# Respecting Rats:
# Creating healthy cities for humans, and the rats they inevitably attract

Submitted in partial fulfillment of the requirements for the degree of Master of Architecture at Lawrence Technological University. 2024

**Mackenzie Wilson**

**Thesis Committee:**

Scott Shall, Thesis Committee Chair
Taka Yoshikawa, Thesis Committee Member
Kurt Neiswender, Thesis Committee Member

**Figure 1**: Photograph of rats using human waste as resources. Source: (CHANAWAT PHADWICHIT/GETTY IMAGES)

# Respecting Rats:
# Creating healthy cities for humans, and the rats they inevitably attract

**Mackenzie Wilson**
Lawrence Technological University, Southfield, Michigan 2024

ABSTRACT: Historically, rats have followed human settlement. Whether it be in cites, suburbs, or rural areas, rats tend to follow humans. Current human habitats inadvertently create ideal conditions for rats, leading to their ability to thrive in these spaces. These adaptable creatures are especially drawn to dense urban areas because of their ample availability of resources such as food, water, and shelter. Due to this ability of rats to adapt to human environments, designs should be developed to peacefully coexist in shared urban spaces.

The current methods for managing rat populations—such as using traps, rodenticides, and free-ranging cats—do not achieve the desired results. These methods not only fail to control the population of rats, but they can also result in unintentionally encouraging the growth of diseased and more violent rat colonies. The very methods used to control rat populations actually achieve the opposite effect.

The built environment should adapt to accommodate the inevitable presence of rats, using their natural behaviors to guide architectural modifications for a balanced coexistence between humans and rats. Rats are densely populated in almost every large city. Chicago specifically was named the “Rattiest City” in the United States, which is where this

investigation will take place (Robledo 2023). By examining resource availability and detection methods (visual, auditory, olfactory, tactile) for both rats and humans, this research seeks innovative strategies to integrate rat populations into human environments, reducing conflicts and promoting mutual cohabitation.

KEYWORDS: Coexistence; Synanthropic; Ecology; Cooperation

## 0.1. TABLE OF CONTENTS



## 0.2. LIST OF FIGURES AND IMAGES

## Part 01: CURRENT RAT-HUMAN INTERACTION

### 1.1. Rats Throughout History

Rats have followed human settlement since the 1300s (Gunawan 2015). Initially, rats were a symbol of wealth and were often kept as pets (Gunawan 2015). However, over time humans grew a large distaste for rats because of the Black Plague. As it turns out, rats are not responsible for the Plague itself but rather the transmission of it (fleas that live on rats were the true culprits) (Gunawan 2015). According to Rob Kuznia's *PBS NewsHour* piece, the COVID-19 epidemic had a major effect on rat populations, forcing them to move into residential areas as a result of businesses and restaurants closing. The strain of adjusting to new food sources decreased rat populations significantly. However, rats began learning how to adapt to the changes brought about by COVID. So now that establishments have reopened, rat populations have bounced back and are thriving in big cities (Kuznia 2023).

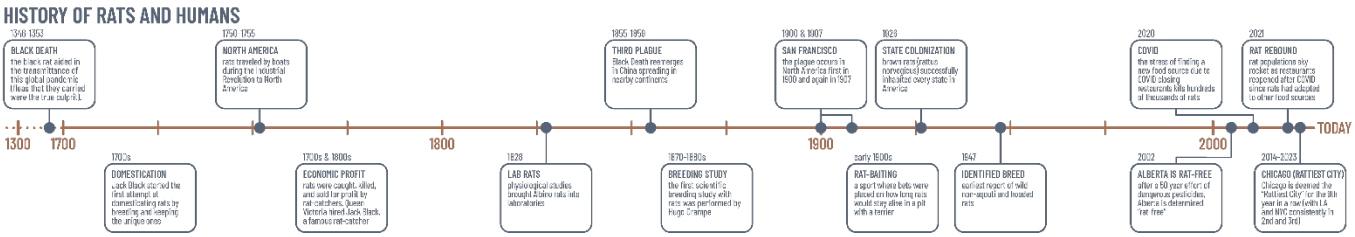


**Figure 2**: Timeline of rat interaction with humans. Source: (Image by Author 2024)

### 1.2. Rats in Human Perception

Due to the negative perspective on rats mainly from the Black Plague, rats have integrated into human language. The term “rat” has very negative connotations in most cultures. Referring to someone as a “rat” means that they are possibly dishonest, disorderly, or a traitor (Stewart). Additionally, it is commonly thought that rats are dirty animals. However, rats are actually very clean. Rats do not like being dirty therefore they clean their fur almost immediately when dirt gets in their fur similar to a cat (FOUR PAWS 2022). The belief that rats are dirty may also be attributed to the general spread of disease from rats. However, the only way for humans to contract a disease directly from a rat is from a bite, consumption, or contact with their bodily excretions (FOUR PAWS 2022). Although the truth about rats does not support general beliefs about the, these adverse associations continue to thrive in human society.

### 1.3. Rat Population in Chicago

A study completed by Illinois Answers Project and Block Club Chicago revealed over 214,000 rat complaints in Chicago from 2019 to the end of 2022. These findings reflect the difficulties in managing the rat population in Chicago and draw attention to the significant public concern about it. Chicago has been named the “Rattiest City” in the United States by Orkin for nine years in a row, based on the number of rodent treatment services implemented (Robledo 2023).

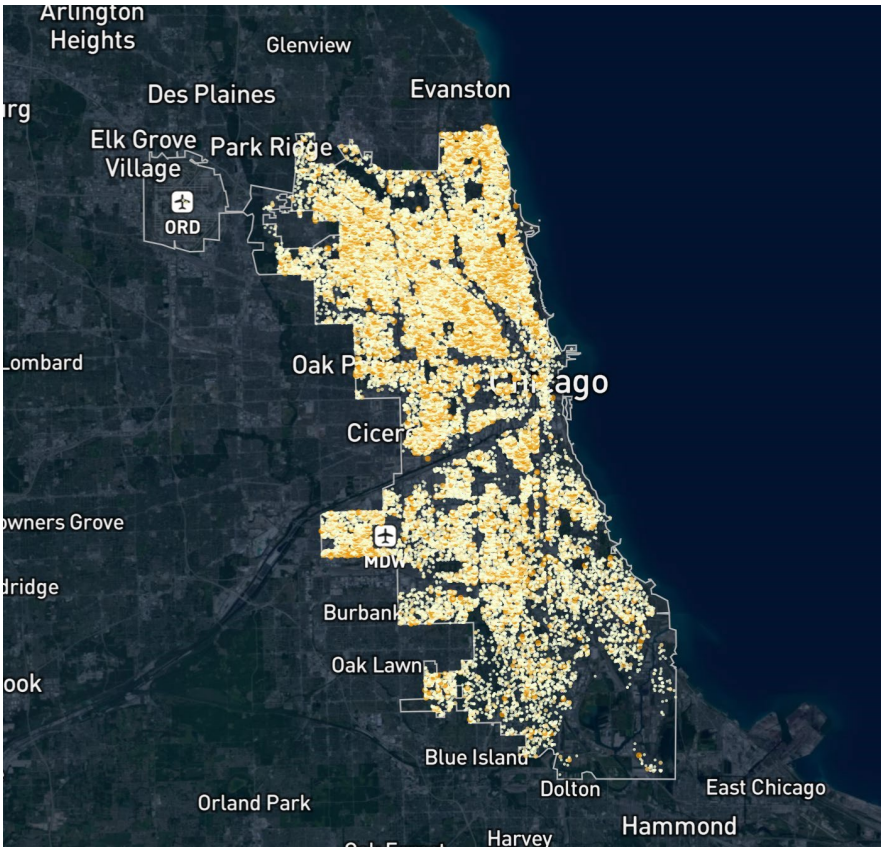


**Figure 3**: Map of rat complaints in Chicago from 2019-2022.. Source: (Chicago Department of Streets and Sanitation | Analysis by Casey Toner. Map by Cesar Calderon. 2023)

### 1.4. Effects of Rat Traps

Snap traps may be somewhat helpful for individual homes, however, they are not a long-term answer to rat infestations. These techniques have a humanized impact on the ecosystem in addition to disrupting the social structures of rat populations, which results in more violent behavior (J.B. MacKinnon 2023). As a result, these disruptions tend to promote the spread of diseases among surviving rats, making the issue more severe rather than improving it and emphasizing how difficult it is to effectively control the rat population.

