the ruin Palácio Ford (own work)

RUINS AS MULTI-SPECIES LANDSCAPES OF AFFORDANCES

Tim Edensor describes the ruin as a helpful tool for thinking when analysing issues with actors` perceptions and socio-cultural behaviours in a particular space over time. He examines how humans and non-humans are connected to one another and to their environments, and what this can imply in terms of affordances and responsiveness of different species. According to Edensor, ruins serve as profoundly relational spaces that involve a variety of species, where non-human beings exhibit social behaviours and have a social life, too (Edensor, 2005, p.19). Abandoned ruins offer an alternative realm for social activities, allowing humans, flora, and fauna to thrive outside the normative and regulated urban landscape and engage in different interactions with their surroundings (Edensor, 2005, p.21).

First, he describes the potential of ruins to marginalized human groups operating in the urban domain, showing how they serve as spaces for leisure, adventure, culture, shelter and creativity. "[T]he looseness of ruined space permits a wide range of socio-cultural practices. [...] In a multitude of sites assigned the status of "derelict" and "void", or labelled "dead zones" by architects and planners, space is produced in diverse yet unprescribed ways by "transgressive" practitioners who hold "raves", have sex, garden or dwell, expanding the possibilities and meanings of such realms" (Edensor, 2005, p.22). In this section, Edensor analyses how ruins are utilised as sources of useful materials or serve as venues for alternative productive creativity and subculture. From the perspective of affordances, individuals relate to specific affordances provided by ruins to perform and pursue their current interests. For instance, ruins may offer opportunities for fantasy precisely because they are perceived as forbidden or dangerous areas, allowing unrestricted adventure and serving as sites for unimaginable and illegal activities. Edensor suggests that the appropriation and use of space in ruins are primarily characterized by their temporal and improvisational nature, related to physical objects within the space (Edensor, 2005, p.25). Interpreted through the lens of affordances, substances, surfaces, and architectural objects within ruins enable specific actions. For example, long corridors facilitate sprinting, steps can be run on, and windows offer opportunities for climbing. Moreover, large floor areas and roofs provide locations for cultural activities. The random arrangement of objects and the presence of items that do not belong to the original place can be attributed to objects brought in from outside or discovered within the walls of the ruin (Edensor, 2005, p.26).

Secondly, vacant structures also serve as refuges for flora and fauna within urban areas. As spaces become unpoliced and less regularly cleaned to minimize non-human intrusions, animals and plants demonstrate their adaptability by seizing opportunities that arise in the city. They quickly find cracks and crevices where they can thrive, securing nesting spaces, food sources, and territories (Edensor, 2005, p.42). Edensor describes the inter-relational process of spatial appropriation by non-human actors, following Gilbert's four-stage model. This process is not static but changes over time based on the longevity of the abandoned site (Edensor, 2005, p.43).

The first phase, referred to as the "Oxford ragwort stage," involves the colonization of quickly growing grasses and plants. Mosses, lichens, liverworts, rosebay willow herb, and breeze-borne plants appear inside the ruin and on its walls. Rotten wood attracts shaggy caps, puffballs, fungi, and other microorganisms. These species aid in decomposition and prepare the ground for the growth of taller plants. Their presence also attracts various microorganisms, insects, voles, mice, and their predators. In the "Tall-herb stage," larger perennial plants gradually blur the boundary between the inside and outside of the ruin. Climbing plants such as ivy, wall-rue, and water convolvulus grow on the walls. On the ground, flowers, brambles, thorns, rose bushes, fat hen, nettles, sorrel, horsetail, ferns, groundsel, chickweed, thistles, and knotweed thrive, attracting pollinators such as bees, butterflies, and other insects. Climbing plants eventually form voluminous bushes that provide shelter for small birds. The "Grassland stage" involves the combination of marshlands and taller perennial plants, creating a more stable and diverse ecosystem that can eventually support the growth of trees and taller shrubs. Finally, in the "Shrub woodland stage," trees and shrubs such as elder, willow, silver birch, hawthorn bushes, and hogweed grow, attracting various bird species (Edensor, 2005, p.43).

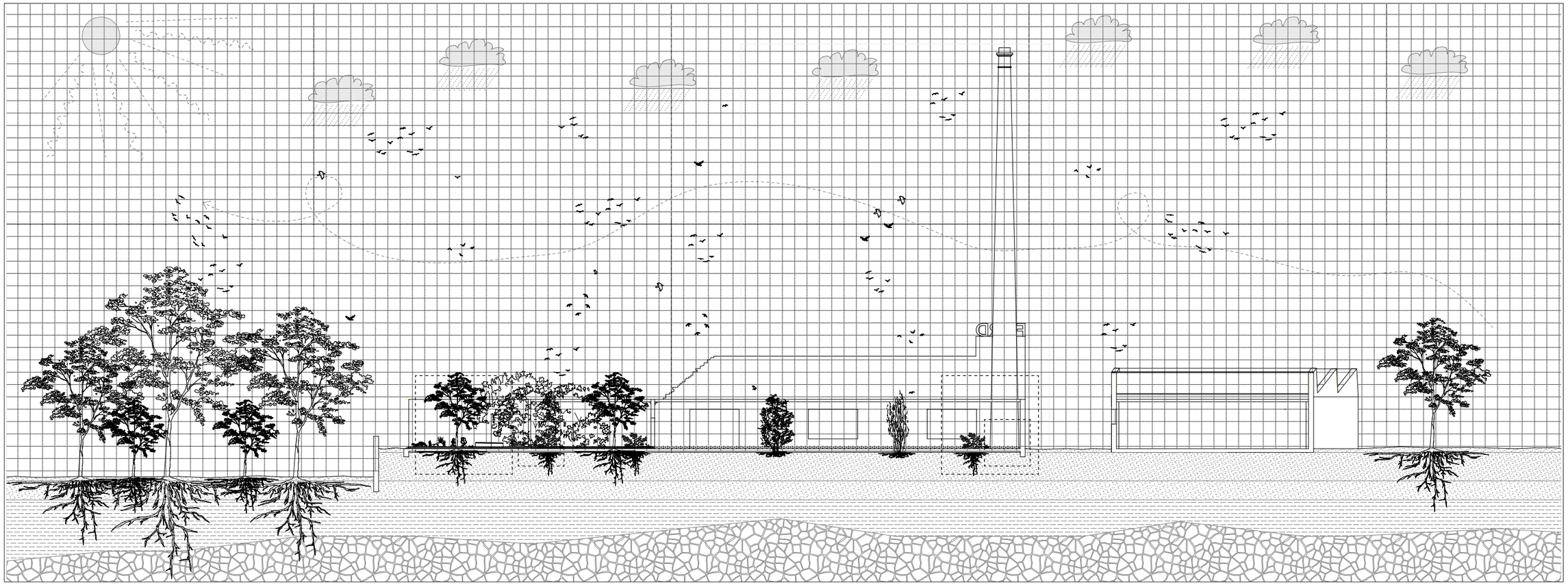
Consequently, what Edensor describes is that the ecological succession of spatial appropriation by plants also significantly affects the presence of animals. From the perspective of affordances, this means that one species is capable of creating a new form of life that allows another species to thrive. During this succession, affordances develop consecutively over time, depending on the skills and abilities that actors contribute to the process. For example, human abandonment and the decay process, including roof collapse, make the ruin accessible to other species. Water seeps in, creating spatial voids such as cracks and soil that provide a foundation for plant growth. Pioneer species, such as small annual plants and insects, encourage the presence of small animals like voles and mice, which in turn attract their predators such as birds. Subsequently, perennial plants, including berry bushes, climbing plants, small trees, and shrubs, form an intermediate community that provides nourishment, shelter, safety, and well-being for birds. Only through this combination can suitable conditions and possibilities emerge, allowing the bird to appropriate, perform actions, and utilize the space. In other words, these are the affordances embedded in the environment within the landscape of the ruin, enabling the bird to operate within its ecological niche.

According to Edensor, as ruins become occupied by plants and animals, they become part of ecological temporalities, dissolving the illusion of permanence often associated with the human-created urban fabric (Edensor, 2005, p.33). This perspective aligns with another notion discussed in an interview published in Arch+ Magazine titled "Cohabitation" between Marion von Osten and Prof. Dr. Thomas Hauck, founder of studio Animal-Aided-Design. Hauck suggests that biodiversity present or adapted on derelict land, such as ruins, is not a result of the absence of human use, but rather a side effect of current or previous human activities. It is through the transitional state between different, often informal uses that individual and complex assemblages of functions and multi-species groups emerge. Thus, everything can be considered in flux, where the action of one species always elicits a reaction from another (Hauck, 2022, p.203). When analysing what architects can learn from interspecies space-making in vacant buildings like ruins, it becomes relevant to reconsider the term "decay." While architects may perceive decay as negative, it holds great potential for other species. In the action and reaction sequence described by Edensor and Hauck, the formation and deformation of architectural elements, such as roofs and walls, contribute to the non-human spatial activation of the ruin. Furthermore, it reveals the need for architects to design heterogeneously produced space in terms of time, embracing continuity and incompleteness. Edensor's work demonstrates how ruins, as landscapes rich in multi-species affordances, facilitate various types of human and non-human actions in response to existing or evolving affordances. Therefore, ruins can be regarded as valuable urban ecological assets that enhance the vitality, biodiversity, and affordances of the urban environment. When reintroducing human activity to these spaces, it would be inappropriate to disregard these existing qualities, especially in light of the current ecological challenges faced by the architectural practice.

