The Multispecies City: Becoming with Rats in Zurich

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pour l'obtention du grade de
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Summary

This thesis focuses on rethinking the rat-human relationships in Zurich's multispecies urban landscape. The shared history of Norway rats (*rattus norvegicus*) with humankind and their ubiquity as urban animals has given rats a reputation as pesky pests and a branded them as generally unwelcomed co-inhabitants of what are considered human spaces in the city. Taking its cue from the question "How can we rethink the rat-human relationship in a multispecies city?" this thesis argues for a reconsideration of the rat-human relationship in terms of a more-than-human co-becoming. I use a combination of theoretical approaches from the fields of Urban Political Ecology (UPE) and Animal Geographies to advance the understanding of the co-constituted relations between humans and other-than-human beings in order to explore the different roles and spaces of rats in Zurich. Using the concepts of the 'rat multiple' (Mol, 2003), 'rat spaces and places' (Philo & Wilbert, 2000) as central themes, the thesis reveals how spatial, legal, and political contexts shape rat lives in the social and material fabric of urban environments.

Noting the many pitfalls of anthropocentric approaches, this thesis proposes a more-than-human methodology which allows for the study of urban rats in their multiple roles, emphasizing their co-constitutive nature in shaping the urban environment and human-rat relations (Brighenti & Pavoni, 2020; Urbanik, 2012). I apply mixed-methods approach grounded in a multispecies ethnography in order to capture complex entanglements through participant observation, interviews, and field notes, which enabled me to address the methodological consequences of the epistemological challenges of conducting animal research. As such, this thesis contributes to acknowledging and respecting the unheard voices and traces of other-than-human beings and make space for their stories to emerge (Dooren & Rose, 2012). Through this data I analyse the 'becoming with' (Haraway, 2008) of rats, humans, and other-than-human beings and explore the ramifications thereof in regards ways of co-existence in a multispecies city.

Overall, by examining the making, killing and 'becoming with' rats in Zurich, this thesis advances the understanding of the rat-human relationship and, in particular, how this relationship has been shaped through socio-cultural and spatial interactions. By critically questioning and challenging the fixed boundaries and categories of how rats are perceived and where they should be, this thesis works toward a more informed multispecies co-existence between rats, humans, and other-than-human species.

Résumé

Cette thèse vise à repenser les relations entre le rat et l'homme dans le paysage urbain multispécifique de Zurich. L'histoire commune qu'entretiennent les rats de Norvège (rattus norvegicus) et l'humanité, ainsi que leur omniprésence en tant qu'animaux urbains ont donné aux rats une réputation d'animaux nuisibles et les ont stigmatisés comme co-habitants non désirés de ce qui est considéré comme des espaces humains dans la ville. Partant de la question "Comment pouvons-nous repenser la relation rat-homme dans une ville multi-espèces ?", cette thèse plaide pour une reconsidération de la relation rat-homme en termes de coappartenance plus qu'humaine. J'utilise une combinaison d'approches théoriques issues des domaines de l'écologie politique urbaine (Urban Political Ecology, UPE) et des géographies animales pour faire progresser la compréhension des relations co-constituées entre les humains et les êtres autres qu'humains afin d'explorer les différents rôles et espaces propres aux rats à Zurich. En utilisant les concepts de 'rat multiple' (Mol, 2003) et de 'rat spaces and places' (Philo & Wilbert, 2000) comme thèmes centraux, la thèse révèle comment les contextes spatiaux, juridiques et politiques façonnent la vie des rats dans le tissu social et matériel des environnements urbains.

Contournant les écueils des approches anthropocentriques, cette thèse propose une méthodologie plus qu'humaine qui permet d'étudier les rats urbains dans leurs rôles multiples, en mettant l'accent sur leur nature co-constitutive dans le façonnement de l'environnement urbain et des relations homme-rat (Brighenti & Pavoni, 2020 ; Urbanik, 2012). Je applique une approche mixte fondée sur une ethnographie multi-espèces afin de saisir ces enchevêtrements complexes par le biais de l'observation participante, d'entretiens et de notes de terrain. Ce travail m'a permis d'aborder les conséquences méthodologiques des défis épistémologiques liés à la recherche sur les animaux. En tant que telle, cette thèse contribue à reconnaître et à respecter les voix et les traces non entendues des êtres autres qu'humains et à faire émerger leurs histoires (Dooren & Rose, 2012). À travers les données récoltées, j'analyse le 'becoming with' (Haraway, 2008) des rats, des humains et des êtres autres qu'humains, et j'explore l'articulation de ce phénomène avec les modes de coexistence dans une ville multi-espèces.

Enfin, en examinant la fabrication, la mise à mort et le 'becoming with' des rats à Zurich, cette thèse fait progresser la compréhension de la relation entre le rat et l'homme et, en particulier, la manière dont cette relation a été façonnée par les interactions socioculturelles et spatiales. En remettant en question les limites et les catégories fixes de la perception des rats et de l'endroit où ils devraient se trouver, cette thèse œuvre en faveur d'une coexistence multi-espèces mieux informée entre les rats, les humains et les espèces autres qu'humaines.

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Introduction

Multispecies Worlds

> In December 2017, I found myself in the city of Marseille, walking back to the hotel with my colleagues after a team retreat day. The touristy city was bustling with people and, to my fascination, rats. I had seen the occasional rat scurrying around metro stations in New York, London and Seoul, but I had never seen so many rats running around alleyways in such large numbers and so seemingly undisturbed by people passing by. My colleagues were not as intrigued as I was at the time; in fact, they were a bit disgusted. They expressed their concerns for how the city apparently managed, or rather did not manage, this 'problem'. I had been striving to find a good *problématique* for my thesis on urban nature. Somehow, the living and moving critters that I had in front of my eyes did not qualify as part of 'urban nature' in my eyes. Instead, I was thinking of green spaces, parks, ecosystem services and aesthetically pleasing forms of urban nature. Yet, the simple idea of rats as agents of both nature and urban gnawed holes into my neatly defined understanding of urban nature and started blurring the boundaries of dichotomies that I did not even know were deeply embedded in my head. I did not know it at the time, but this encounter was the very moment in which rats became the central subjects of my thesis.

The idea of an 'urban nature' that responds to anthropocentric interests has become popular in the last two decades and has been heavily promoted by scholars and politicians alike, in an attempt to answer the calls to save the environment from capitalist overexploitation of the human species (see Robbins 2012; Angelo 2019). Proponents of this kind of urban nature believe, to put it bluntly, that the greener a city is, the better. The concept of urban gardening is booming; grass lawns are being replaced with biodiverse seed mixes mirroring a meadow, and every new building now features some green space, a green wall or trees in the name of sustainability and the environment. But what about the ugly, the mundane and the everyday 'mud' side of nature (Haraway 2016)? What about the rats?

While I reflected on these questions, the Urban Political Ecology (UPE) framework emerged as a promising approach to further unfolding the intricate dynamics of the co-

constructed spaces humans and other-than-humans share. Encompassing the understanding of the blurred boundaries between humans and nature, UPE challenges the perception of urban environments as purely human territories, instead defining them as spaces teeming with other-than-human life. It directs attention towards how urban processes, as well as human behaviours, contribute to the formation of these shared spaces. In doing so, UPE aids in the challenging and deconstructing of traditional dichotomies such as nature–society, culture–environment and city–wilderness (see Keil 2005).

I wondered about how the human–nature relationship is understood and enacted when 'humans' and 'nature' are no longer seen as separate categories. Deeply seated notions of the urban as a 'non-natural' environment in opposition to a pristine wilderness of nature were still deeply anchored in my mind; I grappled with finding a way to think about this topic without reproducing or even strengthening these dichotomies. Drawing inspiration from concepts such as 'hybrids' (Latour 1993; Whatmore 2002) and 'cyborgs' (Swyngedouw 1996; Gandy 2005; Haraway 2006) was a first step to understanding the world as composed of in-between categories in contradiction to the neatly separated dichotomies of 'human' and 'nature'. However, trying to determine which parts of an environment can be attributed to each category still runs the great risk of reinforcing dualist thinking while attempting to overcome it. Are the rats in Marseille a rebellion of nature? Or are they a typically urban phenomenon? Where would one most expect to find rats? In a city or in a forest? How can we rethink these categories?