### 1.5. Effects of Rodenticides

Although anticoagulant rodenticides are an affordable option for managing rat populations, their effectiveness is questionable. When a rat is poisoned, it can take five to ten days before the rat is killed. During this period of time, rats' immune systems are severely weakened, making them three times more likely to carry and spread infections (J.B. MacKinnon 2023). By not efficiently regulating the rat population, this cycle makes matters worse by increasing the threat posed to it. Additionally, rodenticides are not consumed solely by rats, which can result in unintentionally disrupted ecosystems. Furthermore, when natural rat predators eat poisoned rats, these toxins not only cause resistance in rats but also cause harm to the wildlife (J.B. MacKinnon 2023).

### 1.6. Effects of Other Rat Population Control Methods

Other methods to reduce rat populations would work in theory, however, they are simply unreliable in practice. Although some support using free-ranging cats to control rats, their efficacy is still debatable. Rats are experts at escaping capture, thus cats are more likely to seek smaller prey like birds and mice. In reality a cat may stalk 20 rats, but it may only attempt to kill three of them, and most likely be successful with none (Lodi). Introducing natural predators Furthermore, it is important to remove rat attractants by enforcing sanitary standards and securely storing food waste in durable containers. However, these measures by themselves are unable to appreciably reduce rat populations in the absence of regular enforcement and upkeep due to the unreliability of humans (J.B. MacKinnon 2023). Overall, changing human behavior and releasing cats into urban environments are not feasible solutions to control rat infestation. Historical attempts to eradicate rats in cities have consistently failed, often exacerbating the problem. These attempts ignore the ecological balance and adaptive capabilities of rats, leading to ineffective and environmentally damaging outcomes. Hostile urban architecture like barbed wire and metal needles used to deter animals, as mentioned in Jain Aaishwarya's work, often results in harmful consequences for wildlife. Such approaches are counterproductive to fostering a sustainable cohabitation between humans and urban wildlife.

### 1.7. Consequences of Current Rat Conditions

Brown rats coexist with humans in a variety of environments, but because they are linked to diseases like salmonellosis and the bubonic plague, which they can spread via bites, urine, or fleas, they are frequently considered pests. Despite their ability to self-clean, there are health hazards associated with them (Hulme-Beaman 2021). Also, by eating and tainting grains and animal feed, brown rats damage property, taint food supplies, and have a negative impact on agriculture (Hulme-Beaman 2021). Overall, rats existing in human environments may pose many negative consequences on human existence. Ecological urbanism promotes socially just and environmentally sensitive interventions, aligning with the need for humane urban wildlife management. This approach considers the well-being of all urban inhabitants, including animals, offering a more balanced and ethical solution to urban wildlife issues.

### 1.8. Sustainability of Anthropocentric Design

Current urban planning practices focus exclusively on human needs, disregarding the sustainability of cohabiting with urban wildlife like rats, leading to unsustainable ecological outcomes. If unchanged, this anthropocentric approach will exacerbate environmental imbalances, increasing conflicts between humans and animals (Ned Dodington 2014). A shift towards inclusive urban design, recognizing and integrating the needs of all life forms, promises mutual benefits. By fostering coexistence, cities can become ecosystems that support diverse species, ensuring a sustainable, vibrant future for both humans and rats (Ned Dodington 2014). This holistic approach is essential for the ecological and social health of urban environments.

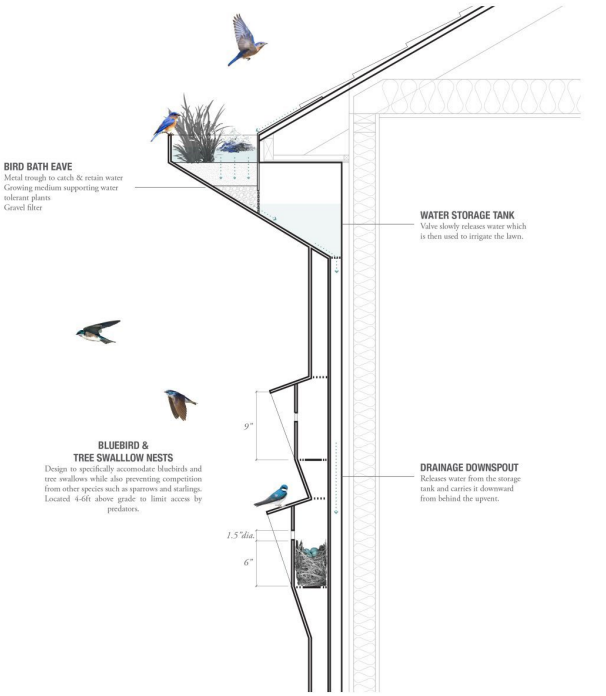


**Figure 4**: Proposed example of how urban wildlife (in this case birds) can become mutually beneficial with humans.. Source: (Sarah Gunawan 2015)

## Part 02: WHY RATS THRIVE

### 2.1. Rat Adaptability

Rats are difficult to remove from urban environments because of their ability to adapt to human settings. Their physical characteristics, which include a large caecum, a long alimentary canal, constantly growing incisors, and lack of a collar bone, allow them to survive in hostile environments and to take use of a variety of food sources (Jeanna Bryer 2008). They follow certain migratory routes in search of warmth, obtain food and water from human dwellings, and use materials such as insulation for nesting. Their ability to adapt, along with their skills for climbing and flexibility in their food, emphasizes the necessity of safe circulation techniques to keep them out of houses and away from inflicting harm (Vulcan Termite 2019).

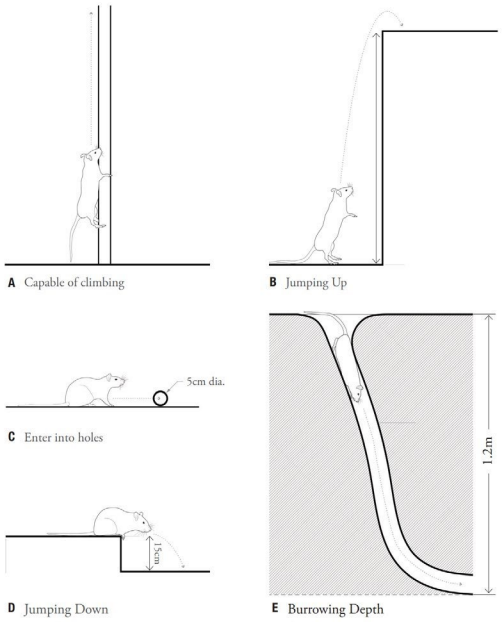


**Figure 5**: Physical movement capabilities of rats. Source: (Sarah Gunawan 2015)

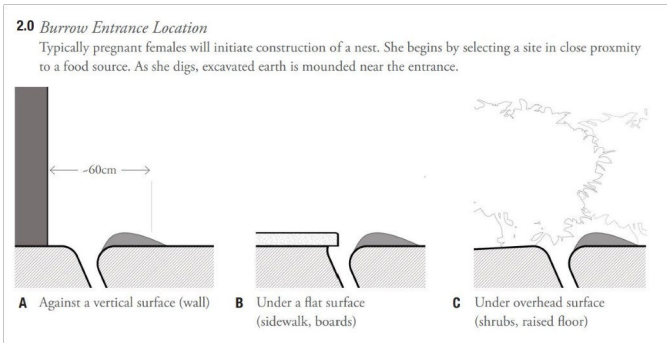


**Figure 6**: Burrow entrance locations of rats in relation to the built environment. Source: (Sarah Gunawan 2015)

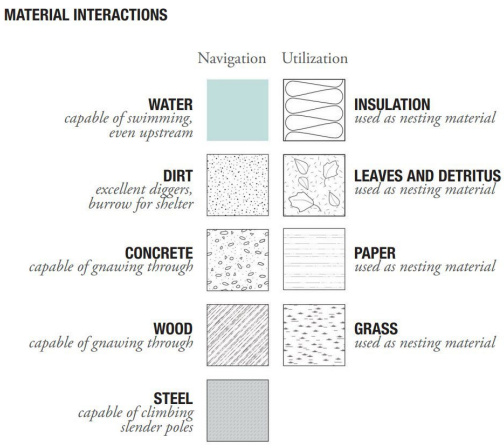


**Figure 7**: Material interactions of rats. Source: (Sarah Gunawan 2015)

## 2.2. Design Practices that Support Rat Populations

The design and layout of urban spaces encourage rats to populate there. Textured walls and gaps in enclosures encourage rat infestations by giving these adept climbers to easily access buildings. Vertical planes perpendicular to the ground (walls, curbs, installations, etc.) provide rats with a safe traveling condition. Narrow alleys are perfect conditions for rats as they often have an abundance of food resources with little to no lighting, minimal human traffic, and plenty of textures/vertical planes to travel along.