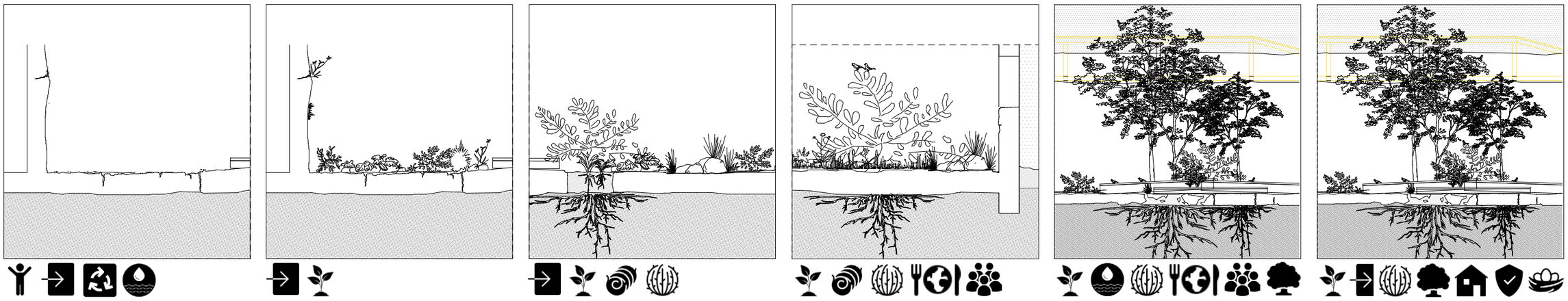
In conclusion, this reflection is supported by Edensor's following quote:

"The ways in which animals and plants, as well as humans, produce urban space, most conspicuously at sites such as ruins, call for what Whatmore and Hinchcliffe describe as a 'recombinant ecology', a concept which acknowledges the dynamic reconfiguration of urban ecologies through the ongoing relationships between people, animals and plants (2003: 39). Since the impact of erasing large numbers of ruins at once would be considerable in terms of diminishing the richness of urban ecology, it seems particularly inapt to identify ruins as dead spaces, conceived, in true colonial fashion, as terra nullius, devoid of value, purpose and life. For like all forms of urban and rural space, ruins are heterogeneously co-produced by humans and non-humans (Murdoch, 2003) which are connected to the site by numerous flows, routes and networks of association. Nature is thus not in any sense pure and distinct from the humans but part of the hybrid environments to which both belong, which they both create, and which constrain and enable their activities" (Edensor, 2005, p.50).

Landscape = Ruin Palácio Ford



Affordances = Offer for action



1. Abandonment

Substances, walls, slabs, soil, water, materials & objects (roof tiles, wood, rubble)

2. Oxford ragwort stage

Micro-organisms, fungi, grasses, mosses, insects, decomposed matter

3. Tall-herb stage

Perennial plants, climbing plants, herbs, small bush, flowers, pollinators, bees

4. Grassland-stage

Shrubs, small trees, marshland with taller perennial plants & bushes

5. Shrub-woodland stage

Pioneer trees & big shrubs, elder, willow, silver birch trees, hawthorn bushes hog-weed, bramble

6. Animal stage

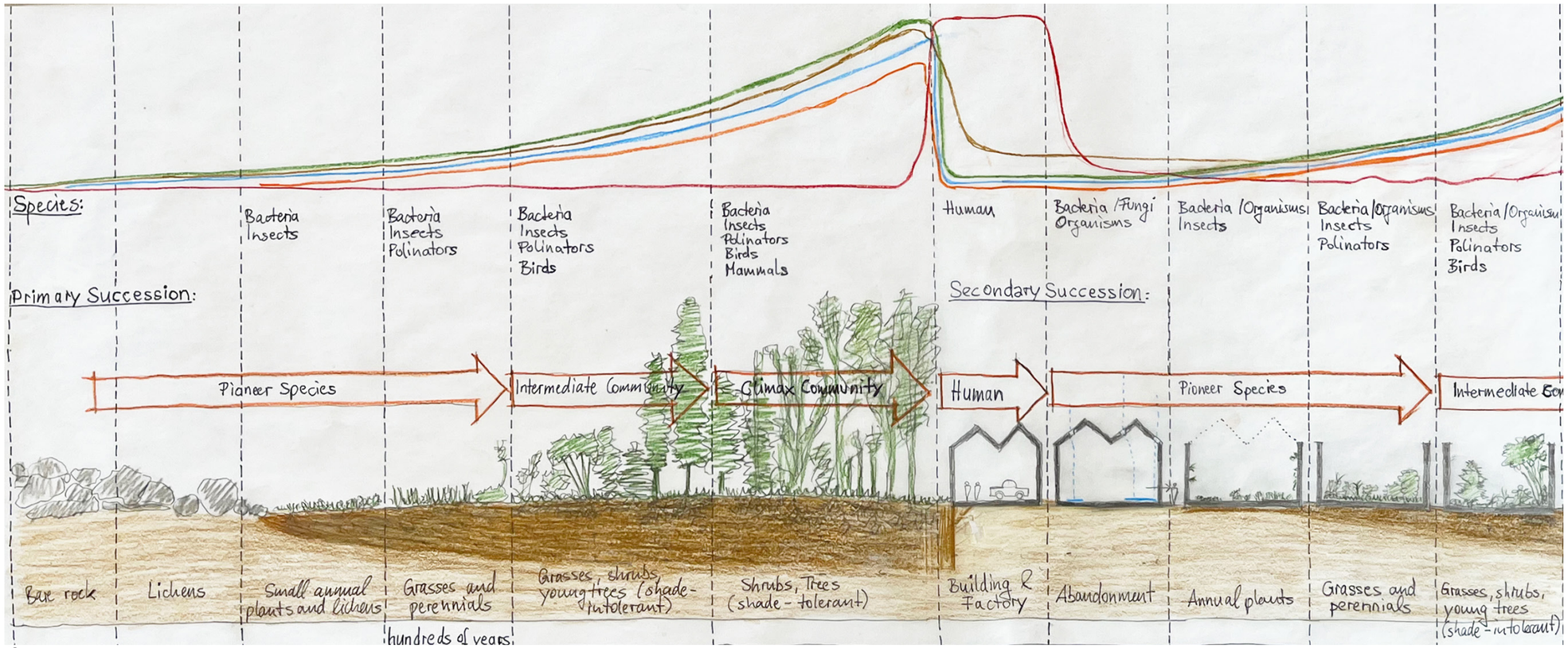
Birds (house sparrow, black redstard, swift, blackbird, grey & blue tit) + mammals (mice, hedgehog)

time

Decay = Successive development of affordances

ECOLOGICAL SUCCESSION

Disruptive moment:
Construction of Ford-Factory



time

Hundreds of years

1892
Farmland

1934
Building
1940
Renovation

1960
Abandonment

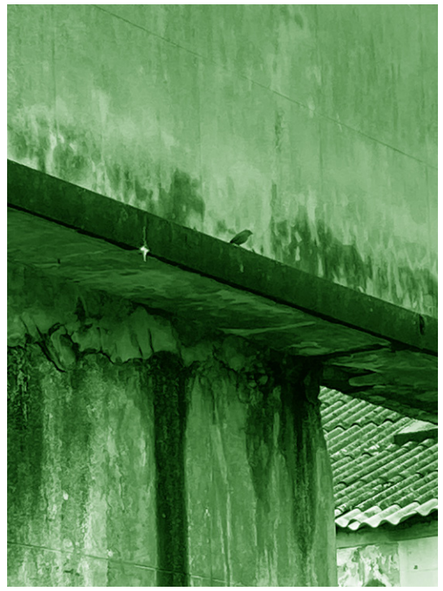
NOW
Reclaimed
by Nature

Ecological succession of the ruin Palácio Ford, Porto (own work)

Design position:
Design process in symbiotic relation with ongoing ecological succession of the ruin

Ruin Palácio Ford, Porto (own work)

Ruin Palácio Ford, Porto (own work)



Ruin Palácio Ford, Porto (own work)

Ruin Palácio Ford, Porto (own work)

A NEW HOME FOR JACK

One day, I flew again and again for hundreds of miles,
through the streets of the city with the beautiful blue tiles.
I tried all my best to find food and little cracks,
you know quite well now that this is what lacks.
So, I took all my strength and flipped my little wings,
and flew over the high roofs to find better things.
Behind the big houses, I found a great surprise,
a house without a roof, no humans, but lots of mice.
Very unusual to find in the human world,
dirt and dust, what normally we birds preferred.
Messy places full of plants such as these,
with flowers, shrubs, and sheltering trees.
I found berries, grains and much more food,
not to imagine how this changed my mood.
I can not tell you who brought all these seeds,
maybe someone that everyone needs.
So, I told all my friends and family to come,
there are still some places to live and have fun.

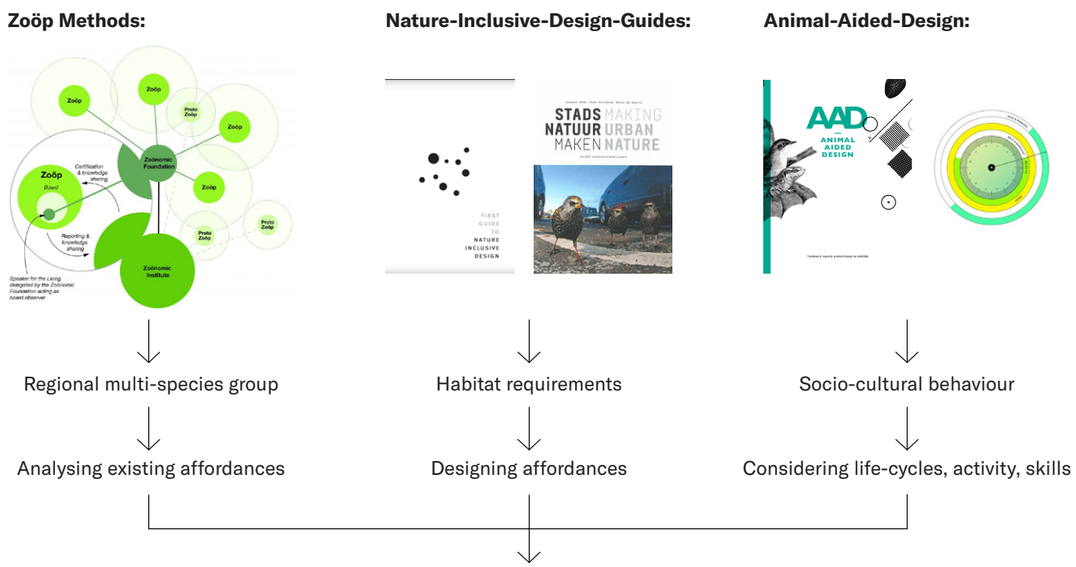
3.2 MULTI-SPECIES DESIGN

Zoöp methods

In his interview in the Arch+ Magazine “Co-habitation,” Prof. Dr. Thomas Hauck, founder of studio Animal-Aided-Design, highlights a crucial concern when designing for a multi-species context. He acknowledges that human activity stimulated by architectural intervention will inevitably alter the species composition in a given location, with potential positive or negative outcomes. Hauck emphasizes the need to accept this reality and recognizes that every formative human intervention either creates or destroys habitats. What benefits one species may harm another. Therefore, designers must carefully consider the consequences of their interventions, as interventions in biodiversity are inherently experimental and self-dynamic. He therefore argues for a reflective multi-species design practice in architecture. (Hauck, 2022, p.203).