I pondered how I could move away from placing 'other-than-human beings' into categories, judging their value through my own anthropocentric perspective. To this end, this research takes inspiration from the field of Animal Geographies. Animal Geographies is an interdisciplinary field that examines the spatial relations, agency, cultural representations, interactions and ethical considerations associated with human-animal relationships. The field of Animal Geographies, unlike UPE, broadly covers human-animal interactions, including those in rural and wilderness areas, which contrasts UPE's urban-centric perspective. It also prioritises understanding animal agency and draws from disciplines beyond political ecology and urban studies, including sociology and zoology. While both fields acknowledge other-than-human agency, Animal Geographies focuses on human-animal relationships, while UPE incorporates other non-human entities in its urban ecosystem analyses. As such, Animal Geographies can extend and nuance UPE's

understanding of urban ecosystems by illuminating the diverse roles and impacts of animals within these spaces. This opens up a new understanding of the ways in which humans and their environment are entangled, rather than trying to purify the world into discrete spheres (Latour 1993).

Following the tradition of Animal Geographies, I begin by cleaning up my terminology. I use the term 'other-than-human' to refer to the lively bodies of non-human beings, preferring the prefix 'other-than' over 'non' in an attempt to acknowledge the difference without situating it as a 'lack' that could be understood as an inferiority to humans (Kirksey and Helmreich 2010, 555). In a similar manner, I use the term 'more-than-human' to refer to the relations and entanglements that emerge from the interaction between other-than-humans and humans. This restructuring of viewpoint enables us to delve into the complexity of human–rat interactions and the various dynamics that they produce, and it offers a first step towards focusing on the ways that more-than-human constellations enrich our world.

Donna Haraway has taken up this challenge of rethinking the human-other-than-human relationship in more-than-human ways, theoretically, conceptually and empirically (Haraway 2003; 2008; 2016). In her work, she critically examines the idea of thinking of humans as separate from their environment and points to the many ways in which this exceptionalism is harmful to finding ways of coexistence with other-than-humans. This perspective becomes very apparent in situations wherein human wellbeing is pitched against other-than-human wellbeing, with the outcome usually involving humans valuing their own or other humans' interests and comfort above the needs and even lives of other-than-humans.

An example of this hierarchy of interests, the rats in Marseille were considered problematic not only by my colleagues, but also by the city itself, which, after several failed attempts to get the situation under control, is now trying to fight the '*nuisibles*'[1] with ferrets (Conetto 2022). In order to fight the species of rats, the city of Marseille chose to make use of another species – the ferret. Within this multispecies arrangement of humans, rats and

[1] Translated: pests.

ferrets, the clear intentions of a '*dératisation*'[2] dominate the interaction and clearly reveal the roles and values assigned by humans to different other-than-human beings. In this process of humanity assigning value to different forms of nature based on how useful they are to humans, some animals become pets, while others become pests. This forced categorisation is especially relevant for urban animals such as rats, whose presence in cities does not serve any human interest. As a consequence, the value of rat lives is reduced to being a nuisance to humans, particularly when they dare to interfere with human activity or livelihoods. To fully comprehend this, humans must confront anthropocentric categorisations and value judgements, as demonstrated by the situation in Marseille.

Regardless of humanity's desire to divide nature into categories, the reality, as Haraway argues, is an interdependence wherein we become what we are through our relationships with 'significant others' across space and layers of time (Haraway 2003). Her concept of 'significant otherness' is based on the acceptance that every being has its own 'disparate inherited histories', making them 'significantly other'; yet, it is through the relations and interactions with those who are different from us that we 'make each other up in flesh' (Haraway 2003, 2–3). This perspective of seeing the world as being in continuous exchange with itself and others has its roots in what Bruno Latour calls 'becoming with' (Latour 2004, 208). As humans, we are part of the world, not in the sense that we are just 'being in' it, but in the sense that we are actively 'becoming with' it by affecting it as much as we are being affected by it. Haraway describes this state as being bound in significant otherness, wherein we are neither whole nor separate parts, instead made in the embodied 'fleshly' spaces of encounter (Haraway 2008). For this reason, it is necessary to understand not just the human side of an interspecies relationship, but also the cultural, historical and ecological aspects of the other-than-humans with whom we are 'becoming with'.

Building upon Haraway's examination of human and other-than-human relationships in urban environments, the idea of a multispecies city emerges as a core frame of this thesis, extending the 'becoming with' discourse into the urban domain. The concept of a

[2] The removal of rats. Not to be translated with the term 'deratification', related to the term 'ratification' meaning 'the action of signing or giving formal consent to a treaty, contract, or agreement, making it officially valid' (Oxford Dictionary). Although, one could argue that the de-ratification of rats' right to the city could be interpreted as an action of going back on an agreement of cohabitation that has existed for centuries.

"multispecies city" is a relatively recent development that emanates from the increasing recognition of the intertwined lives of human and other-than-human species within urban ecosystems (Dooren and Rose 2012). The genesis of this concept can be traced back to the cross-pollination of urban studies, ecology, and multispecies studies, with significant contributions from scholars such as Anna Tsing, who examines the ecological entanglements of different species (Tsing 2015). The main two species under observation in this thesis are humans and rats. The 'multi' in 'multispecies city' extends beyond a mere numerical account of species to encompass the intricate, reciprocal relationships that transcend species boundaries and impact a multitude of life forms. In urban environments traditionally perceived as human-centric, a plethora of species coexist, ranging from the microbial to the mammalian. Consequently, research into the rat-human dynamic reflects this abundance of the broader multispecies interactions within these ecosystems and benefits the consideration of wider implications for and connections with other urban species.

In doing so, the multispecies city concept further serves as a central connection of the two main research fields of this thesis, UPE and Animal Geographies. UPE traditionally focuses on the interconnections between socio-political processes and ecological changes in urban settings (Heynen, Kaika, and Swyngedouw 2006). As such, UPE enables the understanding of multispecies cities as inherently political while also recognising that non-human entities are not merely passive recipients of human action but active agents in shaping urban landscapes (see Zimmer 2010). Building on this understanding of cities, Animal Geographies emphasises the importance of animal agency and seeks to understand the roles, experiences, and perspectives of animals in relation to humans (see Buller 2014). The multispecies city concept, in combination with Animal Geographies, allows us to draw upon the diverse animal species within urban spaces, highlighting the importance of other-than-humans in shaping urban space and challenging the anthropocentrism that often characterises urban planning and policy. Overall, the multispecies city is not merely a conceptual framework but a call to action for reimagining urban life in more-than-human terms. It is the understanding of the urban ecosystem where diverse species' lives and stories converge, influencing and being influenced by one another in a dynamic, ongoing process of 'becoming with' that defines the essence of urban cohabitation.

The co-constitutive nature of interspecies relationships is central to an overall multispecies approach as it asserts that the presence and behaviours of one species are both shaped by and shaping those of another. In the case of rats and humans, their co-evolution and collaborative creation of urban spaces exemplify this dynamic, revealing the mutual influence exerted upon the urban spaces (see Feng and Himsworth 2014). Decisions regarding rats in urban settings, such as control or conservation measures, also reflect and inform broader societal values and norms about interspecies cohabitation, welfare, and rights (see Mason and Littin 2003). Additionally, rats hold significant symbolic and cultural meaning, influencing human perceptions and interactions with not only rats but the other-than-human world at large. The cultural portrayal of rats then often serves as a lens through which human-animal relationships are understood and constructed (see the case of pigeons in Jerolmack 2008).

In synthesising these points, I argue that the study of rats and humans in urban environments constitutes a genuine 'multispecies' inquiry. Such research is inherently interdisciplinary, weaving together ecological, ethical, cultural, and socio-political threads to offer a holistic understanding of the co-constitutive relationships between humans and other-than-human beings. Taking into account the different frameworks and approaches from UPE and Animal Geographies, this thesis seeks to elucidate the central research question: **How can we rethink the rat–human relationship in a multispecies city?** This research question is further broken down into three central sub-questions, each of which is examined in their respective empirical chapters:

- How are rats made through their relationship with humans?
- How is the framing of the rat as abject and a pest embedded in practices of pest control management?
- How to make space for rats in a multispecies city?

In order to investigate the intricate relationship between humans and rats, I opted for a more-than-human methodological framework which is designed to respect the agency of both human and other-than-human beings and to reflect the intertwined narratives they co-create within shared urban spaces. I confronted and addressed key challenges inherent in Animal Geographies, such as the human-animal communication barrier, the tendency to marginalise other-than-human animals within academic discourse due to anthropocentrism, and the dualistic thought that often segregates humans and animals into

binary categories (Buller 2015; Gibbs 2019). These challenges necessitated a departure from traditional human-centred research methodologies, demanding innovative ways to engage with other-than-human subjects and to capture their agency.