Additionally, alleys are consistent throughout the entire city, offering rats a clear network to reach other resource locations. Rats can consume almost anything which results in them often damaging buildings by eating through insulation, structural components, and electrical wires, leading to fires and structural issues. The convergence of these factors, alongside human errors and the lack of effective rat-proofing measures, significantly increase the likelihood of rat populations flourishing in city settings.

## 2.3. Maintenance Practices that Support Rat Populations

Urban environments, with their high density of resources in close proximity, create perfect conditions for rats to thrive. This is largely due to human negligence. Rats have easy access to resources in poorly maintained buildings and poorly managed trash, which helps them survive and reproduce (J.B. MacKinnon 2023). Rats find ideal conditions when trash is left on streets and building maintenance is neglected, as this gives rodents access to food, shelter, and materials for nesting. The neglect of property upkeep and waste management has a direct effect on rat control initiatives, increasing the vulnerability of human habitations to infestations. The abundance of food sources, from restaurant dumpsters to improperly managed trash pickups, offers rats easy access to sustenance (City of Chicago).

## 2.4. Resident Considerations

Increasing rat populations result in poor outcomes for not only humans, but rats as well. John B. Calhoun discovered that high population densities damaged rat colonies' social structures, resulting in increased aggression and abnormal behavior. These behaviors included abandonment and cannibalism of young rats, hypersexuality, and social retreat, all of which contributed to the collapse of their social structure and eventual extinction. In light of these observations, architectural strategies to prevent rats from nesting in close proximity to human habitations should give priority to

designs that reduce the conditions that encourage overcrowding. Examples of these strategies include making sure that garbage is managed effectively and erecting obstacles to entry. We may prevent rat populations from growing by incorporating these ideas into architectural designs, which will reduce the threats to human health and the environment.

## Part 03: DESIGN CONDITIONS

### 3.1. Building Scaled Interventions

In order to feasibly alter the existence of rats in an existing city, this thesis aims to design elements at the building scale that can be altered and mimicked throughout the entire city to improve rat-human cooperation without sacrificing the current aesthetics. Designing rat-friendly structures that incorporate sustainable urban designs is a crucial part of modifying urban settings to conform to natural rat habits. By redesigning the local elements to incorporate rat habitats into pre-existing architecture in a way that minimizes tight quarters and promotes cohabitation in a subtle but useful way. By adapting building practices to allow for more rat-friendly designs, with a focus on adopting building methods and materials that reduce ecological disturbance. Rat habitat integration and the preservation of the natural equilibrium are ensured by taking the environment into account both throughout the building and demolition stages. The goal of deconstruction innovations is to save rat populations, emphasizing the significance of ecological factors in urban development initiatives.

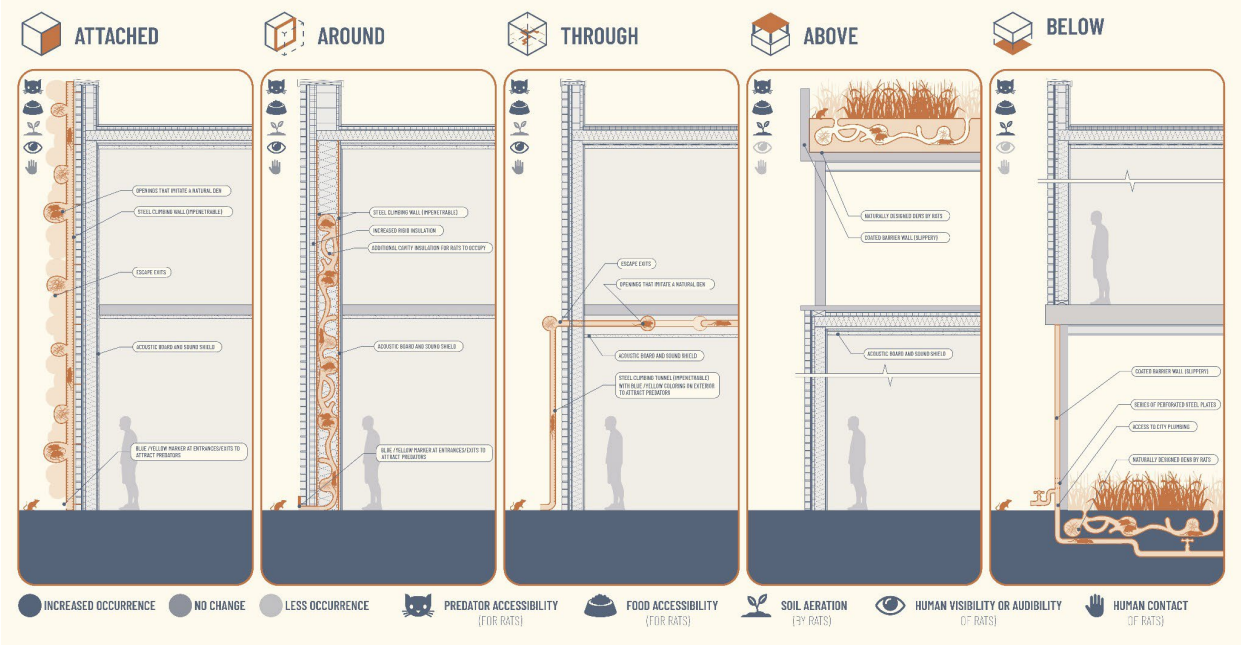


**Figure 8**: General speculation of how rats would be integrated into the built environment. Source: (Image by Author 2023)

### 3.2. Resident Considerations

Rat management and human well-being should be better balanced in Chicago. However, it is important to consider the current residents' desires. It is ideal that these approaches address both rat problems and human concerns through the design solutions that are sensitive to community needs. By looking for solutions that locals find acceptable and helpful, community programs that educate residents on sustainable coexistence promote understanding and support. This strategy aims to create a shared urban environment by balancing the needs of Chicago's rat and human populations.

## Part 04: DESIGN INVESTIGATION

### 4.1. Primary Goal

Minimizing negative rat-human interactions is the primary goal in this investigation. The objective is to establish a peaceful coexistence through understanding and minimizing the variables that cause these interactions. It is achievable to lessen the detrimental effects of rat populations on human communities and vice versa to promote a healthier and more sustainable urban ecology. By addressing the core causes, such as availability of food and housing, and putting architectural and environmental initiatives into practice, peaceful coexistence may be possible.

### 4.2. Primary Variable

The primary variable in this investigation is the building envelope's architectural design. The envelope research will focus on altering their designs to control interactions between people and urban rat populations. Using design to

address the inevitable presence of rats in urban settings and promote a balanced ecosystem within the built environment. The goal is to create harmonious cohabitation spaces that minimize negative impacts on both humans and rats by modifying the architectural elements of the building envelope.

### 4.3. Controls

4.3.1 The location of this investigation will take place in West Town, Chicago. This location has a significant number of rat complaints, dense human and rat populations interact within the U.S.'s "rattiest" city, exacerbating conflicts (Robledo 2023).

4.3.2 Rats tend to invade human spaces more often in the winter in order to receive warmth. Therefore, this investigation will base its predictions on cold winters, where rats are more prevalent.

4.3.3 This investigation will also take place as a retrofit in an existing mixed-use building, where public businesses as well as residential invasion of rats can be addressed.

### 4.4. Dependent Variables

4.4.1. Success in reducing negative human-rat conflict will be measured by a decrease in rat resources in non-human spaces. Ensuring food, water, and shelter are inaccessible to rats outside human areas will indicate less of a desire for rats to invade human spaces.

4.4.2. The ability of rats to penetrate human spaces will be evaluated by the frequency of rat encounters within living or working environments. A reduction in these incidents reflects better building integrity and effective sealing of entry points.