This statement aligns with the notion put forth by Prof. Förster-Balenius regarding improvisational approaches in multi-species design based on retro-active sense-making. According to Förster-Baldenius (2022), design decisions should be informed by observations and interpretations of socio-cultural practices of animals and plants. In this process, the reflective part of giving sense to your previous action is key to the multi-species design practice. Viewing these ideas through the lens of Rietveld and Kiverstein’s concept of affordances, it can be argued that analysing existing affordances in a given place is essential before designing for multi-species contexts.

In this regard, the Zoöp model developed by the research department of Het Nieuwe Instituut in Rotterdam serves as a valuable tool. Zoöp, short for Zoöperatie, represents an organizational model for cooperation between human and non-human life that safeguards the interests of all living beings (“Het Nieuwe Instituut,” n.d.). The Zoöp model incorporates the Zoönomic Year Cycle, consisting of four stages: Demarcating, Observing & Sensing, Characterizing, and Intervention. In the Demarcating stage, a mapping of the physical structure and living bodies of the Zoöp, including humans, animals, and plants, is conducted. The subsequent Observing & Sensing stage focuses on non-physical aspects such as activities, movement, and interactions of the actors, which aligns with Prof. Förster-Baldenius’ emphasis on observation and interpretation of socio-cultural practices. A valuable stage for the concept of affordances is Characterizing, where the health condition of the Zoöp is assessed. Within this stage, existing affordances of the place can be assessed, forming the basis for the subsequent Intervention phase.



Reflective multi-species design practice based on affordances

DESIGN RESEARCH: Zoöp - Methods

Demarcating: Local species group at Palácio Ford, Porto (own work)

Madeira ivy
Hedera canariensis Willd.

Forest elder
Nuxia floribunda Benth

Herb mercury
Mercurialis annua L

Plaintain
Plantago monosperma Pourr.

Scented oakfern
Gymnocarpium robertianum

Lauraceae
Persea indica (L.) Spreng.

Egyptian mallow
Malva parviflora L

Grasses
xxx

Grasses
xxx

Grasses
xxx

Bermuda-buttercup
*Oxalis pes-caprae_*

Bramble
Rubus ferocior

Bramble
Rubus ferocior

Grasses
xxx

Wild tobacco
Solanum mauritianum Scop.

Australian cheesewood
Pittosporum undulatum Vent

Red nightshade
Solanum villosum Mill

Purple milk thistle
Galactites tomentosus Moench

Spreading pellitory
Parietaria judaica L.

Hazelnut
Corylus avellana L.

Cocupa plant
Erodium cheilanthifolium Boiss

Water convolvulus
Ipomea indica

Moss
Bryophyta

Plane tree
Platanus

Demarcating: Local species group at Palácio Ford, Porto (own work)

Seagull
Larinae

Pigeon
Columbidae

House Sparrow
Passer Domesticus

Blackbird
Turdus merula

Wagtail
Motacilla alba

Swift
Apus apus

Black redstart
Phoenicurus ochruros

Magpie
Pica pica

Magpie
Hirundinidae

White-throated dipper
Waterspreeuw

Bat
Microchiroptera

Lizzard
Lacertilia

Beetle
Coleoptera

Bumblebee
Bombus

Wild bee
Apidae

Honey bee
Apis mellifera

White butterfly
Pieris rapae

Ant
Formicidae

Spider
Araneae

Fungi
Fungus

Earthworm
Lumbricidae

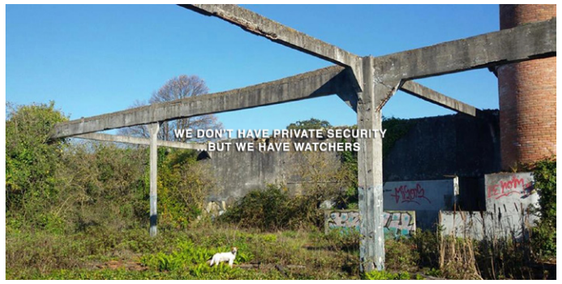
Hedgehog
Erinaceus europaeus

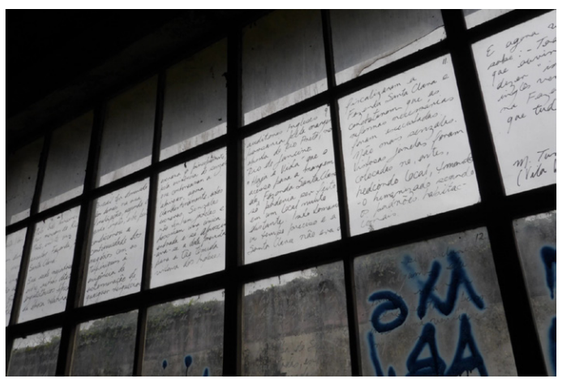
Cat
Felis catus

Dog - German shepherd
Canis lupus familiaris

Demarcating: Local species group at Palácio Ford, Porto (own work)

Art exhibition:
“para inglês ver”, 14.11.2018





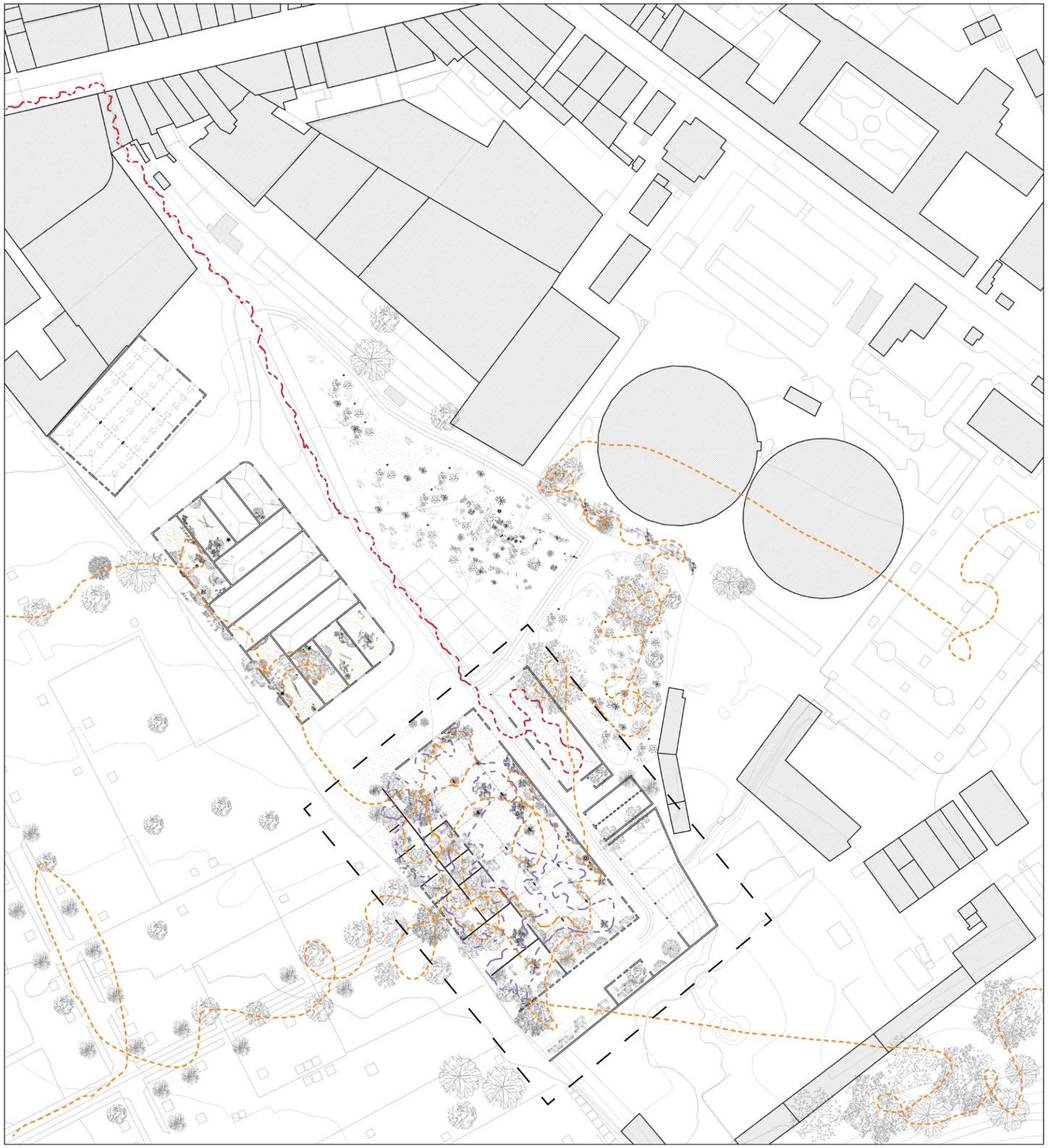
Theatre:
“V” performance, 27. - 30.06.2022