My multispecies ethnographic approach, therefore, incorporated both natural and social sciences, drawing on the behavioural ecology of rats to inform a deeper understanding of their social behaviours and interactions within the urban ecosystem. This was complemented by a commitment to the principles of 'staying with the trouble' (Haraway 2016) and 'additive empiricism' (Latour 2016), which advocate for a research posture that is open, inclusive, and responsive to the complex realities of multispecies cohabitation. By employing observation, participant observation, semi-structured interviews, and an extensive review of both scientific literature and media, I collected a variety of data that encompassed field notes, thick descriptions, and photography. The practical application of these methods during my fieldwork, which spanned over three years, was both explorative and adaptive, allowing me to embrace the unexpected and to reflect deeply on my own positionality in the research process (Malkki 2008; Müller 2012). This reflective stance was crucial in ensuring that my research did not reinforce the very anthropocentrism it sought to overcome.

The fieldwork was conducted through a flexible and improvisational approach, which proved essential in navigating the unpredictable nature of urban rat populations and the human actors connected with them. My ethnographic practice was deeply ethical, extending considerations of care and moral consideration to the other-than-human subjects of my study (Seymour and Wolch 2010). Moreover, the methodology chapter underscores the potential of 'animal stories' to reveal the active roles other-than-human animals play in shaping human knowledge and urban spaces. By focusing on these narratives, I aimed to portray rats not merely as subjects of human action but as co-constituents of urban life (Dooren and Rose 2012). Through this more-than-human methodological approach, I endeavoured to address the epistemological and ontological gaps in our understanding of human-animal relations. The methodology enabled me to gather diverse perspectives and construct a more comprehensive and empathetic narrative of the lives of rats in cities. It also facilitated the ethical and political implications of engaging with rats as subjects with their own intrinsic value, challenging the conventional pest-centric view and exploring more inclusive and empathetic urban animal policies.

Setting the stage

Zurich as a case study

In the quest to explore the complex dynamics of rat-human relationships, the need for a carefully selected case study is essential. In line with Haraway's critique of human exceptionalism, the chosen case study should illustrate the fallacy of perceived separation between humans and their environment and demonstrate the intrinsic interdependence of humans and rats. The presence of rats in this context is not a mere backdrop but a fundamental element of the multispecies city, revealing the deep-rooted connections across species that share a common space. The main criteria then for a case study about the rat-human relationship is the presence of both rats and humans and the related delineation between urbanity and nature. This dichotomy is critical to exploring the various interactions that characterise the relationship between humans and rats. However, with only this criteria, almost every city in the world qualifies as a case study. In order to be able to delve deeper into the rat-human relationship requires an acknowledgement of the roles rats play in the city's ecology, culture, and history. While much of this background information can be acquired through extensive reading and field research, I was consciously looking for a city, where I already had strong roots in understanding the history, culture, political and legal environment, as well as geographical knowledge about the case study city. And so, I opted to explore the city of Zurich as a prime candidate for a case study, which proved to be a very fruitful choice. The main language spoken in Zurich is Swiss German, an Alemannic dialect that varies greatly between the different cantons of Switzerland, with German being the main written language. This makes research for those who do not speak the language rather difficult, which means that it is less likely to appear on the radar of international urban researchers. As such, choosing Zurich as a case study offers to shine a light on a city outside the more common representative metropoles used for research in Europe such as London, Paris, Barcelona, Berlin, Rome or Lisbon.

Zurich stands out as an ideal case study for examining urban rat populations due to its unique blend of environmental conscientiousness, rigorous animal welfare legislation, and the presence of advanced urban planning. It is the largest city in Switzerland and one of the world's largest financial centres, and plays an important role in the global economy, with a classification as an 'alpha city' according to the 'Globalisation and World Cities' (GaWC) Research Network (GaWC 2020). Due to its economic power, its high living

standards and its vibrant cultural scene, Zurich is a popular place to live, counting 440,000 inhabitants in its centre and 1.4 million inhabitants in the centre plus agglomeration areas (Bundesamt für Statistik BFS 2021). The socio-economic status of Zurich is among the highest in the world. This affluence can influence both the resources available for urban wildlife management and the public's expectations regarding urban cleanliness and animal presence. Cities with different economic resources may approach the management of rat populations differently, prioritizing cost-effective measures over more humane but potentially costlier alternatives.

The city is geographically located in the central northeast of the country and experiences four distinct seasons, with temperatures varying between the lowest monthly mean of –2°C in January during winter and the highest monthly mean of 24°C in July during summer (MeteoSchweiz 2021). The city centre is nestled between forest hills at the northern tip of Lake Zurich and expands along the flat-floored valley of the river Limmat. Zurich boasts a rich array of aquatic resources, including Lake Zurich, the Limmat and Sihl rivers and a network of public fountains. These water features play a role in maintaining the city's water quality and accessibility while also shaping its urban landscape, culture and economy. Lake Zurich, the largest body of water in the city, covers an area of 88 square kilometres and has a maximum depth of 143 metres (information taken from Bundesamt für Umwelt 2023). The Limmat and Sihl rivers flow through the heart of Zurich, shaping the city's urban landscape and providing numerous ecosystem services. The Limmat River, originating from Lake Zurich, runs for approximately 36 kilometres before joining the Aare River. The Sihl River, on the other hand, is a 68-kilometer-long tributary of the Limmat, which flows from the Swiss Alps through the city. Both rivers are essential for drinking water supply and wastewater management and also contribute to the city's flood protection measures, green infrastructure and recreational opportunities.

The city's water supply system relies on a combination of local groundwater sources, spring water and water from Lake Zurich, which is treated and distributed to households and public fountains. Zurich's wastewater treatment plants employ advanced technologies to treat and remove pollutants from the water before discharging it back into the Limmat and Sihl rivers, further safeguarding water quality (Stadt Zürich 2018). Zurich takes great pride in maintaining the pristine quality of the lake water, ensuring that it meets the Swiss Drinking Water Ordinance standards (Bundesamt für Umwelt 2023). The lake also plays a

role in promoting the city's recreation, tourism and economic development by offering a multitude of water-based activities such as swimming, boating and fishing. Additionally, Zurich is known for its vast network of over 1,200 public fountains, which serve as historical landmarks and functional water sources (Moy de Vitry 2022). These fountains, some of which date back to the 16th century, are supplied with high-quality drinking water from the city's distribution system. They not only provide free access to potable water for residents and tourists but also serve as focal points for social interaction and urban design (Čerba and Hamerlík 2022). The climate, number of green spaces and prevalence of many water sources offer plenty of ressources to rat populations. In comparison, the colder climate of cities like Helsinki have a strong influence on the behaviours and dynamics of rat populations. The cold climate affects rat survival and reproductive rates, heightening the need for rats to have access to warm shelter in comparison ("Urban Rats Group Hesinki" 2018).

Zurich is also known for its well-maintained infrastructure, museums, universities and public transport, as well as for having one of the most expensive shopping streets in the world – the famous Bahnhofstrasse, which runs from the main station to the lake of Zurich (Meyer 2022). Founded by Romans about 2,000 years ago, Zurich has a long history that is visible in the Old Town, which contains many fountains and old mediaeval buildings. Be it in the Old Town or the more modern parts of the city, Zurich is very clean and even globally recognised for its spotlessness. Additionally, the city is actively investing to include and expand forms of urban nature and promote and protect green spaces within the city, aiming for a sustainable and aesthetically pleasing city image (City of Zurich, n.d.). In comparison, cities like London and Paris, with their long histories and dense populations, present urban landscapes that have been shaped over centuries, creating complex infrastructures that provide ample resources for rat populations. The socio-economic disparities and varying urban planning strategies across these cities also impact rat management practices and the visibility of rat populations to the public (see Parsons et al. 2017). This also becomes apparent in the public discourse about rats, which is much stronger in the media in bigger cities like Paris, London and New York for example, where rat sightings are daily occurrence (Gabbatt 2021; Marris 2020; Belmain 2015; Willsher 2018). Zurich, with a smaller and less dense population, offers a more controlled environment for studying rat populations and their interactions with humans. The often

isolated occurrence of rat cases in Zurich, allows for in-depth analysis of the situated context and identification of factors influencing each manifestation of rat populations.