4.4.3. Minimizing human intrusion into rat spaces will be gauged by reduced human-rat interactions in areas typically inhabited by rats. This success indicates effective urban planning that respects wildlife habitats while safeguarding human areas.

4.4.4. Diminishing the ability of rats to sense and avoid predators or humans will be assessed through their behavior and movement patterns in urban settings. Lower detection rates suggest an improvement in environmental controls that disorient rat navigation.

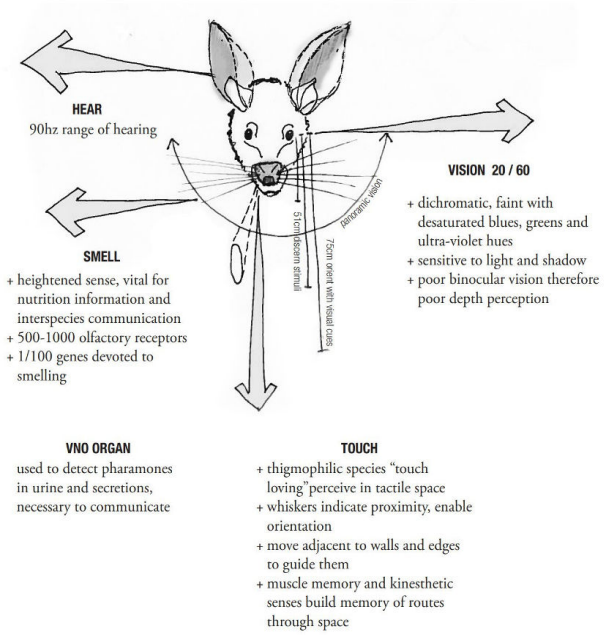


**Figure 9**: Efficiency of rats' senses. Source: (Sarah Gunawan 2015)

4.4.5. Lastly, reducing human ability to detect rats, aiming for coexistence with minimal distress, will be measured by fewer reports of rat sightings and related complaints. Success here means integrated urban designs that keep rats out of sight and mind, fostering a harmonious cohabitation.

**1**
**VERTICAL SPACE**
High shelves are not immediately perceivable but are accessible to the rat because of their ability to climb.

**2**
**TACTILE DIFFERENTIATION**
High sensitivity to touch allows the rat to differentiate between smooth tile surface versus textured laminate wood providing orientation and spatial location within the room.

**3**
**PROTECTIVE INTERFERENCE**
Table and chair legs as well as the island base interrupt the open floor space of the kitchen providing sheltered spaces beneath which to hide.

**4**
**PHYSICAL INTERRUPTIONS**
Rats are warry of changes and interruptions into the physical environment of their preferred passage routes.

**5**
**PROTECTED EDGE**
Underside of cupboards provides protection.

**Figure 10**: How rats perceive human spaces. Source: (Sarah Gunawan 2015)

## Part 05: RESULTS AND CONCLUSIONS

### 5.1. Intentionally Designing where Rats Belong

Initially this investigation wanted to design intentionally to attract and deter rats for them to peacefully coexist among the human population. The plan below is to design intentional spaces for rats to inhabit that provides them with all the resources they need so that they are not tempted to invade human spaces.

The thesis investigation emphasizes the necessity for a change in direction by highlighting the unsustainable effects of current city designs on interactions between rats and humans. This project recognizes that rats are inevitably going to try and invade human spaces. The outcome goal is to lessen these negative encounters, not halt them altogether. The primary focus of urban design is meeting human demands, with little regard for ecological balance or coexisting with urban wildlife, such as rats. Conflicts between humans and animals as well as environmental imbalances are made worse by this anthropocentric approach. According to the research, inclusive urban planning that takes into consideration the requirements of all living things is the way to go in order to ensure a bright future for both humans and rats. Cities can become ecosystems that support a variety of species and ensure the ecological and social wellbeing of society by promoting cohabitation and taking rats into consideration when developing urban areas. Achieving a balanced coexistence and tackling the issues raised by urban wildlife require an all-encompassing strategy.

In order to achieve overall cohabitation, building envelopes were investigated specifically with the intention of this design being implemented throughout the city). Rat characteristics, such as their need for overhead protection, tendency to climb, gnaw, and reliance on whiskers for navigation, can be strategically used in building envelope designs to prevent unwanted rat interaction and encourage cohabitation in specific locations. By understanding the wants and needs of rats, the architecture can be curated to attract and deter rats from different human spaces accordingly. This strategy not only addresses the immediate problems that rats in urban environments present, but it also emphasizes the more general need for architecture that balances the requirements of people and wildlife in order to promote a sustainable coexistence. The results call for a redesigned urban environment in which nature and design work together to improve everyone's quality of life—human and animal alike.

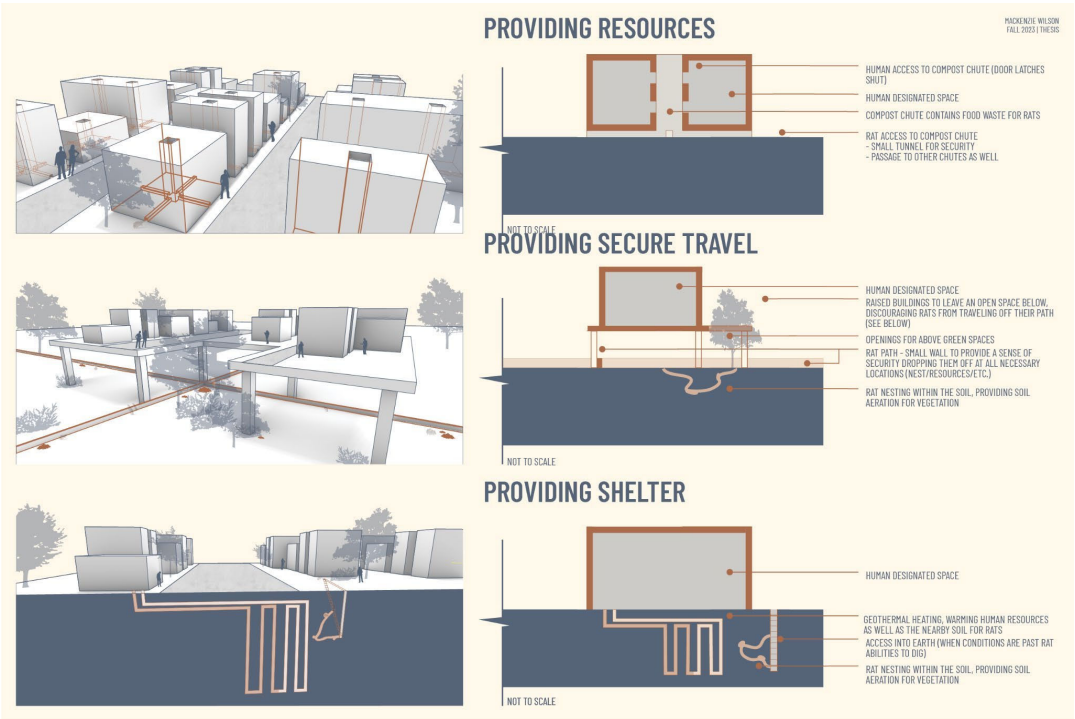


**Figure 11**: Speculations of how rats can be integrated at the entire building scale. Source: (Image by Author 2023)

In order to achieve overall cohabitation, building envelopes were investigated specifically with the intention of this design being implemented throughout the city). Rat characteristics, such as their need for overhead protection, tendency to climb, gnaw, and reliance on whiskers for navigation, can be strategically used in building envelope designs to prevent unwanted rat interaction and encourage cohabitation in specific locations. By understanding the wants and needs of rats, the architecture can be curated to attract and deter rats from different human spaces accordingly. This strategy not only addresses the immediate problems that rats in urban environments present, but it also emphasizes the more general need for architecture that balances the requirements of people and wildlife in order to promote a sustainable coexistence. The results call for a redesigned urban environment in which nature and design work together to improve everyone's quality of life—human and animal alike.