Architecture Biennale:
“Archisummit”, 13. - 15.07.2022

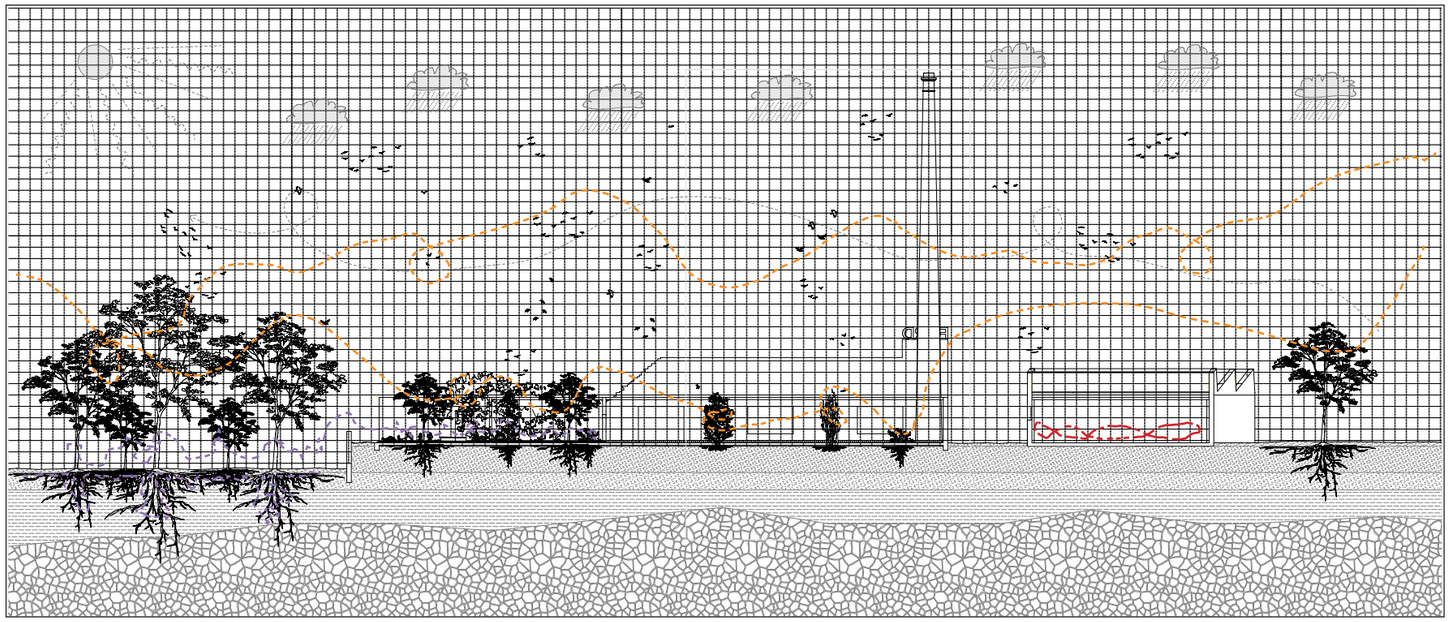
Fashion Event:
pedro pedro studio, 15.10.2022

Demarcating: Local species group at Palácio Ford, Porto (own work)

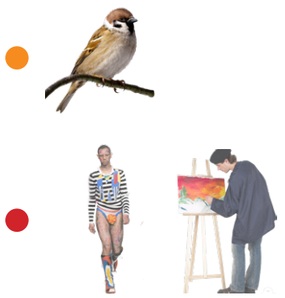
Demarcating: Local species group at Palácio Ford, Porto (own work)



Observing & Sensing: Local species group at Palácio Ford, Porto (own work)



Observing & Sensing: Local species group at Palácio Ford, Porto (own work)



MULTI-SPECIES DESIGN GUIDES

When designing affordances for an intervention, the guides “First Nature Inclusive Design Guide” and “Making urban Nature” provide technical requirements on how to design for the non-human domain. Key principles derived from these guides are food and water supply, shelter and possibility for breeding-activities with varied spaces, climate and thermal comfort, orientation, safety, protection from air and light pollution and from disturbance by humans and predators (Van Stiphout, 2019, p.83 and 119 f).

Studio “Animal-Aided-Design” also brings a framework to design for non-humans such as animals and plants. Their design approach is based on understanding life cycles and the critical needs that vary throughout the year due to individual temporal mechanisms and lifestyles of different species. This approach incorporates temporal aspects, including seasonal variations and designing with a changing climate over the year. Hauck emphasizes that a planner’s knowledge of a species’ life cycle, from birth to reproduction, and understanding their needs during different life phases, is crucial for successful design with animals (Hauck, 2022, p.200).

Of particular importance for the concept of affordances is the recognition of the activity and abilities embedded in the socio-cultural practices of each species, as highlighted by “Animal-Aided-Design”. Architects can find relevance in this notion when considering the dependencies of affordances on the specific skills possessed by different species, as discussed by Rietveld and Kiverstein in their concept of affordances. For example, this information is valuable for the planner to know when species are active on the site or when to provide shelter for the animals ability and need of reproduction.

In the course of this thesis, a diagram of affordances was developed. As possible affordances given in a particular environment, *Shelter*, *Community*, *Nourishment, Accessibility*, *Safety & Well-being*, *Climate*, and *Material Environment* are defined using the principles stated above. Moreover, the effect on *Other species*, as well as *Practice & Service* to the environment are set as skills and abilities the actor brings. These information can be used by architects to design and implement affordances for other species in their projects and thus, to enrich the offers of the designed environment to actors. As an example of this scheme, one diagram representing affordances, skills and abilities of the House Sparrow was made.

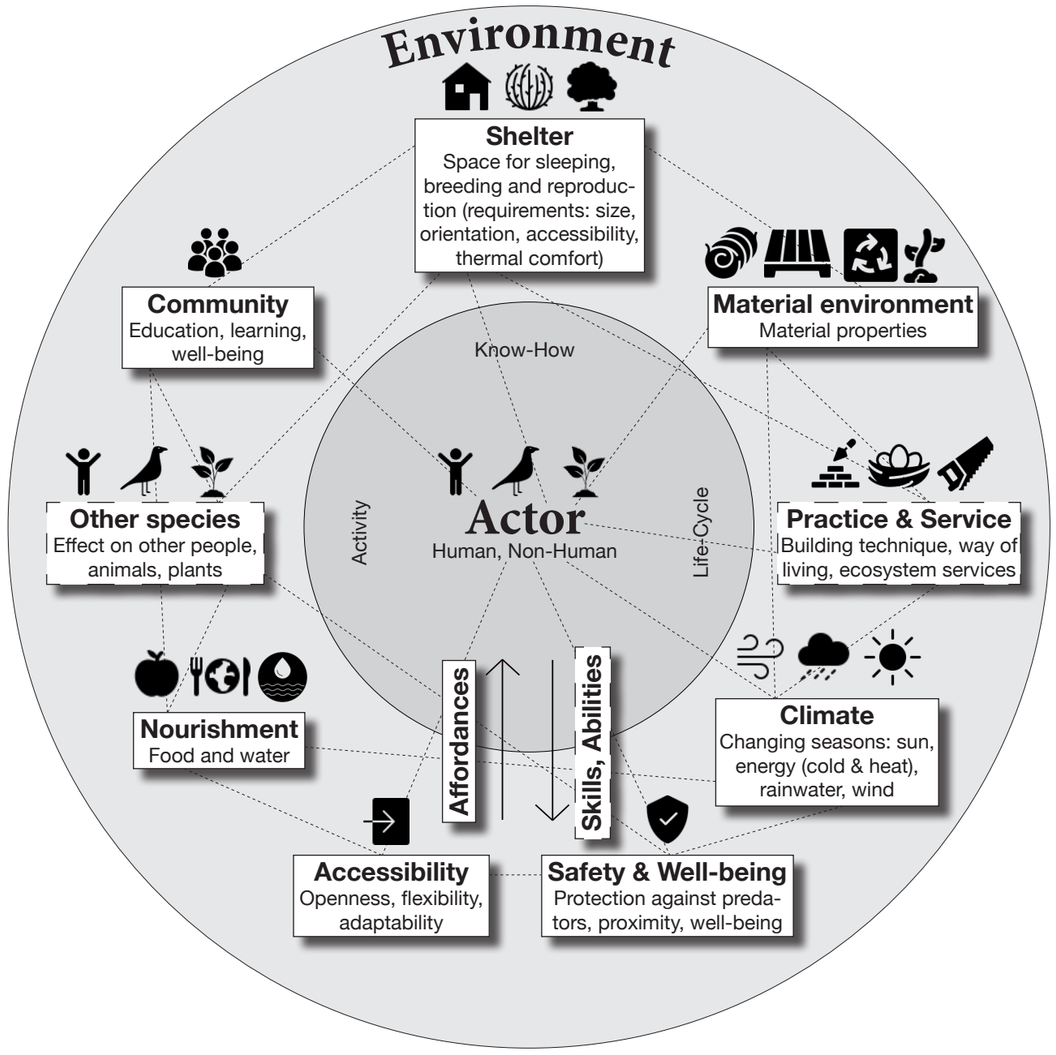
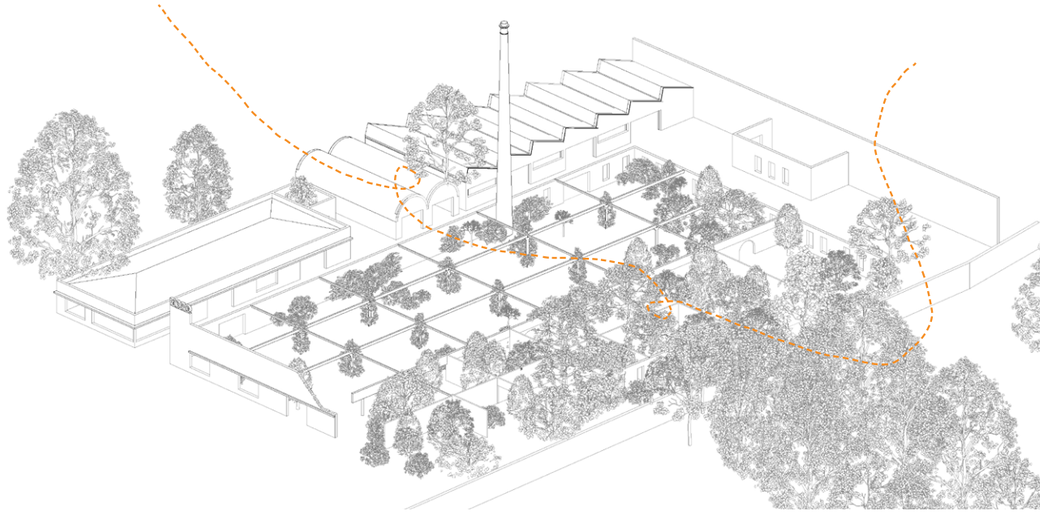