At the same time, as an advanced urban environment, Zurich provides an exceptional platform for delving into the diverse dimensions of human–rat interactions. The density of the human population, combined with the well-developed urban infrastructure, creates an environment that is appealing to adaptable and opportunistic species such as the Norway rat. Especially in the area of the mediaeval town centre, the houses are built closely together, and the infrastructure is older, which benefits the spreading of pests of all kinds (Landau, Müller, and Schmidt 1999). However, rats are not only present in Zurich as city rats but also as lab rats and pet rats. In the context of laboratories, rats are fundamental to scientific pursuits, becoming the subjects of biological and behavioural studies that potentially benefit human health and scientific knowledge. Meanwhile, as pets within domestic spaces, rats are perceived and treated differently, often valued for their companionship and regarded as integral parts of familial constellations. Conversely, the city rat, often found in urban infrastructure, is usually met with control measures and seen as a disruptive element in the otherwise human-centric cityscape. This contrast calls to mind Philo and Wilbert's concepts of 'animal spaces' and 'beastly places' (Philo and Wilbert 2000b), which serve as a way to rethink how certain animals, such as city rats, are frequently situated as 'out of place' in urban environments and considered as not belonging. These diverse spaces and interactions create a rich tapestry of experiences that can significantly contribute to our understanding of multispecies cities and our relationships with the non-human beings that cohabitate in these spaces. Consequently, Zurich stands as an exemplar, shedding light on the intricate sociocultural, spatial and ethical dimensions of human-animal relationships. These contrasts in human–rat relationships within Zurich give rise to various questions about the heterogeneity of multispecies interactions and how these interactions shape the coexistence of different species in a highly developed urban milieu. In investigations of these cases through the lens of Haraway's 'becoming with', these spaces serve as sites of mutual transformation and interspecies entanglements, particularly when focusing on how humans and rats shape each other's existences (Haraway 2008). The roles ascribed to rats in Zurich, then – as research subjects in laboratories, companion animals in homes and often unwelcome inhabitants in the city – illustrate an intricate spectrum of multispecies interrelations within the city scale.

Furthermore, in the context of Switzerland's well-known and strict animal welfare laws, the study of rats in Zurich can offer a unique perspective on the human-animal relationship, one that involves a substantial legal and ethical framework. Swiss legislation on animal rights is among the most progressive in the world, mandating humane treatment of all animals, including pests. As Zurich's rat populations remain mostly invisible to the population, cities like London and Paris are found to apply less regulated and more lethal pest control practices, as they are faced with the presence of a much higher number of rat populations which demands efficient action for the protection of human safety (see Baker et al., 2022; E. Baker et al., 2020; Littin et al., 2004). Analysing the rat–human interactions and management approaches within this setting can serve as an exemplar for discussing the broader ethical considerations of living with urban animals in general and allows one to delve deeper into the concept of multispecies coexistence.

A History of Rats

Building on the previous introduction of the case study city of Zurich, it is essential to take a look at the ecological and cultural history of rats. The narrative surrounding the rats not only reveals an intricate web of human-animal dynamics but also illuminates the shifting roles and identities of rats within different urban contexts. For this reason, it is important to consider the ecology and ethology of rats, which shape and are shaped by these interspecies interactions. Their biological traits and behaviour have not only facilitated their successful survival within urban settings but have also significantly contributed to their image as pests or companions in the eyes of humans. This historical lens not only grounds this research in a sociocultural context but also enables a rethinking of urban spaces as multispecies habitats, where humans, rats, and other-than-human beings have coexisted for centuries, each playing a role in shaping the urban environment. Understanding the history of rats, therefore, provides critical insights into the evolving dynamics of multispecies urban ecosystems. It aids in recognising the complexities and challenges of fostering human-animal relationships in cities. As this thesis explores the concept of a multispecies city and the co-becoming of humans and rats, delving into the historical context of rats sets the foundation for a more comprehensive understanding of these relationships.

Starting off with the essentials of the ecological history of rats, the Norway rat (*rattus norvegicus*), also called the Brown rat, found almost[3] everywhere in the world, is the focus species of this thesis. The Norway rat is not to be confused with the Black rat (*rattus rattus*), which originated from India and can also be found worldwide. The Norway rat is more prevalent than the Black rat in many parts of the world, particularly in urban and suburban environments (Feng and Himsworth 2014). This broad distribution is largely attributed to the Norway rat's adaptable nature and its ability to thrive in varied environments (Capizzi, Bertolino, and Mortelliti 2014). Historically, the Black rat was the predominant species in Europe during the Middle Ages. It was not until the 18th century that Norway rats entered Europe. Originating from northern China, Norway rats ventured out of their initial ecological habitat, finding everything they needed in the dense settlements of human societies and eventually spread globally through the advent of international trade routes (Aplin, Chesser, and Have 2003). As Norway rats are bigger, heavier and more aggressive compared to Black rats, their invasion and spread drove out and displaced the Black rats in most places (Boivin et al. 2016). In modern times, Black rats are still found in coastal regions, port cities and ships, mirroring their historical association with maritime activities; however, they are now much less common than the Norway rats (Feng and Himsworth 2014). While Black rats occupy elevated or arboreal areas such as trees, attics and higher floors of buildings, Norway rats are typically more terrestrial, often found in burrows, basements, sewers and other lower-lying areas (Desvars-Larrive et al. 2018).

As generalists, Norway rats adapt quickly and easily to a wide range of environments as long as their basic needs are met, which are water, food (of almost any kind, as they are omnivores) and shelter, all of which can be found particularly easily in urban environments (Heiberg, Sluydts, and Leirs 2012). Like many other synurbic species, Norway rats rely on human-generated waste as a primary food source (Himsworth et al. 2014). Easy access to food waste in garbage bins, dumpsters and even sewer systems allows rat populations to flourish in cities. In addition to food, Norway rats also require a consistent source of water for survival. In cities, water is easily accessible to rats in sewers, lakes, rivers and fountains, and rats often choose their nesting ground close to such water sources. If green spaces or open soil are present, rats are likely to burrow their own home within building structures

[3] Except for the polar regions, a handful of islands and, apparently, the Canadian province of Alberta (Heiberg, Sluydts, and Leirs 2012).

or in dense vegetation (Guo et al. 2023). However, they are highly skilled at exploiting small gaps and openings to enter buildings, where they can find warmth, shelter and food (Lee et al. 2022). In these cases, Norway rats are not picky and will build their nests in any space, as long as it is undisturbed and concealed, such as wall cavities, basements or dry sewer pipes (Guarino 2017). The nesting sites of Norway rats are aimed to provide protection, seclusion, and proximity to food and water sources. As a result, rats are often found to inhabit sewers, subway systems, parks, and other green spaces, especially near restaurants, markets, and waste disposal sites (Burt 2006).

Rats of all species are particularly social animals, forming complex social structures and living in groups known as colonies. Within a colony, Norway rats exhibit a dominance hierarchy, with dominant individuals having priority access to resources such as food and mates (Costa et al. 2016). Social interactions among rats play a critical role in their survival as they cooperate to protect each other from predators, raise offspring and share information about food and shelter. Norway rats have high reproductive rates with a short gestation period of only 21–23 days, enabling females to produce multiple litters per year, each consisting of six to fourteen pups (Schweinfurth 2020). This high reproductive potential, combined with the rats' adaptability, contributes to their rapid population growth in urban environments as it allows rat populations to quickly recover from population declines, making them resilient to control efforts. Population dynamics can also be influenced by factors such as resource availability, predation and disease (Combs et al. 2018). These influential factors are essential to know when analysing interspecies interactions, as human behaviour, especially with regard to food waste, can strongly influence rat population growth.

Often related to these ecological aspects of rats' lives, the long-shared history between rats and humans has created an abundance of reactions, narratives, symbolic meanings and cultural practises surrounding rats. These different cultural aspects related to rats are often intrinsically connected to their biological features. The term 'rat race', for example, refers to a way of life in which people are fiercely competing in an endless, futile pursuit for wealth and power, just like rats scavenge for survival in the city. The phrase 'smell a rat' is often used to express suspicion, likely drawing upon the unique olfactory prowess of rats, who can detect scents that humans cannot, symbolically associating them with unmasking

deceit or revealing hidden truths. Another rat-related idiom says that someone moved 'like a rat up a drainpipe', trying to emphasise that someone moved extremely quickly.

In Chinese cosmology, the rat commands the lead in the twelve animal zodiac cycle, based on the legend in which it cunningly secures victory in a race among all twelve zodiac animals, determining the zodiac sequence (Wang 2017). In the corresponding cultural narrative, the rat characterises vitality, intelligence and wealth, which correspond to the species' ability to reproduce, adapt and persist under varying conditions. Furthermore, characteristics attributed to individuals born in the Year of the Rat often mirror the perceived attributes of the animal. These people are deemed resourceful and adept problem-solvers who are adaptable, persistent and sociable – virtues ostensibly informed by the rat's perceived intelligence, adaptability and social behaviour (Xu and Sharifian 2018). In contrast, negative associations tied to the Rat Zodiac seem less linked to the animal's traits and more steeped in culturally constructed imagery. Traits like deceitfulness, impulsivity and restlessness are ascribed to Rat Zodiac individuals, projecting the rat's natural behaviours, such as resource gathering, quick movements and active lifestyle, into negative human traits (Wang 2017).