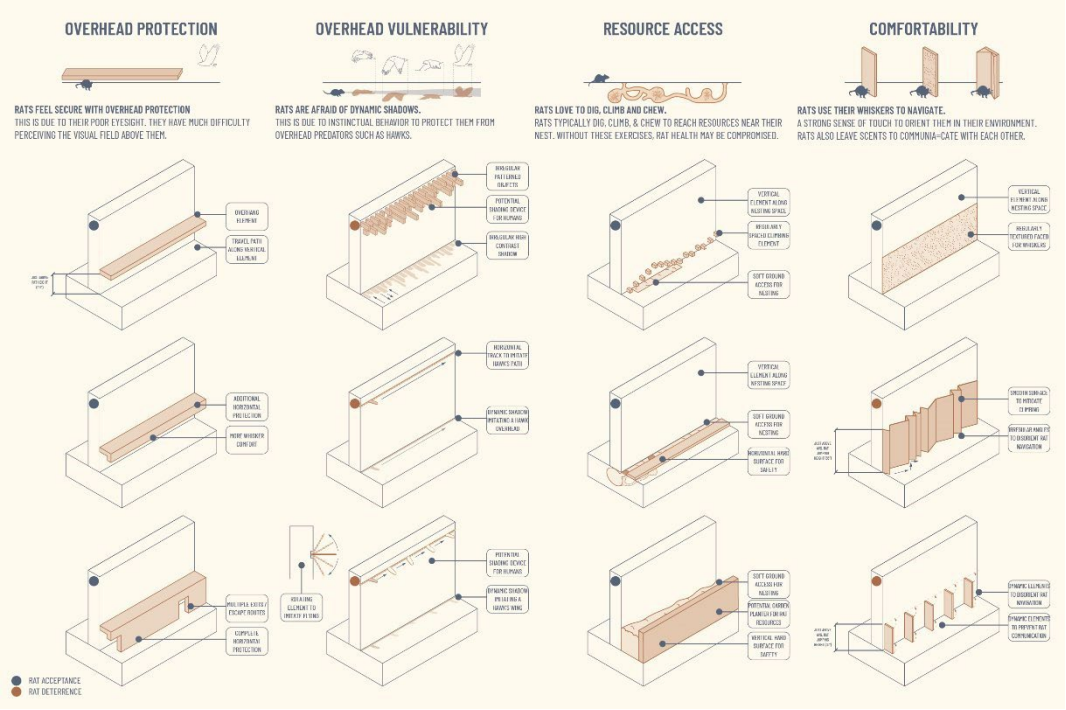


**Figure 12**: Speculations of building envelope design to attract or deter rats. Source: (Image by Author 2024)

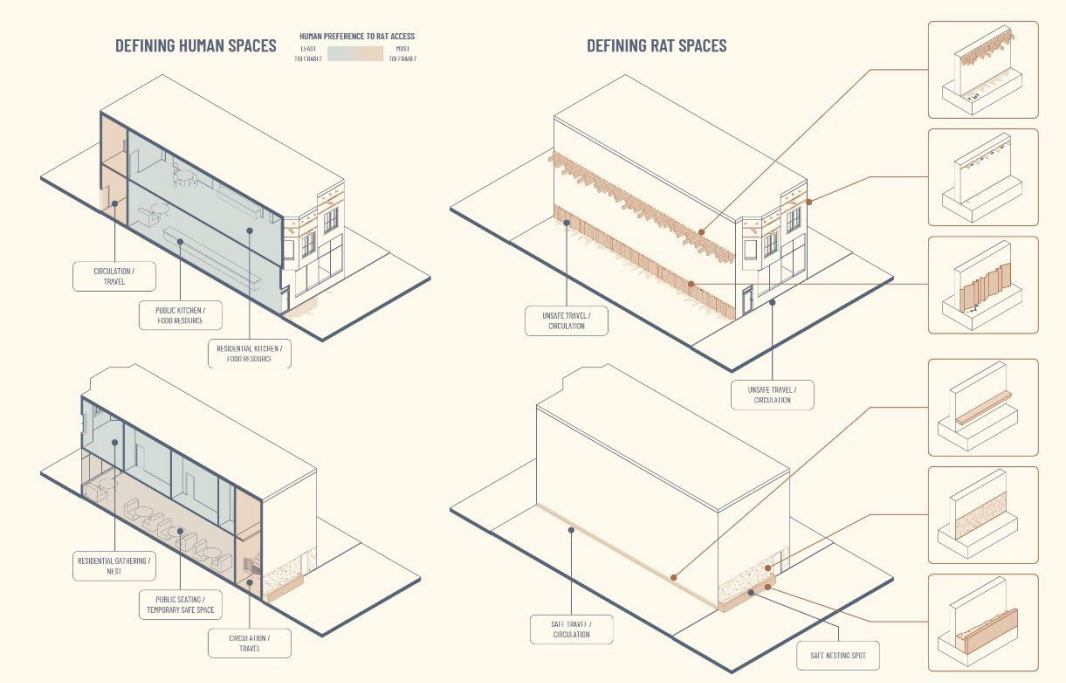


**Figure 13**: Speculations of building envelope design to attract or deter rats applied to Chicago building. Source: (Image by Author 2024)

### 5.2. Findings of Intentionally Designing where Rats Belong

Intentionally Designing for where rats do and do not belong would be an effective route to take if rats were not as adaptable as they are. However, as previously stated in Section 2.1, rats are able to adapt to almost any environment. Therefore, designing spaces that attract them would most likely result in overcrowding, ending in a worsened state for both rats and humans. Essentially, every space is already designed to attract rats, so that is not a problem that requires a new solution. However, designing spaces to deter rats is currently a large issue. Therefore, this thesis investigation began investigating only the rat deterrent strategies.

### 5.3. Results of Rat Deterrent Investigation

In order to deter rats, two qualities of the rat were focused on to deter them. The first quality is their poor eyesight, making it difficult for them to perceive high contrasting colors and objects. The second is their incredible whisker sensation that they need in order to travel safely (due to their poor eyesight). A series of four investigations is made using curtainwall, brick, concrete, and metal paneling.

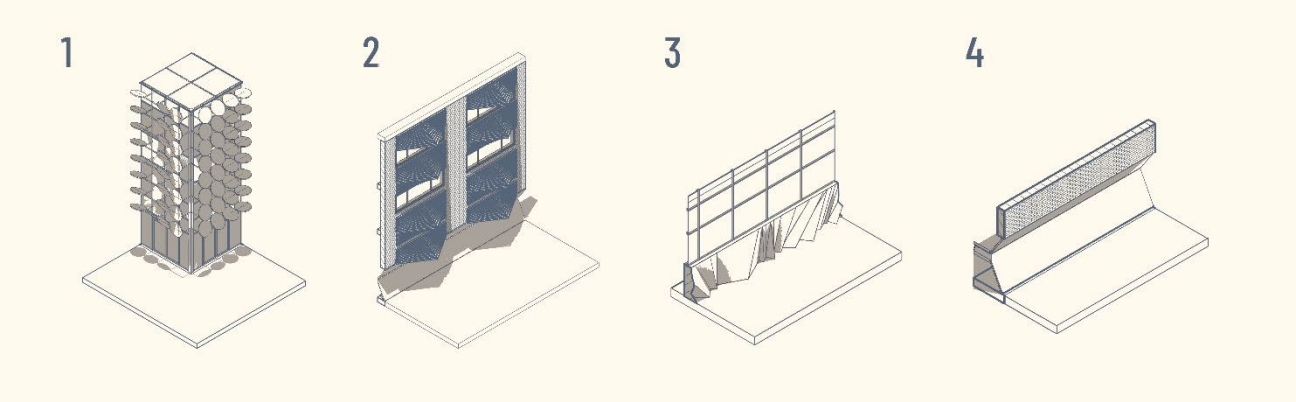


**Figure 14**: Four investigations made to deter rats. Source: (Image by Author 2024)

The first design investigation uses a kinetic shading system in front of a glazed curtainwall. This condition will create a moving shadow pattern along the ground. These moving shadows make it difficult for the rats to determine what the moving shadow is. This also will imitate the appearance of an overhead predator, making this an uncomfortable place for rats to travel through.


**Figure 15**: Dynamic shading system on a curtain wall to deter rats. Source: (Image by Author 2024)

The second investigation uses a protruding brick pattern above the first floor height. This creates high contrasting shadows The constant high contrasting shadows will be difficult for the rat to feel safe consistently. Similar to the previous curtainwall investigation.