Diagram of Affordances (own work)

JACK SPARROW

House Sparrow, Passer domesticus



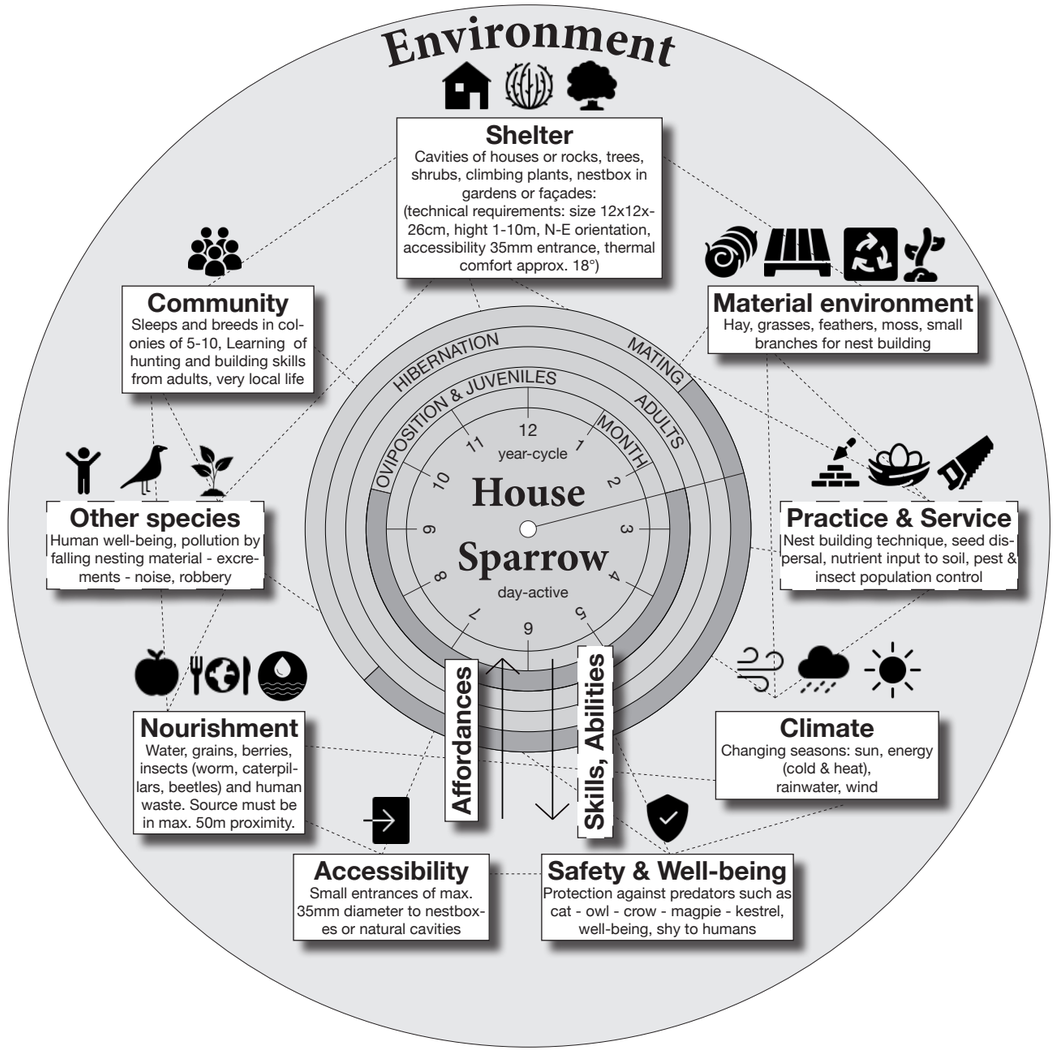


Diagram of Affordances of the House Sparrow (own work)

3.3 ARCHITECTURE

Architectural object

The translation of the concept of affordances and multi-species design into architecture raises questions about the nature of the architectural object and the role of the architect. In their essay titled “Architecture and Ecological Psychology - RAAF’s Exploration of Affordances,” published in the book “Habitat - Ecology Thinking in Architecture” (2020), Erik Rietveld and Janno Martens argue against viewing the built environment as a collection of static objects. Instead, they propose seeing it as a dynamic ecological system and advocate for process-related approaches to architecture and planning. They draw inspiration from James Gibson’s statement: “The perceiving of an affordance is... a process of perceiving a value-rich ecological object. Any substance, any surface, any layout has some affordance for benefit or injury to someone. Physics may be value-free, but ecology is not” (Martens & Rietveld, 2020, p. 129).

Thus, from an ecological perspective that considers affordances, the architectural object should be understood as a social and ecological entity integrated into the larger context of the built environment as an open and dynamic socio-ecological system. Rietveld and Kiverstein emphasize that the environment is composed of a network of affordances. Thus, the architectural object, in its physical or non-physical forms, can facilitate individual affordances or networks of affordances such as *Shelter*, *Community*, *Material environment*, *Nourishment*, *Accessibility*, or *Safety & Well-being* (refer to the Diagram of Affordances). Additionally, it has the capacity to support the skills and abilities of actors, including other species and the practices and services provided by humans. According to Rietveld and Kiverstein, affordances and capabilities are interconnected. As a physical object, the architectural entity can take the form of substances, surfaces, objects, or other spatial and living structures.

When seen as a building, it should be designed as an open and dynamic living system that enables flexibility, adaptability, and user engagement. Furthermore, “Animal-Aided-Design” highlights the importance of developing architecture as a multi-species, climate-adapted object, considering the diverse life-cycles of species and the varying climate conditions throughout the year. This requires architects to design with attention to processes, time, and relationships. In this sense, the architectural object also encompasses a profound non-physical structure associated with the socio-cultural behaviours of its inhabitants.

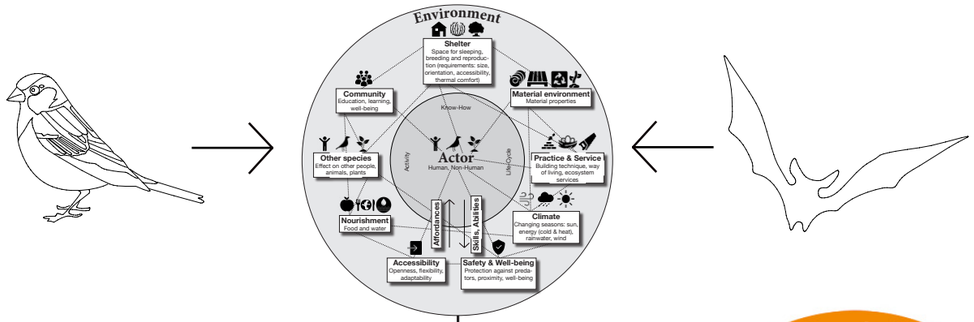
Regarding the building envelope of the architectural object, a relevant paper titled “Creating ecologically sound buildings by integrating ecology, architecture and computational design” published in collaboration by different authors from the TU München, TU Wien, “Animal-Aided-Design” and more in 2023, gives valuable insights. They envision the envelope to be designed as an “Ecolope”, which they define as following:

“[The authors] propose the design of an ecolope, a shared multi-species architectural space which blurs the boundaries between the outside environment, the building’s envelope and the interior (Figure 1). [Their] vision of the ecolope is that a building envelope should no longer be a generic separating boundary between humans within a building and the environment outside the building. An ecolope will be in intensive exchange with the environment outside the building and needs to be designed to allow for this exchange. The ecolope then has the potential to act as an enabler of human–nature interactions. This can be accomplished by designing it with the aim to support the life of other species as well as for humans. [They] envisage the ecolope as a designed ecosystem whose community assembly is driven by architectural design, local and regional environments—including the regional species pool—as well as human use and management. [They] propose the ecolope to be a dynamic space shared between humans, animals, plants and also microbiota, that is constantly transformed through species interactions. Within the ecolope, positive feedback loops can be generated by way of, for example, decreased temperatures through evapotranspiration, which consequently affects all inhabitants” (Weisser et al., 2023, p.10-11).