In Western culture, the symbolism of rats often takes on a negative connotation. Particularly in European history, Black rats are strongly associated with death and disease due to their role in historical pandemics, most notably the Black Death of the 14th century (McCormick 2003). This historical relationship has greatly contributed to the negative impression of rat species in collective human memory, framing them as carriers of diseases and symbols of decay (Wundram and Ruback 1986). In literary and cinematic narratives, rats often symbolise moral decay, corruption or treachery. For instance, in George Orwell's '1984', rats represent the protagonist's deepest fear and the invasive surveillance of the totalitarian state (Orwell 1949). Moreover, the perception of rats as symbols of filth and urban decay is related to their tendency to thrive in human-made environments, especially in areas marked by poverty or neglect (Biehler 2013). These traces of rats within human history, language and cultural representation are evidence of the ways that rats, humans and other-than-human beings are integrated and co-constitutive parts of each other's lives.

'Becoming with' Rats[4]

This thesis then takes off with the intention of adding to the understanding of cities as a product of the relations of humans and other-than-human beings by exploring how rats and humans have and are 'becoming with' each other. Urban environments have been experiencing a re-emergence of more-than-human entanglements in the form of urban gardening, beekeeping, green spaces, heightened consumption of alternative and more sustainable foods, increased awareness of environmental issues and generally more environmentally conscious behaviour. To examine how rats and other less desirable species are so consciously ignored amidst the endeavour to bring nature back into the city is the ground from which this thesis departs. In the last five years, rats have challenged the previously discussed dualist viewpoints and guided me towards seeing a world that is intrinsically intertwined and continuously emerging through the relations and interactions between humans, animals, plants, other forms of life and the material environments that surround them. Highlighting the role of rats within this multispecies entanglement challenges the very core of anthropocentric ideas about the city-nature dichotomy and, therefore, invites us to think of new ways to reconceptualise the urban environment.

Ever since rats found their way to human settlers, they have stayed with them, making themselves comfortable in human-made landscapes (Feng and Himsworth 2014). They have found their perfect ecological niche in urban settings, thriving through and off of their human-made environments. They are 'human commensals', species that thrive in response to human disturbance and benefit from forming associations with humans (Puckett, Orton, and Munshi-South 2020). In other words, rats live in cities because of human activity, not in spite of it; they live in the city 'by means of the city', making use of neglected spaces and flows of anthropogenic food waste (Holm 2012, 74). Researchers even suggest that Norway rats are so well suited to cohabitating with humans that they thrive better in urban environments than anywhere else and are rarely found in places with little human activity (Aplin, Chesser, and Have 2003). This cohabitation makes rats one of the animals most commonly thought of as an 'urban animal', which is a group of species that are faced with the challenges and derogatory nature of dualist thinking.

[4] From here onwards, when I use the term 'rats' only, I refer to the species of Norway rats, as they are the ones found in my case study in Zurich.

The process by which a species flourishes, particularly in the urban environment and in response to urbanisation processes, is called 'synurbanisation' (Luniak 2004). A 'synurbic' species is, therefore, a species of animal or plant that is more successful in urban environments than anywhere else (Parker and Nilon 2012). These species usually share some common characteristics, such as having fast-growing populations, being non-demanding eaters and occurring ubiquitously in cities across the globe (Francis and Chadwick 2012). It is because of these characteristics that the popular discourse on synurbic species degrades them to 'pests' and 'nuisances', and most humans only deal with them when they interfere negatively with human interests or comfort, such as by posing a health risk or damaging infrastructure (Corrigan 2006).

Synurbic species such as the city rat[5] offer a useful case through which to explore what 'becoming with' each other really means in practice. These species share a preference for urban settings and the waste produced by humans, finding valuable food sources in anthropogenic trash. However, these survival tactics leave them vulnerable as they are likely to be associated with the unwanted and dirty spaces of the city, leading them to be perceived as 'trash animals' (Nagy and Johnson II 2013). While some urban animals, such as ducks, enjoy the privilege of being perceived as cute – being featured in children's songs and considered worthy of animal-human feeding interactions – rats are not so fortunate. This difference in perception is important to analyse, because 'the value that people assign to a given species can determine the selective pressures that species experiences, and therefore its likelihood of survival' (Beckman, Richey, and Rosenthal 2022, 105). Rats owe their success to their ability to adapt to the urban setting and to human activity, yet they are often perceived not to belong and are therefore treated as invaders, ignored or killed when deemed necessary (Byrne 2010).

Focusing on the interactions between humans and rats in the urban environment allows us to see how built and natural environments intertwine and reveals an array of entanglements between human and other-than-human beings. As the situation in Marseille illustrates, these urban environments, shaped as they are by both human and rat activity, underline the importance of considering these interactions in our attempts to foster

[5] From here on, I use the term 'city rats' to refer to Norway rats living in the urban environments of cities.

cohabitation. The city's infrastructure, including sewers and waste management systems, unintentionally creates ideal environments for rats. This rat-friendliness is amplified by littering behaviours, which inadvertently provide sustenance for these animals, highlighting the unintentional yet influential role that humans play in shaping these urban habitats.

The urban geographer Jennifer Wolch states that urban researchers have long neglected the role of other-than-humans and their ability to shape the urban environment (Wolch 2002). Combatting this issue, the field of UPE was especially strong in pushing a research agenda that sees the urban environment not as a static and spatially fixed place but as 'a network of interwoven processes that are both human and natural, real and fictional, mechanical and organic' (Swyngedouw 1996, 66). In doing so, UPE shifted thinking away from dualist and anthropocentric perceptions of the urban environment and towards perceptions centring the roles and involvement of other-than-human beings in shaping the urban context more clearly. In her research on moss in London, Gabrys explains that other-than-human beings 'become urban as part of the urban political ecologies in which they are situated and to which they contribute' (Gabrys 2012, 2925). She refers to this process as 'becoming urban' (Gabrys 2012, 2922). Considering the lethal consequences that arise for urban animals in the case of conflicts with humans, there is a deeply political component to accepting the agency of synurbic species and acknowledging their power to shape the urban context (Kornherr and Pütz 2022). Wolch argues against the political marginalisation of other-than-human species that would render them abject and killable, and instead stresses the importance of recognising them as part of the 'anima urbis'; '...the breath, life, soul and spirit of the city', she writes, 'is embodied in its animal as well as human life forms' (Wolch 2002, 721). She recommends studying the animal-human interactions and spaces that they create in the urban environment in an attempt to 'create a new political ecology of people and animals in the city' (Wolch 2002, 734).

In this sense, the city plays an important role not just as the backdrop of the rat–human interactions but as an involved part of the 'becoming with'. The context and material environment in which and through which interspecies encounters happen to influence the outcome. Chris Philo and Chris Wilbert investigate this connection by analysing the different perceptions and sociocultural associations linked with certain species in particular locations in their book 'Animal Spaces, Beastly Places'. 'Animal Spaces' refer to areas in cities that are either created by or for animals, illustrating the ways in which cities are not

solely human constructs but also incorporate other-than-human lives (Philo and Wilbert 2000a). These 'Animal Spaces' are perceived positively by humans, as they align with human expectations and norms regarding animal behaviour and location; they include, for example, parks and zoos, where animal presence is expected and even appreciated. On the contrary, 'beastly places' refer to spaces where animals are seen as being 'out of place', often leading to a negative perception. These places are typically locations where the presence of certain animals is perceived as disruptive, dangerous or unwanted by humans. This idea is also closely related to Julia Kristeva's concept of the 'abject', which refers to a deep psychological reaction to things that exist on the boundary of what society considers acceptable and what it finds repulsive (Kristeva 1982). In her book 'Powers of Horror: An Essay on Abjection' (1982), Kristeva argues that 'abject' is something that disturbs system, order and identity by not respecting borders or rules, evoking intense feelings of disgust or horror. In many societies, rats are seen as creatures that transgress the borders humans establish between clean and dirty, safe and unsafe and civil and unruly (Holmberg 2016). The rats' tendency to infiltrate homes and public spaces, their rapid breeding and their ability to thrive in environments that humans consider unsanitary or unsafe, such as sewers, challenge the order and cleanliness that humans strive to maintain in urban environments (Seegert 2014).

This suggests, that while humans might have constructed designated 'rat spaces' in their heads, rats often escape or transcend these spaces, highlighting a significant disjunction between human intentions and animal behaviours. Following the research question, "How is the framing of the rat as abject and a pest embedded in practices of pest control management?" I explore the human-rat relationship in urban settings, focusing on the spatial, cultural, ethical, and legal aspects that determine when and how rats become a target for extermination. Key findings from field observations in Zurich and interviews reveal that the perception of rats is highly subjective and context-dependent. The urban environment is brimming with what can be considered 'rat spaces' such as sewers, subway systems and trash areas, where rats are expected due to the cultural association of these areas with filth and dirt, eliciting feelings of disgust, fear or repulsion in humans – emblematic of the concept of the abject. Additionally, when rats venture out of their assigned 'rat spaces' and show up in human households, parks or restaurants, they are usually unwelcomed by humans and quickly labelled as 'pests', 'vermin' or 'beasts' (Philo and Wilbert 2000b). Rats, therefore, become symbols of abjection as they represent the

blurring of boundaries between constructed human spaces and assigned 'rat spaces'. Thus, the concepts of 'animal spaces' and 'beastly places' illustrate how location, sociocultural perceptions and biases shape animal-human dynamics and spaces in cities (Yeo and Neo 2010).