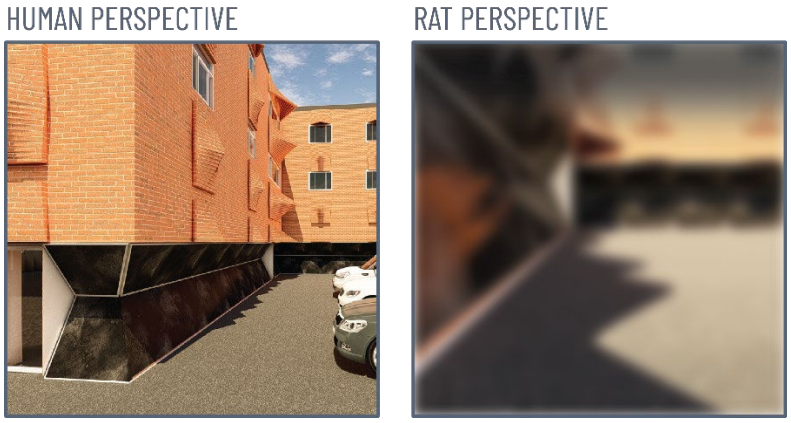


**Figure 16**: Protruding brick façade creating high contrasting shadows to deter rats. Source: (Image by Author 2024)

The third investigation uses a dimensional concrete base and the ground intersection of the façade. This investigation requires rats to contort their body around these corners consistently to travel safely by with whisker sensation. If they decide not to travel directly along the wall, but rather in a straight line, they will not receive consistent whisker sensation. This would result in an uneasy and unsafe travel path for rats.

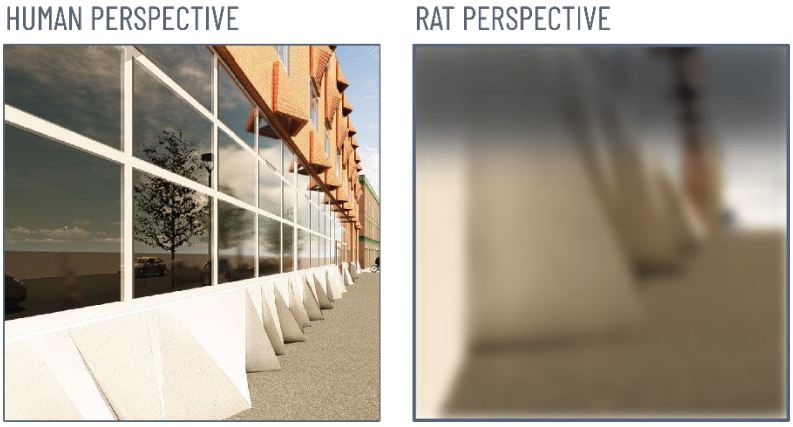


**Figure 17**: Dimensional concrete facade at the ground plane to deter rats. Source: (Image by Author 2024)

The fourth investigation uses an angled metal panel to deter rats from nesting and travelling in this area. The metal panel is smoother than typical Chicago materials such as brick, preventing rats from easily climbing and reaching residential spaces within the building. The angle of this panel requires the rat to angle their head to receive full whisker sensation. Therefore, the rat will either not have full comfort as they walk along the wall, or they will tilt their head which makes the rat uneasy.

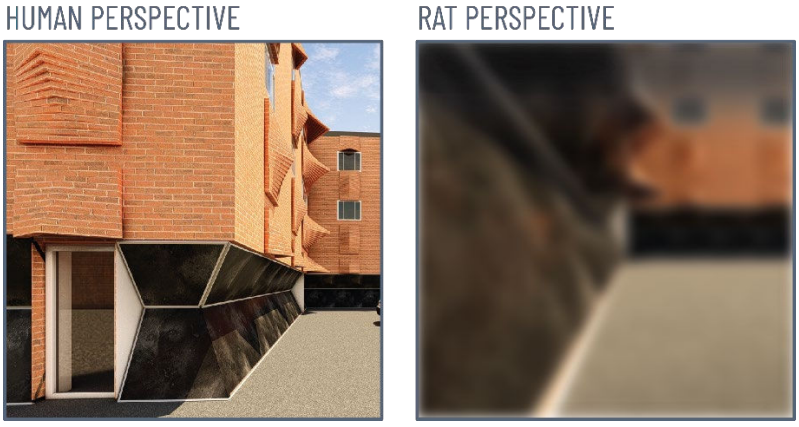


**Figure 18**: Angled metal panel at the ground plane to deter rats. Source: (Image by Author 2024)

**Figure 19**: Culmination of all four investigations. Source: (Image by Author 2024)

## APPENDIX A

### A.1 Examining the Current Spectrum of Relationships between Cities and Wildlife
Jain Aaishwarya

I am studying the current relationships between cities and wildlife because I want to find out how architectural changes can help solve issues with rats in dense urban areas, in order to understand how we can coexist peacefully with these animals, rather than resorting to harmful and often unsuccessful methods of eradication.
This source is significant to my work because it explores the contemporary situation of wildlife in cities and emphasizes the negative impacts of human interference on their natural existence, is especially pertinent to my research. It critically looks at the usage of hostile architecture, which is frequently used in urban areas to deter animals. Examples of hostile architecture include barriers topped with barbed wire and metal needles. This source presents a transdisciplinary approach that goes beyond conventional architecture and urban planning by advocating the adoption of ecological urbanism. It focuses on developing socially just solutions that are considerate of the needs of animals as well as the environment. This viewpoint provides insights into different approaches for resolving urban rat issues through coexistence and ecological consideration, which is precisely in line with this study.

Key excerpts:

- “This usually manifests as hostile architecture towards urban animals. Walls topped with barbed wire, glass shards, or pointed metal needles serve as a defense mechanism in buildings in many cities.” (Aaishwarya)
- “Adopting an ecological urbanism approach would call for transdisciplinary strategies that look beyond the confines of architecture, urban planning, and human needs to be able to produce “socially just interventions that are sensitive to the environment.”(Mostafavi, 2020).

### A.2 Synanthropic Suburbia
Sarah Gunawan

The source "Synanthropic Suburbia" by Sarah Gunawan is extremely relevant when discussing the coexistence of urban animals with architectural interventions that mitigate rat issues associated with dense urban environments. This thesis investigates the idea of synanthropic architecture and argues for incorporating animal habitats into urban planning. It highlights a departure from conventional architectural methods and suggests creative solutions for designing areas that satisfy the needs of both people and animals, particularly in urban areas. This concept is crucial to my research on how to modify architecture to allow urban species, such as rats, to live in harmony and create a more sustainable urban ecology instead of using destructive extermination techniques.

Key excerpts:

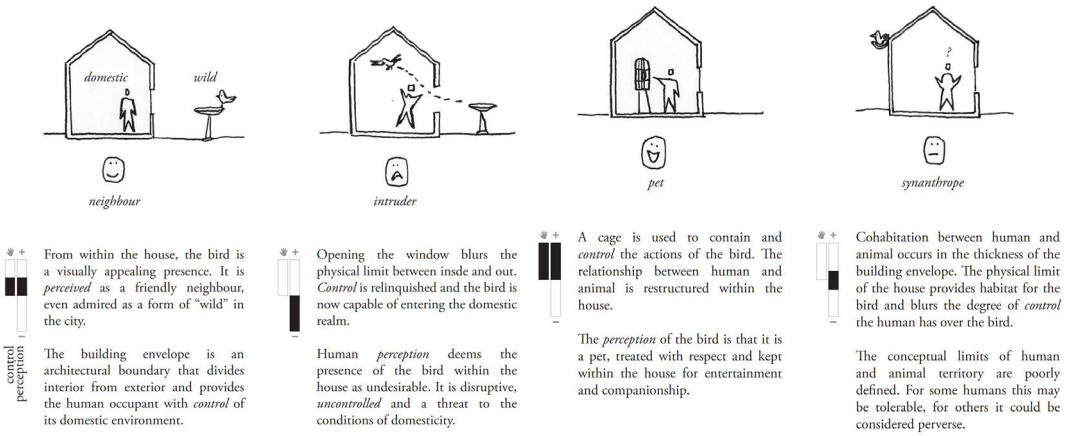


**Figure 14**: Examples of relationship types between humans and urban wildlife. Source: (Sarah Gunawan 2015)

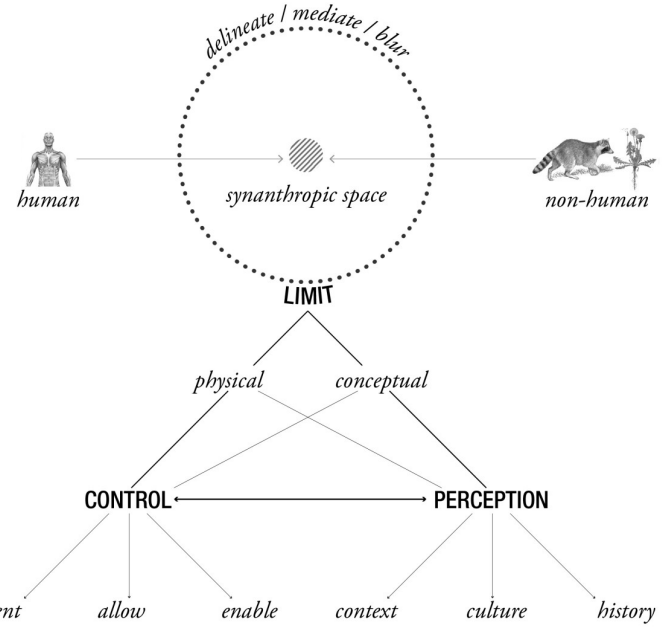


**Figure 15**: Diagram of how humans and urban wildlife can successfully coexist. Source: (Sarah Gunawan 2015)

### A.3 Synanthropic Habitats

Ned Dodington

I am studying "Synanthropic Habitats" because I want to find out how to create ecosystems where people and animals both live, particularly in urban contexts. This source highlights how crucial it is to create architectural plans that incorporate animal habitats, allowing people to live side by side with different species, such as bats, birds, and oysters. This strategy claims that architectural interventions can have a positive impact on urban wildlife habitats and entails the creation of shared living areas. The article provides insights on how architecture might be modified to manage urban rat problems, encouraging peaceful coexistence rather than destructive eradication tactics. It is closely aligned with the theme of urban wildlife harmony in large cities.

Key excerpts: ● “Synanthropic projects rely on a collaborative relationship between human and animal partners and this is not unique to them alone – indeed most, if not all, of the projects on Animal Architecture claim somekind of symbiotic relationship and propose a kind of utopian other-world view that is possibly lightly romanticised, and usually optimistic” (Dodington)

- "Synanthropic Habitats propose scenarios where animals and humans live closely together in crossspecies cities or abodes."
- "The basic modus operandi of Synanthropic Habitats is humans making concerted efforts to design for, improve, and invite alternate species into human environments."

### A.4 How Will We Live Together with All Other Species?

Marko Brajovic

This source examines the possibility of human coexistence with other species, highlighting the necessity for a change in ecological awareness and interdependence. By criticizing the anthropocentric worldview and the profit-seeking of nature, Brajovic promotes coexisting more peacefully with other species. The COVID-19 pandemic, which is viewed as a catalyst for rethinking human connections with nature along with each other, is used to frame this discussion. The source also discusses how cities could develop into more inclusive ecosystems where people and wildlife become mutually beneficial. This viewpoint is especially pertinent to the coexistence of urban animals and the necessary architectural redesign required to handle rodent problems in densely populated areas, favoring coexistence over destructive extermination techniques.

Key excerpts:

- “...we urgently need architects to project themself in time and imagine the bright future, products, buildings, and cities designed for all species.”

- "The urban space is designed only for humans and eventual domesticated animals. So when wildlife comes downtown, we are scared, and as well deeply seduced with our ancestral perception of co-living with other species."

### A.5 Animal-Aided Design – Using a Species' Life-Cycle to Improve Open Space Planning and Conservation in Cities and Elsewhere.

Wolfgang W. Weisser, Thomas E. Hauck

The source suggests using "Animal-Aided Design" (AAD) to incorporate open space design and biodiversity conservation into urban development. AAD requires that designers consider the needs of animals from the very start of a project, as these needs both inform and inspire design. The objective is to pair effective urban planning with species protection by developing urban areas that either sustain steady wildlife populations or foster their expansion. This strategy suggests a change from a human-centric to a more inclusive urban design that takes into account the requirements and cohabitation of many species, which is especially pertinent for tackling difficulties with rat harmony and urban wildlife harmony in densely populated regions.

Key excerpts:

- "It is unclear, however, how such green infrastructure can be implemented, given existing planning practices that generally ignore biodiversity"
- "We propose 'Animal-Aided Design' (AAD) as a methodology for the design of urban open spaces, to integrate conservation into open space planning"
- "The basic idea of AAD is to include the presence of animals in the planning process, such that they are an integral part of the design."
- "For AAD, the desired species are chosen at the beginning of a project. The requirements of the target species then not only set boundary conditions for the design, but also serve as an inspiration for the design itself."
- "using a species' life-cycle to improve open space planning and conservation in cities and elsewhere"

### A.6 How Cities Reshape the Evolutionary Path of Urban Wildlife

Brendan I Koerner

This source expresses the rapid adaptation of urban wildlife through evolution. Studying these adaptations will reveal how necessary it is that wildlife and humans need to coexist, and how architecture could aid this solution. This demonstrates how some animals may survive in challenging urban settings, raising the possibility of creating urban areas that coexist peacefully with resilient wildlife. It emphasizes the need of comprehending the genetic adaptations of urban animals such as rats, as this could guide architectural modifications to mitigate rodent problems in cities, promoting coexistence instead of using damaging control measures.

Key excerpts: ● "But in the quest to satisfy their intellectual curiosity, urban evolution researchers are also revealing the fundamental genetic attributes that make some species adept at adjusting to urban life—intelligence that could give us the power to forecast evolution's winners and losers in a world that's increasingly hot and crammed with people."

- "Kettlewell's experiment on 'industrial melanism' ... illustrates how species can evolve in a matter of years rather than over millennia due to intense environmental pressures."
- "Urban evolution research can help make our post-climate-change lives less grim... identifying which animals are genetically primed to adapt well to living amid glass and steel."
- "...city-dwelling creatures have adapted to life among buildings, traffic, and discarded Big Macs"

### A.7 Chicago Wildlife Existence Plan

Lori E. Lightfoot

The source highlights the value of animal and human cooperation in urban environments while discussing Chicago's distinctive urban wildlife ecology. It emphasizes how important it is to establish educational programs and use sensible urban design to reduce the problems caused by wildlife (especially rats) in crowded cities. The strategy recommends steps to reduce unfavorable interactions and encourage harmonious relationships, such as appropriate waste management and habitat changes to coexist. This strategy aligns with the goal of controlling rat populations in cities in a compassionate and practical manner without using damaging techniques, to get a better understanding of how current solutions are working.

Key excerpts:

- “Wildlife are part of the strength and the heritage of Chicago, and they’re here to stay.”
- "Educating residents on local wildlife populations will guide individuals in making appropriate decisions regarding their safety and managing their property and pets."
- "The presence of food sources is often the leading cause of issues in communities, attracting animals to houses and backyards."

## APPENDIX B

### B.1 Synanthropic Suburbia by Sarah Gunawan

In "Synanthropic Suburbia," Sarah Gunawan explores the concept of integrating wildlife habitats within suburban architecture by leveraging animals' natural behaviors. She proposes "architectural scale synanthropic prosthetics" that facilitate animal cohabitation in areas designed for human use, such as suburban neighborhoods, which, despite appearing mundane, offer wildlife opportunities through unintentional architectural features. Gunawan's analysis indicates that thoughtful architectural adjustments can foster coexistence between humans and wildlife, particularly rats in urban environments, by designing spaces that consider animals' needs, thus promoting ecological balance and inclusivity in urban planning.

### B.2 Bat Tower by Joyce Hwang

The "Bat Tower" in New York, developed by Joyce Hwang, exemplifies how architectural projects can support urban wildlife, specifically bats. This innovative structure is designed to meet the specific needs of bats, offering them a suitable habitat within an urban park. While focusing on enhancing bat populations and ecological balance, the Bat Tower demonstrates how architectural designs can facilitate wildlife habitation, including rats. This project aligns with the thesis that urban architecture should evolve to accommodate wildlife, showing that similar strategies can enable rats to coexist peacefully with humans in urban ecosystems.