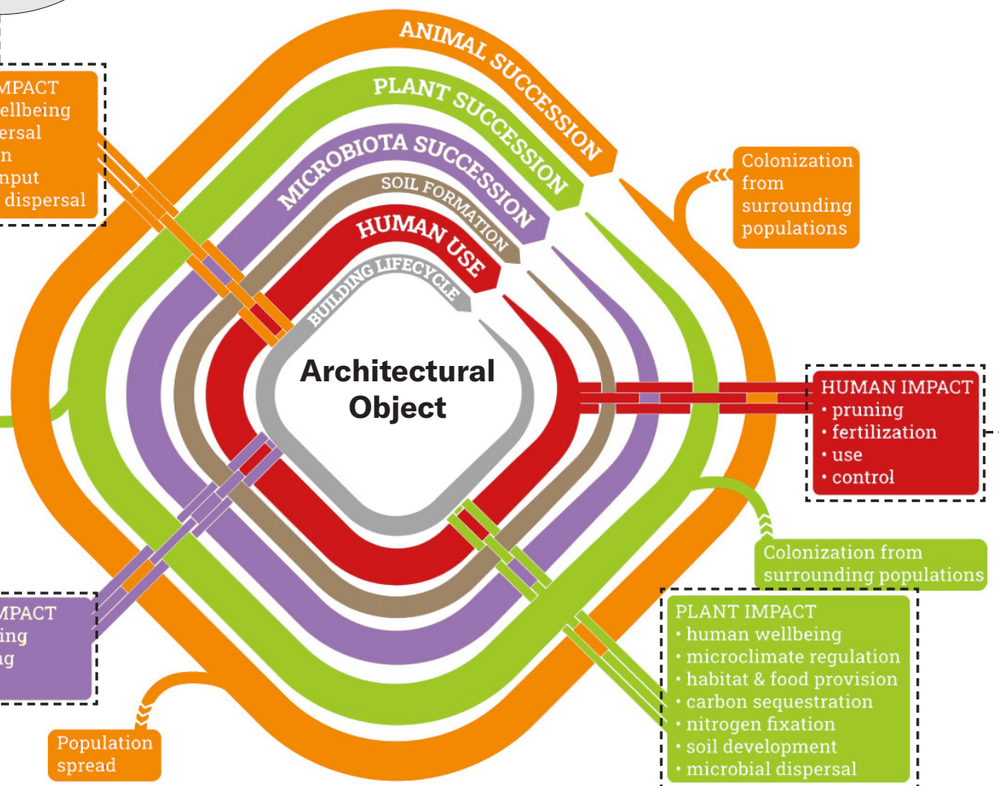
The authors propose that designing the socio-ecological envelope of architectural objects can be a powerful tool for creating inclusive and dynamic spaces that are shared by diverse species, including humans, animals, and plants. Through an interconnected process driven by multi-species interactions, humans and non-humans can establish symbiotic relationships, benefiting mutually from one another. For instance, plants contribute to the well-being of humans by cooling the microclimate through evaporation. Conversely, humans not only benefit from utilizing the space but also possess the capacity to manage tasks like irrigation, pruning, fertilization, and controlling plant growth. Animals, such as birds, also enhance human well-being while providing essential services like seed dispersal, pollination, and nutrient input that support plant growth.

By examining the concept of Ecolopes through the lens of affordances, it becomes apparent that within this spatial context, where the interior and exterior converge, all species within a given region interact with the possibilities offered by the environment based on their socio-cultural behaviours. In this particular context, architects are presented with an opportunity to explicitly incorporate affordances for multi-species users through their designs, as it serves as a threshold where human and non-human actors can actively meet and support each other, while also acknowledging the potential for conflicting interactions. Therefore, architects face the challenge of mitigating conflicts such as disease transmission and predator-prey relationships between different species in their designs.

Affordances: Animals



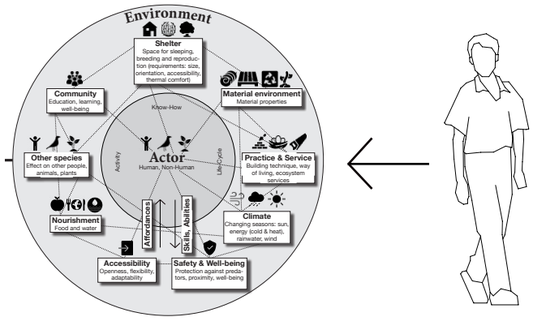
ANIMAL IMPACT
- human wellbeing
- seed dispersal
- pollination
- nutrient input
- microbial dispersal



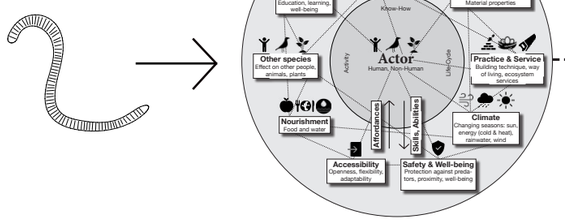
Colonization from surrounding populations

HUMAN IMPACT
- pruning
- fertilization
- use
- control

Affordances: Human



Affordances:
Insects, Microbiota



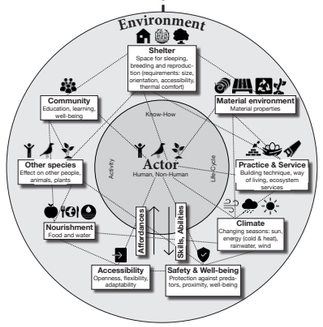
MICROBIOTA IMPACT
- human wellbeing
- nutrient cycling
- plant growth

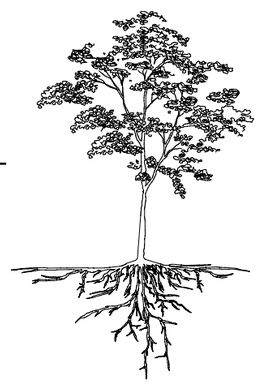
- Seed dispersal
- Wind pollination

Population spread

Colonization from surrounding populations

PLANT IMPACT
- human wellbeing
- microclimate regulation
- habitat & food provision
- carbon sequestration
- nitrogen fixation
- soil development
- microbial dispersal