The transgression of 'rat spaces' to 'rat places' often leads to rat-human conflicts, as rats in their 'beastly places' are perceived as threats due to property damage, disease spread, and safety concerns. Further shows, that there are different thresholds for killing rats depending on situated circumstances. Factors influencing this perception include, for example, the visibility and number of rats, their proximity to humans and the spatial and cultural construction of 'rat spaces' in the context the rats appear. These factors then further determine whether rats are seen as tolerable or threatening, and thus, killable. Answering the question of 'when' rats are killable, my research also explores 'how' rats are killed. Analysing various methods for killing rats, ranging from chemical to mechanical means, I examine the legal frame and ethical implications of different methods. Exploring the legal and ethical dimensions of killing rats reveals a tension between human interests and the ethical treatment of rats, pointing out the struggle to find a balance between animal welfare, efficient extermination and human(e) practices. On one side, there are the Swiss laws of Animal Welfare that require humane killing methods based on moral considerations in deciding how to kill rats. On the other hand, rats pose a threat to human health as well as infrastructure, which requires an efficient and effective approach to ensure human safety. This results in a legal grey zone where the terms of killing are negotiated based on a subjective risk assessment by pest control managers. In most cases, the more painful killing methods are justified through the prioritisation of human safety but also through economic factors. Some methods are more expensive, take more time to implement and yield slower results, while others are more affordable and efficient, but often more painful for the animals.

City rats are typically perceived as pests and are associated with negative traits such as disease transmission and property damage. City rats challenge human-imposed spatial boundaries, leading to conflicts in urban environments. Despite being the same species as lab and pet rats, city rats are not afforded the same level of legal protection or ethical consideration. They are often seen as disposable, and their management often involves lethal methods, raising questions about the ethics of pest control and the human-animal

relationship in urban spaces (Arseneault and Collard 2022). However, in other settings, the same species of rat can occupy different roles and spaces, even within the same city. Laboratory and pet rats are from the same species as the city rat. Norway rats have been selectively bred over generations for specific traits that make them valuable models for scientific research (Birke 2003). Lab rats occupy controlled, sanitised environments far removed from the alleyways and sewers of their city-dwelling counterparts. They serve a key role in advancing human knowledge in fields ranging from genetics to psychology. Similarly, some rats are kept as pets, cherished for their intelligence and sociability. As pets, these rats occupy domestic spaces and are valued for their individual personalities and their ability to form bonds with their human caretakers (Modlinska and Pisula 2020). In contrast to rats with the status of pests or research subjects, pet rats are typically treated with care and affection, and their wellbeing is of paramount importance.

Thus, within a single city, rats can occupy a multitude of roles and spaces, from unwelcome city dwellers to valued research subjects or cherished pets. These diverse roles highlight the differently emerging relationships between humans and rats and emphasise the need for a broader understanding of rat–human interactions that surpasses the simple dichotomies of pest versus pet or subject versus companion. Instead, the rat can be seen as 'rat multiple'. Based on the concept of the "body multiple" by Annemarie Mol, the 'rat multiple' refers to the way the body is enacted in different practices and thus becomes different things (Mol 2003). Mol's concept is itself rooted in the notion of 'multiplicity' from Deleuze and Guattari, suggesting that a given entity is not singular but rather embodies multiple forms, identities or potentials (Deleuze and Guattari 1987). Multiplicity is a transformative and dynamic process of becoming, of rejecting the fixed and static nature of entities, just like the rat can take on different roles depending on its environment and interaction with other species, especially humans. Lab rats, pet rats and city rats – each of these identities does not exist in isolation but forms a part of the rat's multiplicity. The rat does not cease to be a city rat just because of the existence of a pet rat or a lab rat, nor does it discard its role as a pest when it contributes to scientific progress. Some of my key findings confirm that these identities coexist, reflecting the rat's existence as a multiplicity and underscoring the intricate and dynamic nature of its relationship with humans. Even more so, my research reveals that there is fluidity of roles and identities within multispecies relationships. The transition of lab rats to pet rats, facilitated by organisations like the Club

of Rat Friends CH, highlights the fluid transition of these categories and the impact of human interaction on rat identities.

The concept of the 'rat multiple' further pushes us to consider the materialities that enable and constrain these varied identities in the urban landscape. Materialities—such as the physical design of the city, the availability of food and shelter, and waste management systems—play a central role in shaping the lives of rat populations in Zurich. These material conditions not only affect the physical wellbeing of rats but also influence their social and ethical standing within the urban sphere. It is these materialities that often determine whether rats are seen as pests, research subjects, or pets, and how they are consequently treated. This becomes apparent when analysing how the urban infrastructure of Zurich enables the existence and persistence of 'rat places': The city's sewers, its refuse systems, and even its architectural crevices provide habitats that rats exploit to survive alongside humans. Understanding these material conditions is crucial for exploring how human-designed spaces contribute to the creation of 'rat places' and how these spaces, in turn, influence human-rat interactions. Thus, by extending our gaze to the role of materialities, we gain a deeper insight into the entanglement of human and rat lives in Zurich. We see that the human-rat conflict is not merely a result of competing interests but also a consequence of the very fabric of our urban environments. This perspective invites us to reflect on how we might redesign these material conditions to foster a more ethical and sustainable coexistence within the multispecies city.

In conclusion, the theoretical frameworks of 'becoming with', 'animal spaces and beastly places', 'abject', and the condition of 'body multiple' provide a robust and comprehensive analytical toolset to explore the rat-human relationship in the multispecies city of Zurich. These concepts enable an in-depth examination beyond mere coexistence to a more profound intertwinement of lives and spaces. They defy the conventional city-nature dichotomy and challenge anthropocentric urban narratives by acknowledging the active role that non-human agents play in urban ecosystems. This perspective is not only crucial for the ethical consideration of all urban inhabitants but also instrumental in re-envisioning urban spaces as shared, multispecies environments. As such, the study contributes to a more inclusive, just, and sustainable vision for the future of urban living, one that recognises and respects the diverse cohabitations and co-becomings.

Thesis Structure

By tracing the rats in the subject city of Zurich – from their shared history with humans to the co-constituted places they inhabit – this thesis reveals how a multispecies conviviality of rats, humans and other-than-human species comes together in a multispecies city. Building on the main concepts of 'rat spaces', 'rat places' and 'becoming with rats', this thesis contributes to the analysis of the relationship between people and animals within 'complex assemblages, mutually affecting and affected by their fields of becoming', moving towards a 'politics of conviviality' (Hinchliffe and Whatmore 2006, 128, 123). Following the key understandings of my conceptual framework outlined above, this thesis has three intentions: First, it aims to add to the understanding of the world as co-becoming through the relations of humans and other-than-human beings by developing a theoretical and conceptual framework that allows for an alternative way of studying of rats and other urban animals. Second, this thesis offers an alternative and innovative methodology for studying multispecies entanglements, demonstrating the many pitfalls of anthropocentric approaches in order to put more-than-human methods into practice. Third, this thesis analyses the 'becoming with' of rats, humans and other-than-human beings and explores the ramifications thereof.

Following this introductory chapter, this thesis continues with a literature review. chapter 2 serves to draw together a theoretical and conceptual framework for this thesis, addressing the challenges of studying rats in the urban environment. The chapter begins by delving deeper into how dualist ideas and binary thinking heavily influence the value and consideration given to other-than-human beings and considers how this viewpoint reinforces and reproduces limiting anthropocentric perspectives. By carefully retracing the historical milestones of the human–nature relationship, the chapter draws on the field of UPE to navigate through different understandings of nature and arrive at a view of the world as relational and emergent. With the help of UPE, this chapter explores how urban processes and human behaviour situate rats in their relationship to humans and the urban environment. I then expand the conceptual framework of UPE with the help of Animal Geographies to address the challenges of accounting for the agency and subjectivity of other-than-human beings. I discuss the different propositions and adjustments necessary to switch from anthropocentric to more-than-human perspectives. This chapter concludes with a more-than-human conceptual framework based on a multispecies approach that accounts for interspecies encounters between rats, humans and other other-than-humans.