### B.3 Vertical Forest Milan by Boeri Studio

The Vertical Forest in Milan, by Boeri Studio, exemplifies the integration of natural habitats into urban architecture, targeting cohabitation for humans, birds, and dense vegetation on its facades. While it contributes to environmental sustainability by incorporating green spaces and $CO_2$ absorption, criticisms arise over its carbon-intensive and expensive construction. This project aligns with themes of adapting urban spaces for wildlife, stressing the need for balancing ecological benefits with sustainable construction practices to foster harmonious urban wildlife cohabitation, particularly addressing the challenges and opportunities in designing for urban ecosystems.

### B.4 Rooftop Pigeon Lofts

Rooftop Pigeon Lofts in New York City serve as designated structures for housing domestic pigeons, significantly altering their natural behaviors and ecosystem interactions. Managed by their owners, these lofts provide a safe yet controlled environment, diverging from pigeons' traditional urban existence. This practice, while offering protection, domesticates pigeons and detaches them from their natural urban settings, contrasting with architectural strategies aimed at fostering balanced coexistence with urban wildlife. The pigeon lofts exemplify a managed interaction that underscores the need for designs supporting wildlife's autonomy and natural behaviors within urban landscapes.

### B.5 Banff Wildlife Crossings by Public Works Canada

The analysis evaluates Banff Wildlife Crossings in Canada, structures enabling safe wildlife passage over highways, thus reducing animal-vehicle collisions. These crossings exemplify successful integration of wildlife needs into human infrastructure, offering a model for urban architectural designs that accommodate wildlife. Evidence shows these crossings effectively reduce traffic accidents involving wildlife. This supports the claim that such architectural interventions, by providing safe passages for urban wildlife, can facilitate harmonious coexistence between humans and animals in densely populated areas, demonstrating infrastructure can be designed to respect wildlife movement, promoting safer urban environments.

## REFERENCES


Aaishwarya, Jain, and Madhulika A.S. “Examining the Current Spectrum of Relationships between Cities and Wildlife .” MULTILOGUE COLLECTIVE, Mar. 2021, www.multiloguecollective.org/post/theelephant-in-the-room-addressing-wildlife-inclusivity-in-th.

"Allegheny County Health Department. 'How Rats Enter Homes from Sewers.' Allegheny County, www.alleghenycounty.us/uploadedFiles/Allegheny_Home/Health_Department/Programs/Housing_and_Community_Environment/Rodent-ACHD-How-Rats-Enter-Homes-from-Sewers.pdf. Accessed 28 Oct. 2023."

Brajovic, Marko. "How Will We Live Together with All Other Species?" Medium, 16 April 2020, https://medium.com/@marko_30279/how-will-we-live-together-with-all-other-species-f7ea438fe8b6

Bryner, Jeanna “How Whiskers Help Rats Find Their Way.” NBCNews.Com, NBCUniversal News Group, 27 Feb. 2008, www.nbcnews.com/id/wbna23373403.

City of Chicago,
www.chicago.gov/content/dam/city/depts/cacc/PDFiles/FINAL_CHICAGO_WILDLIFE_Mangement_&_Coexistence_plan2021.pdf. Accessed 19 Sept. 2023.

Dodington, Ned, et al. “Synanthropic Habitats.” Ex En, 5 Feb. 2014, expandedenvironment.org/synanthropic-habitats/.

Froberg-Fejko, Karen. “Give a Rat a Bone: Satisfying Rodents’ Need to Gnaw.” Nature News, Nature Publishing Group, 19 Sept. 2014, www.nature.com/articles/laban.611.

Gunawan, Sarah. “Synanthropic Suburbia.” UWSpace - Waterloo’s Institutional Repository, 1 Jan. 1970, hdl.handle.net/10012/9765.

“How Good Are Cats at Catching Rats? - Lodi UK.” Lodi UK Ltd, www.lodi-uk.com/agricultural-mediacentre/news/how-good-are-cats-at-catchingrats#:~:text=They%20only%20managed%20to%20kill,don’t%20see%20them%20anymore! Accessed 27 Oct. 2023. Accessed 3 Feb. 2024.

“How Good Is a Rat’s Sense of Smell?” Terminix, https://www.terminix.com/, 24 July 2023, www.terminix.com/blog/science-nature/rats-sense-of-smell/#:~:text=Rats%20rank%20pretty%20high%20in,to%20land%20mines%20and%20tuberculosis.

How Rats Enter Homes from Sewers - Allegheny County, www.alleghenycounty.us/uploadedFiles/Allegheny_Home/Health_Department/Programs/Housing_and_Community_Environment/Rodent-ACHD-How-Rats-Enter-Homes-from-Sewers.pdf. Accessed 28 Oct. 2023.

Hulme-Beaman, Ardern et al. “The origins of the domesticate brown rat (Rattus norvegicus) and its pathways to domestication.” Animal frontiers : the review magazine of animal agriculture vol. 11,3 78-86. 19 Jun. 2021, doi:10.1093/af/vfab020

Koerner, Brendan I. “How Cities Reshape the Evolutionary Path of Urban Wildlife.” Wired, Conde Nast, 23 Sept. 2019, www.wired.com/story/urban-wildlife-evolution-climate-change/.

Kuznia, Rob. "Rats Are on the Rise. Here’s What Cities Are Doing About It." *PBS NewsHour*, March 4, 2023. https://www.pbs.org/newshour/nation/rats-are-on-the-rise-heres-whats-cities-are-doing-about-it.

Lightfoot, Lori E. “Chicago Wildlife Existence Plan” Wired, Conde Nast, 23 Sept. 2020, https://www.chicago.gov/content/dam/city/depts/cacc/PDFiles/FINAL_CHICAGO_WILDLIFE_Mangement_&_Coexistence_plan2021.pdf.

MacKinnon, J. B. Hakai Magazine. “In Defense of the Rat.” Hakai Magazine, hakaimagazine.com/features/indefense-of-the-rat/. Accessed 27 Oct. 2023.

McCartney, Josie. “Digestive System of the Rat (Rattus Norvegicus).” Instructure, vasd.instructure.com/courses/6421/files/84392/download?wrap=1#:~:text=%E2%9E%94%20They%20have%20a%20large,their%20search%20for%20food%20easier.

MessyNessy. “The Rooftop Pigeon Men: A New York Subculture.” Messy Nessy Chic, 22 Jan. 2019, www.messynessychic.com/2013/09/11/the-rooftop-pigeon-men-of-new-york/.

Nonstudio. “My Neighbor, the Bat by Joyce Huang.” Biodesigned, Biodesigned, 11 Nov. 2021, www.biodesigned.org/joyce-hwang/my-neighbor-the-bat.

“Prejudices Against Rats.” FOUR PAWS International – Animal Welfare Organization, 99 May 2022, www.fourpaws.org/our-stories/publications-guides/prejudices-against-rats.
Robledo, Anthony. “Chicago Holds Rattiest City for 9th Straight Year as La Takes #2 Spot from New York, Orkin Says.” USA Today, Gannett Satellite Information Network, 25 Oct. 2023, www.usatoday.com/story/news/nation/2023/10/23/chicago-rattiest-city-for-9th-straight-year/71296021007/.

Stewart, Post. “Grammarphobia Blog: You Dirty, Yellow-Bellied Rat.” Grammarphobia, 2 Dec. 2016, www.grammarphobia.com/blog/2016/12/rat.html#:~:text=English%20speakers%20began%20using%20the,especially%20in%20a%20romantic%20relatioship.

Termite, Vulcan. “Can Rats Climb?” Vulcan Termite & Pest Control, 9 June 2019, www.vulcantermite.com/pest-profiles/can-rats-climb/#:~:text=They%20have%20five%20phalanges%20%E2%80%9Cfingers,%2C%20wires%2C%20ropes%2C%20etc.

“This Vertical Forest Tower Makes Elite Green Design Affordable. but Is It Actually Green? | CBC News.” CBCnews, CBC/Radio Canada, 18 Nov. 2021, www.cbc.ca/news/world/green-housing-bosco-milan-trudo-netherlands-1.6228709.

Weisser, Wolfgang W., and Thomas E. Hauck. “Animal-Aided Design – Using a Species’ Life-Cycle to Improve Open Space Planning and Conservation in Cities and Elsewhere.” bioRxiv, Cold Spring Harbor Laboratory, 1 Jan. 2017, www.biorxiv.org/content/10.1101/150359v1.

“Wildlife Crossings Key to Highway Safety in Banff.” discoverAPEGA, discoverapega.ca/stories/wildlife-crossingskey-to-highway-safety-in-banff/. Accessed 18 Sept. 2023.