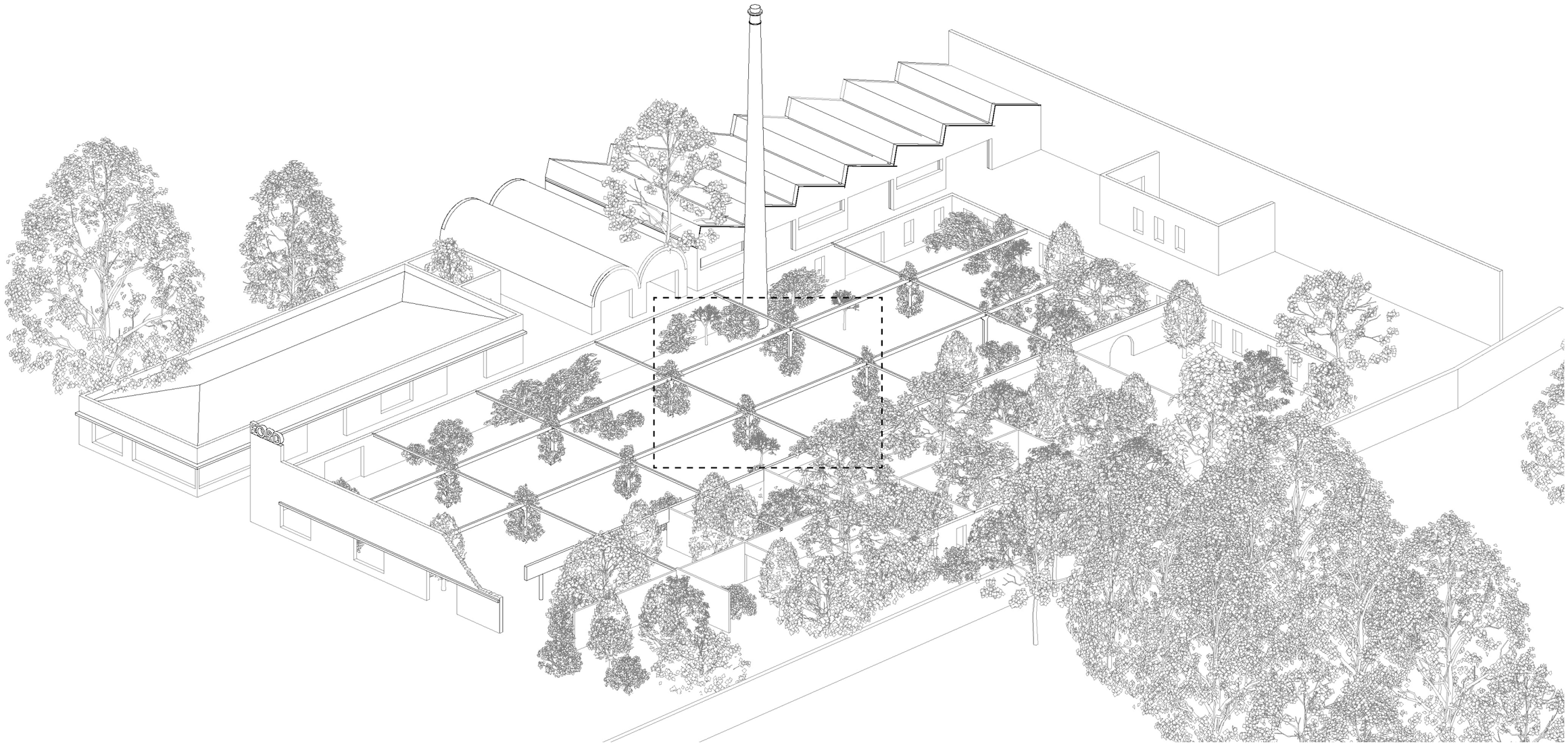




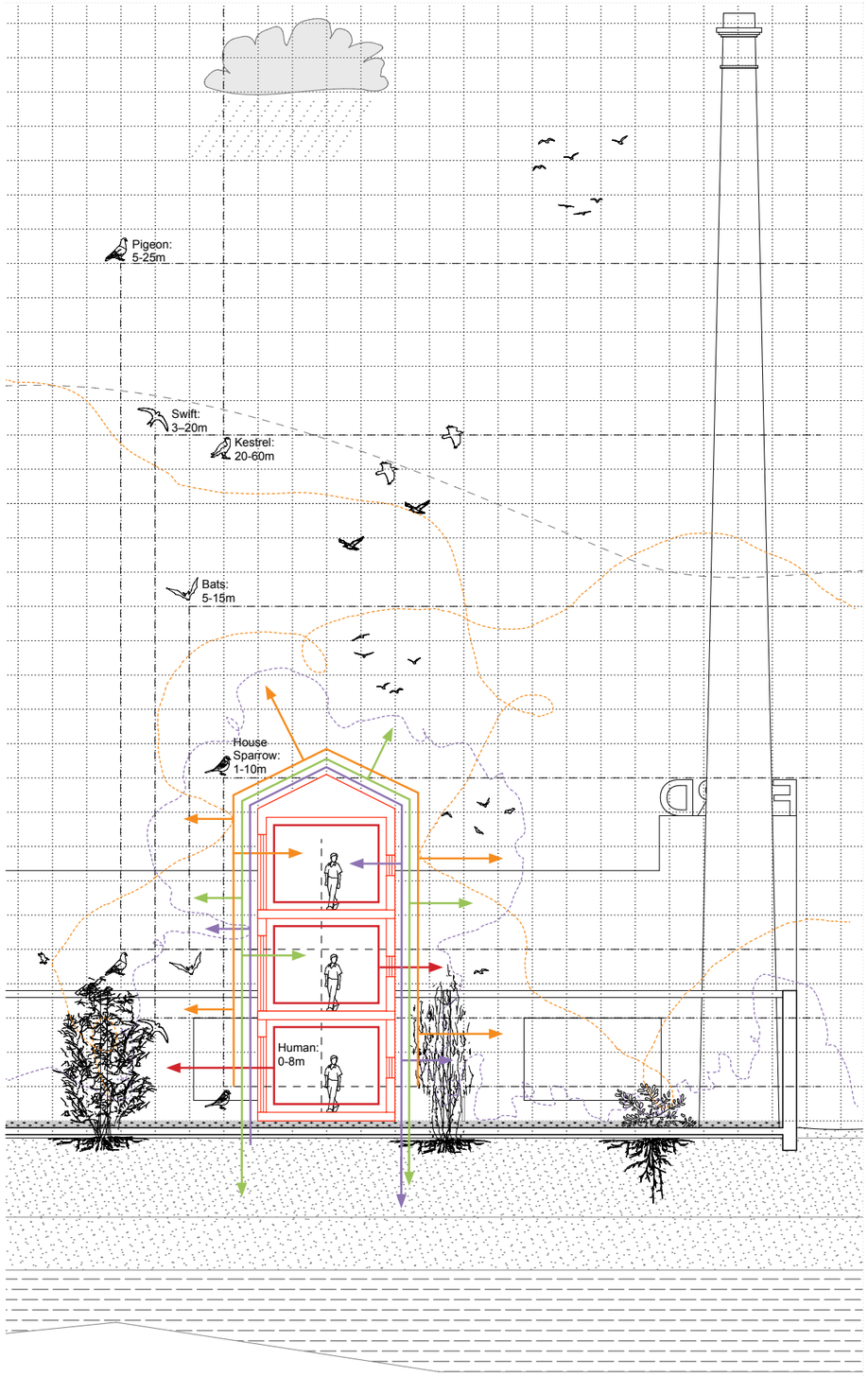
Affordances: Plants

Diagram “Ecolopes” (Weisser et al., 2023, p.10-11)

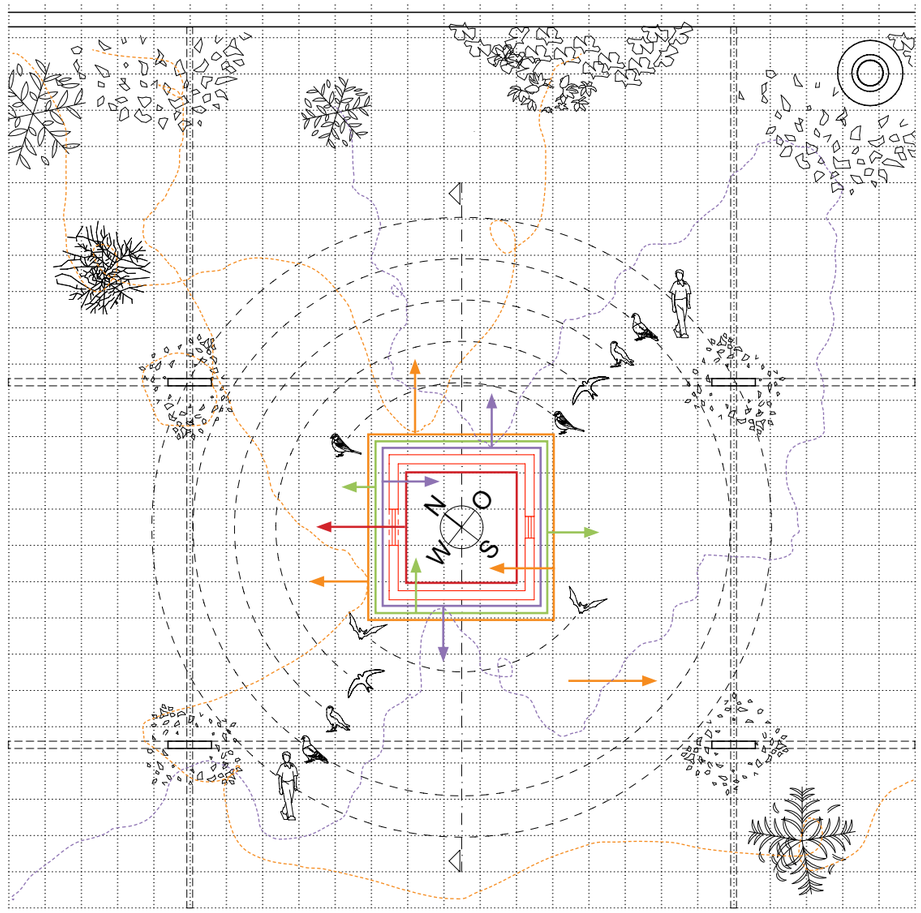
HYPOTHESIS: Architectural Object



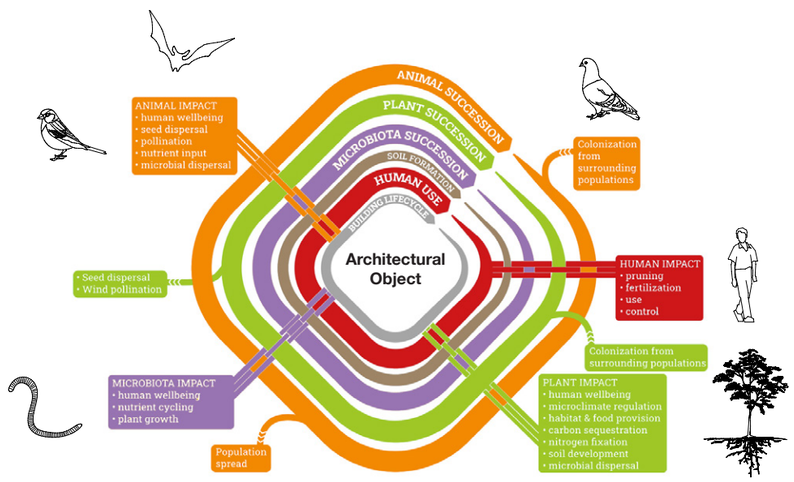
Environment of the ruin Palácio Ford, Porto (own work)



Section - Architectural object at Palácio Ford, Porto (own work)



Section - Architectural object at Palácio Ford, Porto (own work)



ROLE OF THE ARCHITECT

In a multi-species design practice in architecture based on affordances, the role of the architect is to design affordances and hence, to catalyse possibilities for multi-species actions. These actions can ultimately make it possible for human and non-human actors to enter into a symbiotic relationship with each other. In turn, this can lead to a possible flourishing co-existence and cohabitation in one place. Analysed through the diagram of affordances, the architect has a direct influence on physical structures such as *Shelter*, *Material environment*, *Nourishment*, *Accessibility* and *Safety & Well-being*, whereas he or she can indirectly effect the non-physical structures such as the *Community*, *Other species* and their socio-cultural *Practice & Service*. This is relevant, as the non-physical structures of the architectural object depend on the skills and abilities of the actor.