After the theoretical framework outlined before, chapter 3 discusses the methodological consequences of doing more-than-human research. It begins with a review of the way in which animals complicate human epistemologies and how these complications can be addressed through adapted research methods that account for more-than-human entanglements. Aligning with the findings of this review, the chapter discusses the methods employed for this thesis, introducing multispecies ethnography as the methodological framework of the research. The second part of the chapter then focuses on the field research, discussing how the main methods of participant observation, semi-structured interviews and field notes (supported by field diaries and photography) were applied in the field. I also elucidate how I dealt with issues of positionality and humanism. Finally, I explain the process of data analysis and present some examples of how I used my data in the empirical chapters.

In chapter 4, I explore the 'rat multiple' – the different roles that rats inhabit based on their spatial, legal and political contexts. These roles are manifested in 'rat spaces' – assigned and sometimes controlled environments where rats are incorporated under human authority. These spaces are influenced by regulations and political elements, reflecting anthropocentric perceptions. The chapter highlights how rats can defy these human-constructed boundaries, creating their own 'rat places' or 'beastly' spaces that represent transgression and displacement. This concept is especially prominent in the urban environment, where city rats, who are resilient and adaptable, often conflict with humans, leading to their designation as pests and 'abject'. Understanding these 'rat spaces' and 'rat places' helps humans comprehend the fluid and multiple identities of rats across different contexts. The distinction between 'rat spaces' and 'rat places' is highlighted by the city rat's adaptability and resilience, challenging containment within human-designated spaces and leading to conflict. This conflict and the inherent characteristics of rats, such as mobility and reproduction, frame city rats as pests, contributing to their 'abject' designation. The discussion concludes by examining 'pesthood' and 'pestilence', setting up the focus for the following chapter on the circumstances and reasons for city rat extermination.

chapter 5 investigates the dynamics of lethal rat management within urban settings, examining the different factors leading to the labelling of rats as 'killable'. Rats, often labelled as pests and equated to waste, are subject to extermination under the pretext of

urban sanitation and human protection. However, the decision to kill is dependent upon subjective spatial and situational perceptions of human–rat interactions. The chapter delves into 'rat places', areas where rats breach the human-defined 'rat spaces' and create conflict. While rats' presence is tolerated in certain non-urban environments, their appearance within urban spaces such as homes, parks and public transport often evokes public fear and concern. Such encroachments transform the perceived safety of these spaces and necessitate 'sanitation' in the form of rat extermination to restore human control. This chapter aims to unravel the context-specific elements shaping the human–rat relationship, focusing on how and where the decision to kill rats is made.

In chapter 6, the final empirical chapter, the discourse extends from anthropocentric views and conflictual human–rat relationships towards an analysis of how material components and human behaviour in Zurich shape rat populations and behaviours, and also how rats, in turn, shape human behaviour and the material world. Adopting the concept of 'becoming with' rats, this chapter underscores the role of human activities in shaping rat populations and behaviours, analysing rat necessities – water, shelter and food – and the impacts of human infrastructure and waste management on these necessities. Focusing on the mutual co-becoming of both species, this chapter pivots from exploring rats' placement and the consequences of their transgressions to investigating integrative pest control methods and human influence on rat populations. The mutual co-becoming perspective accentuates ethical and moral responsibilities towards other species, or 'multispecies justice'. The chapter integrates field research findings to highlight the consequences of human behaviour and our responsibility to other species. Finally, the chapter presents alternative rat management methods, introducing preventive measures and integrated pest control techniques. By illuminating and applying the concept of 'becoming with rats' to various Zurich spaces, the present different possibilities and modes of co-existence.

In the last chapter, I conclude my thesis with a discussion of the implications of understanding rats within a multispecies world. Instead of seeing rats as pests and disregarding their lived reality, agency and subjectivity, I apply the perspective of 'becoming with' otherness and perceive rats in their multiple ways of being. Whether or not humans accept rats as co-constitutive beings of the city, rats will continue to transgress any boundaries that are set for them, be they physical or theoretical. By acknowledging

that rats, humans and other-than-human beings are 'becoming with' each other, the urban environment becomes a site of multispecies cohabitation that opens up possibilities of living together in significant otherness.

Situating Urban Animals: Expanding Urban Political Ecologies to rat spaces

The aim of this literature chapter is to create a theoretical basis with which rats can be studied. This requires addressing the challenges of studying animals in general as well as studying the urban environment as the broader setting in which in the urban animals can be found. A first challenge is to recognise and understand how dualist ideas and binary thinking regarding city-wilderness, nature-society and culture-environment dichotomies have led to biased understandings of urban environments. Dualist thinking hinders the study of urban animals by simplifying the complexity and interconnectivity of urban ecosystems and often devaluating the animals found in urban environments due to the perception of those animals being 'out of place' or 'not belonging' (Philo 1995). Addressing notions of dualist thinking then is necessary to take on a more inclusive perspective through which urban animals can be seen, heard and studied. This challenge is exemplified by exploring how 'rat spaces' and 'rat places' are created in the city and determine where rats are 'supposed' to live (rat spaces), and where they 'actually' end up living (rat places) (Philo and Wilbert 2000a).

The field of Urban Political Ecology (UPE) has played an important role in criticising classic dichotomies and provided ways to conceptualise nature to approach complex urban environments (Heynen 2017a; Keil 2005). However, a remaining tendency towards anthropocentrism in UPE limits the field's ability to account for the agency and subjectivity of animals. In order to address these challenges, I propose an expansion of the conceptual framework of UPE with the help of Animal Geographies literature. Drawing on both fields opens up new ways to view animals by moving beyond anthropocentrism and towards more-than-human perspective. Anthropocentric views often perceive animals as passive entities subjected to human action, which hinders the exploration of the complexities of space and place from the perspective of non-human beings. One way in which rat agency becomes apparent is through their ability to transgress borders and create their own 'rat places' often leading to human-rat conflict, illuminating the inherent dynamism and inter-species interactions in urban ecosystems (Philo and Wilbert 2000a). Animal Geographies in particular emphasizes the roles of animals as active and co-constitutive participants who

shape and are shaped by their environment and their relationship with other species in a process of 'becoming with' their human and other-than-human beings (Haraway 2008). By engaging with the ecology of rats, much insight can be gained about their spatial and social interactions, their navigation through and use of the urban environment and infrastructure, and their responses to human behaviour. Incorporating these insights can further the pursuit of multispecies justice by fostering equitable and respectful cohabitation in urban environments. As a result, this knowledge can be reapplied to guide the multispecies co-existence between rats, humans and other species in the urban environment.

In addressing these challenges, I work towards a more-than-human conceptual framework based on a multispecies approach that accounts for interspecies encounters between rats, humans and other non-humans (Dooren and Rose 2012; Greenhough 2014; Srinivasan 2019). In doing so, rats can be studied in their multiple co-constitutive roles that shape the urban environment and human-rat interrelations (Brighenti and Pavoni 2020; Urbanik 2012). This 'rat multiple' together with 'rat spaces, rat places' and 'becoming with rats', build the main three concepts with which the different roles, perceptions of and encounters with rats are explored in this thesis.

Note on terminology

What are urban animals? The easiest answer may be found by taking the definition literally and say that urban animals are animals that are found in the urban environment. The debate between 'the urban' and 'the city' has long been a subject of discussion among urban theorists, sociologists, and geographers (Angelo and Wachsmuth 2015). This debate largely hinges on conceptual differences in understanding and interpreting urban space. 'The city' is often referred to as a specific place, a physical location with defined boundaries and a concrete manifestation of urban life (Angelo and Wachsmuth 2015). On the other hand, 'the urban' is understood as a process, a condition, or a way of life rather than a defined place (Brenner 2013). Despite the scholarly interest in this debate, it is important to note that these interpretations are not mutually exclusive, but rather different facets of understanding urban phenomena. However, in the context of this thesis, delving into the semantics of 'the urban' versus 'the city' does not substantively contribute to the central research focus on the multispecies interactions of rats within urban environments. Instead, this work is more concerned with understanding the complex ecological relationships and behaviours that rats exhibit within the broader scope of urban life, irrespective of the theoretical dichotomies of urban terminology.