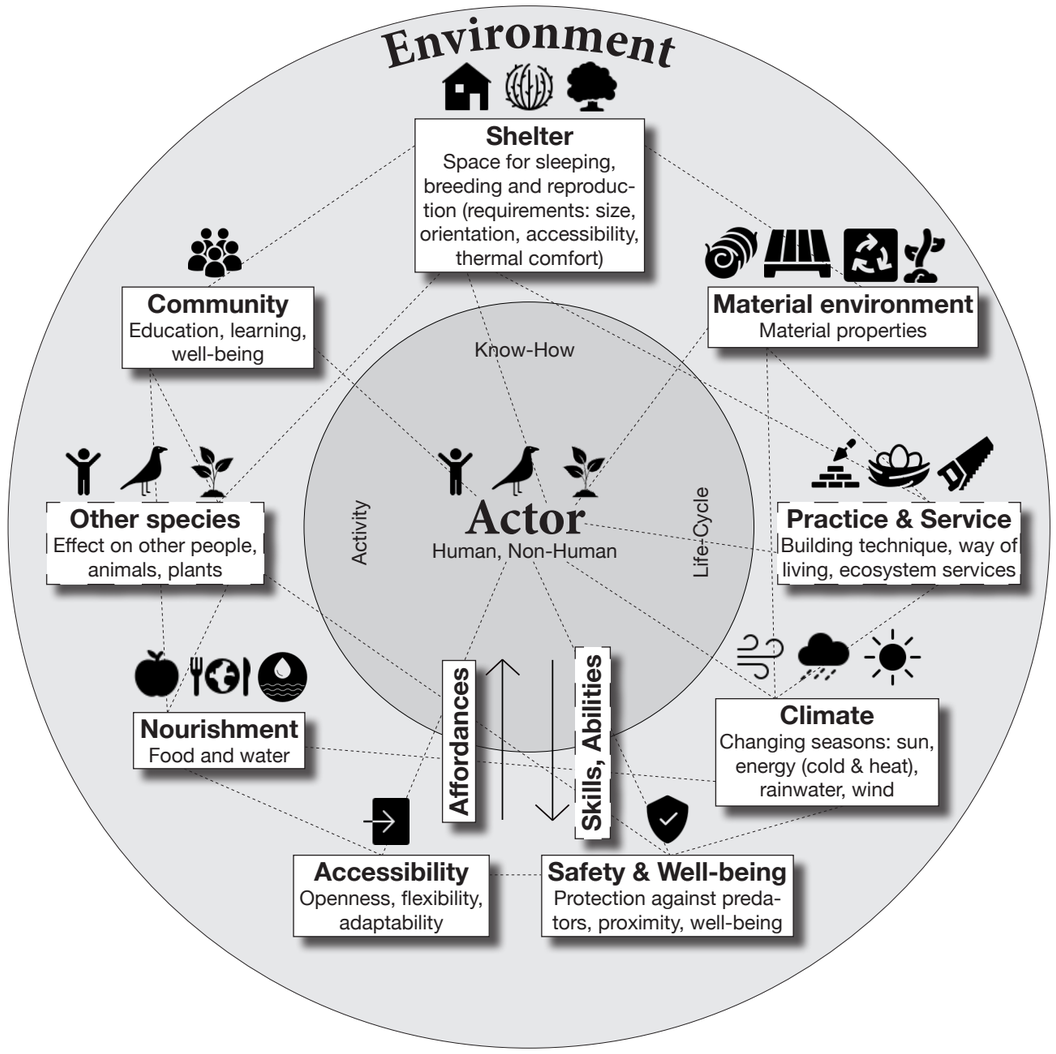
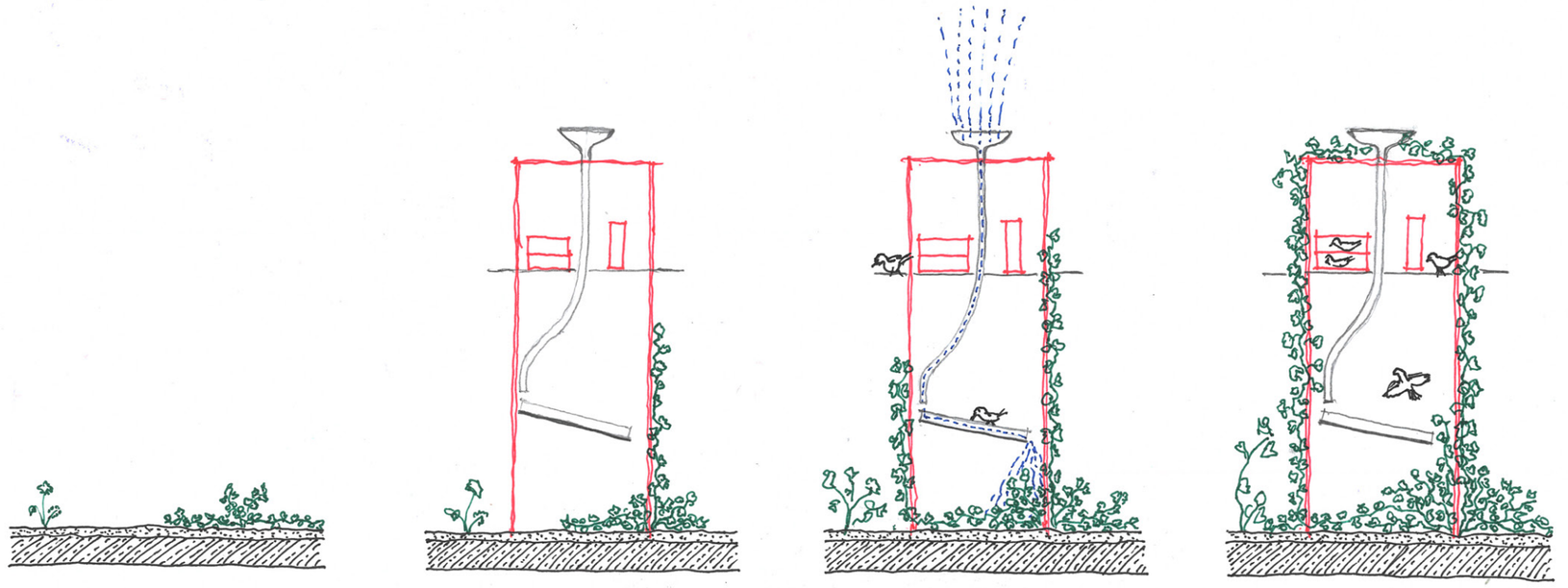


Diagram of Affordances (own work)

INSTALLATION “WOHNHÜLLE” AT PALÁCIO FORD

Installation “Wohnhülle” at Palácio Ford, Porto (own work)

Installation “Wohnhülle” at Palácio Ford, Porto (own work)



Existing

February 2023

Summer 2023

February 2023

4.0 DISCUSSION & CONCLUSION

The research conducted has shown that a multi-species design practice in architecture, based on the concept of affordances, can be regarded as a relevant tool for achieving a symbiotic relationship between architecture and biodiversity. It offers a valuable approach on social and ecological levels within the field of architecture, ultimately supporting biodiversity in the context of the built environment.

First, the investigation reveals that existing architectural design practices pose challenges within multi-species domains. These practices often exclude non-human spatial users and contribute to the production of homogenous urban landscapes, as they primarily focus on human-centered design parameters. Consequently, the architecture profession faces the challenge of considering non-human needs and incorporating habitat facilities for other beings into their projects.

Second, by acknowledging the presence and needs of non-human actors, a multi-species design in architecture based on affordances allows establishing relations and interconnections between different species. A useful tool for designers in this approach is the notion of affordances, which refers to the potential actions or behaviours enabled by the environment for people, animals, plants, and organisms. It is a concept that emphasizes the relationship between an organism and its environment, highlighting the opportunities for action that the environment provides. Understanding affordances helps designing environments and objects that better align with the abilities and needs of the individuals multi-species users who interact with them. Rather than focusing solely on the physical properties of objects or the internal mental representations of individuals, the notion of affordances emphasizes the intrinsic relationship between perception and action. Implementing the concept of affordances into architectural thinking helps to make design decisions on the basis of how much the intervention creates or strengthens possibilities for action to multi-species users of the project. In this process, it is important to consider that these actions depend on the skills and abilities of the human or non-human, which are embedded in socio-cultural behaviours of a particular context.

Thus, it seems valuable to learn from reading the socio-cultural reality of existing multi-species spaces such as ruins. In the course of this paper, the ideas of the cultural geographer Tim Edensor brought important insights to regard ruins as rich landscapes of affordances for multi-species beings. Throughout the successive development of affordances, ruins bear immense qualities for the urban ecology of the built environment, as they represent a heterogeneously space co-produced by humans and non-humans. The research demonstrates how ruins, as landscapes rich in multi-species affordances, facilitate various types of human and non-human actions in response to existing or evolving affordances. Therefore, ruins can be regarded as valuable urban ecological assets that enhance the vitality, biodiversity, and affordances of the urban environment.

For multi-species thinking in architecture, it is particularly instructive to reconsider the meaning of the terms decay, or vacancy. Space does not become useless after human abandonment, as the human act of abandonment results in spatial appropriation by non-humans. When designing human interventions in these kind of places, architects are challenged to acknowledge the socio-ecological qualities of ruins. In this context, a multi-species design practice based on affordances would have the advantage to do so, as it considers the needs and activities of other species on the basis of perception. Thus, the concept of affordances is a relevant system to read a multi-species environment such as the ruin.

To design affordances in a multi-species practice, architects can inform themselves through various nature-inclusive design guides, aiding in acquiring knowledge about the design parameters of other species. This process often requires extensive research, and thus, architects would benefit from working closely with ecologists and urban planners. One outcome of the research is the development of a diagram of affordances, which can effectively communicate specific affordances, as well as the skills and abilities of individual actors. It becomes evident that solely relying on literature brings limitations in a multi-species design practice, as identifying regional species groups requires field research. To do so, useful tools for analyzing existing affordances are provided by the Zoöp methods, which involve *Demarcating*, *Observing & Sensing* local actors, their behaviours, and their interconnections with the environment. This data can then be used to interpret the needs of different species and make informed design decisions. Architects are challenged to adopt a reflective multi-species design practice, as decisions are speculative, and multi-species design inherently possesses an experimental and self-dynamic nature. Thus, actions introduced through architectural intervention have temporal and dynamic aspects and need to be monitored over time and adjusted if necessary. This highlights the retrospective sense-making aspect of multi-species design practice, as it becomes an ongoing process of improvisation.

Lastly, a good multi-species design based on affordances should ideally make possibilities for action to humans, animals and plants explicit. This can be most efficiently done through the design of the architectural object as an open dynamic and socio-ecological object with both physical and non-physical structure. Moreover, the object must be considered as embedded element in its environment, which consists of a multiple set of affordances. In this process, the potential and the role of the architect is to design an object that facilitates one or a network of affordances. Thus, the chance is given to locomotive action and skills related to the socio-cultural behaviour of different multi-species users. Here, the future challenge for architects is to create a multi-species climate-adapted object in process and time, which considers needs and life-cycles of different species changing dynamically. Designers are asked to propose the envelope of the object as a profound relational space shared in co-existence between humans, animals and plants. In this threshold between outside and inside, dynamic exchanges between the environment, the object and its multi-species users can be designed with the affordance to support the life of all beings. But most important, it is in this situation, where design can enforce multi-species interactions which allow the establishment of symbiotic relations between humans and non-humans, or architecture and biodiversity. It is essential to the work that these actions can then only lead to mutually beneficial connections and cohabitation, if the designer also considers mitigating possible conflicts between different species in his or her work.

Thus, architects can contribute to meaningful places of co-existence between humans, animals and plants, as it can be the case in ruins as existing spaces of cohabitation.

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