In this thesis then, I use the term 'city' to loosely refer to a human settlement with a high human population density and built infrastructure created through and contributing to urbanisation processes (Swyngedouw 1996). Likewise, I use the term 'urban' to refer to characteristics of cities which sprawl out into less densely populated core parts of cities. The terms 'urban environments' or 'urban landscapes' are used to loosely refer to the human-nature-entanglement in an attempt to include the variety of human, animal and material interactions and processes found in the urban. They are understood as non-limited spatialities and can include cities, towns, metropolitan areas or suburbs in the way that Ash Amin and Nigel Thrift described them:

> *"The city is everywhere and in everything. If the urbanized world now is a chain of metropolitan areas connected by places/corridors of communication (airports and airways, stations and railways, parking lots and motor ways, teleports and information highways) then what is not the urban? (…) The footprints of the city are all over these places, in the form of city commuters, tourists, teleworking, the media, and the urbanization of lifestyles. The traditional divide between the city and the countryside has been perforated." (Amin and Thrift 2002, 1)*

While this perspective aligns with the idea of 'the urban' as a process in its recognition of the dynamic nature of urban life, it also moves beyond it by focusing on the more micro-level, everyday experiences and the multiple actors involved in the making and remaking of urban spaces. While not specifically reaching out to include urban animals, the notion of understanding urban environments as complex and dynamic spaces constituted by interactions, encounters, and affective experiences, leaves room for the 'becoming with' of other-than-human beings.

'Urban animals' can encompass both domesticated as well as feral animals in urban environments. Every animal that makes its way into an urban environment, be it as a pet, an exotic aquarium fish, a giraffe in a zoo, or a pigeon on a red light, is included. As for 'animals', a differentiation is usually made between 'humans', and 'non-human animals'[6], referring to all animals except humans (Buller 2017, 1). 'Non-human' is a term used to highlight and include aspects of material forms of nature such as water, air or rock and biological forms of life such as animals and plants non. It is important to mention that 'nonhuman' is meant as inclusive

[6] From here on referred to as 'animals'

also to material and biological forms that have been changed, shaped and/or transformed by humans (Barua 2021). In this thesis, I will use the term 'animals' to refer to non-human animals. As such, all animals are non-human but not all non-humans are animals. Another term I will be using is 'other-than-human'. Following Lien and Pálsson (2019), 'other-than-human' describes a conceptual shift in which concerns of culture and sociality are extended from humans to non-humans. As such, 'other-than-humans' refers to all entities that compose the social together with humans "whether they are pigs or ancestors, spirits or machines, parasites or rocks" (Lien and Pálsson 2019, 4), ensuing an understanding that humans are relationally constituted through and with their other-than-human relations.

Another terminology to be clarified for this thesis are the terms 'synanthropes' and 'synurbic'. 'Synanthropes', referring to species which thrive especially well in places of heightened anthropogenic activity but not necessarily located in the urban environment (R. F. Johnston 2001). They can be divided into two groups: those that are forced to adapt to the city due to a lack of alternatives and those that actively choose to live in cities for opportunistic reasons such as consistent food sources, variety of options for shelter and burrowing, and easy access to water (Byers et al. 2019). A term often used for the latter case is 'synurbanisation', a process whereby some animal populations thrive more in the urban environment, even though they are also found in other places and ecosystems. The coupled term 'synurbic' is therefore "reserved to species that are associated with urban areas to a *greater extent* than with? other ecosystems"(Francis and Chadwick 2012, 515) and can only be applied to a number of species eligible, such as rats, pigeons, sparrows, blackbirds, mice and foxes in the case of European cities. A common characteristic of synurbic animals is that they are often generalists, meaning that they are very adaptable to many different ecosystems. This allowed them to learn easily how to exploit urban resources for their benefits, leading to higher population densities in the urban than in their original (or at least historically established) habitat (Francis and Chadwick 2012). Rats are a prime example of a synurbic generalist species, as they show very positive responses to the urban environment and to anthropogenic activity, resulting in greater survival and reproduction, leading usually to a high population number (Feng and Himsworth 2014). In this thesis I use the term 'city' rats to refer to 'synurbic' rats, in order to differentiate them from other rats, such as pet rats and lab rats. Additionally, I will use the term 'urban animals' to refer to all animals living in the urban environment.

Another term I will use is 'entanglement' to refer to the complex and interconnected relationships between humans, animals, and their shared environments (as used by Tsing 2012). The term acknowledges that humans and animals are mutually implicated in each

other's lives, whether that's through domestication, food production, conservation efforts, urban planning, or climate change impacts, among others. Maan Barua argues that acknowledging the entanglement of human-animal relations is critical to understanding the dynamics of the Anthropocene, an epoch defined by human impacts on the planet (Barua 2016). The concept of entanglement in this context can facilitate exploration of multispecies interactions, acknowledging the agency of animals in shaping physical landscapes and human culture. Moreover, entanglement is also used to refer to the inseparability of nature and culture, blurring the binary divide traditionally upheld in Western thought. Donna Haraway uses the concept of entanglement in her 'companion species' manifesto to argue for a view of nature-culture relationships as mutually shaping, co-evolving, and fundamentally entangled (Haraway 2003).

Last but not least, as an animal geographer, I follow the field's commitment to recognizing and respecting non-human agency and subjectivity. This means that I advocate for using relative pronouns that acknowledge animals as individual beings, rather than mere objects (Philo 1995; Wolch, Wilbert, and Emel 2002).Typically, in English, non-human animals are referred to using 'it', 'which', or 'that'. These pronouns can inadvertently reinforce the view of animals as objects or things, rather than individuals. To challenge this perspective, some animal geographers, ethologists, and animal rights advocates suggest using 'who' instead of 'that' or 'which' when referring to animals, as 'who' is traditionally used for individuals with agency and subjectivity (Gilquin and Jacobs 2006).This subtle shift in language can help challenge objectifying views of animals and emphasize their individuality and agency.

From dualist to relational thinking

Geographers of many subfields are in one way or another concerning themselves with the question of the human-nature-relation (as pointed out by Castree 2017). The foundational importance of that relationship for the discipline of geography becomes evident in the dominant place it is given in textbooks. Thus, Cresswell's "Geographic Thought" points out different discourses and narratives which have been spun out of attempts to explain and conceptualise this relationship:

> *Words like "culture" and "nature" for instance are fairly commonplace. We have a vague idea of what they mean and, in everyday life, we don't spend too much time questioning them. In fact these two words have been described by the literary theorist*

> *Raymond Williams as two of the most complicated words in the English language and yet we think they are obvious. (Cresswell 2012, 10)*

Concepts of nature are historically highly ambiguous concerning who or what is included and can be labelled as "nature". For a long time the traditional view of the human-nature relationship was based on the idea that humans, and everything they have built and touched, are separate from a nature that is self-sufficient and in equilibrium, as long as it is left alone from human intervention (Ginn and Demeritt 2003; Cronon 1996).

Until two decades ago it was the norm in both natural and social sciences to portray the 'nature' of the nature/culture dualism as a separate entity which reaches its highest level of value when it is deprived of human activity or influence, a wild and pristine landscape, a 'natural' environment (Castree 2017). This can be observed in practice in many fields concerned with nature conservation. The approach to nature conservation in many national parks, for example, is based on the principle that nature thrives in absence of human activity and interference (Zimmerer 2000).

But many scholars in adjacent fields, especially those with a focus on processes and matters regarding the urban environment, have started to challenge the idea of a separate nature and urban realm (Lorimer 2015; Mansfield 2016). Constructivism and non-dualism both critique traditional boundaries and categories in understanding the world, emphasizing the socially-constructed and mutable nature of reality. Constructivism in geography is an intellectual tradition that is built on the idea that the world is socially constructed (Hacking 1999). Putting humans at the centre, constructivist thinking views geographic phenomena, such as landscapes, regions, and territories, not as given, but as being continuously created, negotiated, and reshaped through societal and cultural processes. Non-dualism, on the other hand, is an approach that rejects the traditional separation of the world into distinct and opposing categories, such as nature and culture, or human and non-human (Castree and MacMillan 2001). It insists that these categories are interconnected, and that the world should reflect this complexity and interdependence. Non-dualism argues for the inseparability of 'nature' and 'culture' and suggests that phenomena often considered distinct are, in fact, continually influencing each other and evolving together (Latour 2005). While constructivism is largely concerned with how realities are socially constructed, non-dualism explicitly addresses the dichotomies inherent in especially traditional Western

thought, suggesting a more holistic understanding of the world where boundaries between categories are fluid and interconnected.

Driven especially by the far-reaching consequences of human-made climate change, it has become more and more apparent that humans have irreversibly changed the earth surface, landscapes and its atmospheres, creating what is conceived as a human-dominated modern world referred to as the 'Anthropocene' era (Corlett 2015). Consequently, scholars have begun to conceptualise nature and humans in more connected and intertwined ways (Head 2016). Rather than trying to find ever more so complex ways to connect, combine or merge nature and society, scholars began to explore alternative ways of thinking that would allow to go beyond the nature-culture dichotomy debate, transcending the binary and avoiding the question of the 'real' or 'constructed' nature argument (Cresswell 2012, 244). These more recent concepts were developed in fields of relational and more-than-human geographies and elegantly avoid engaging with dualisms directly, by focussing instead on interactions and exchanges between matter, humans and other-than-humans (Braun 2005; Murdoch 2005).

This new kind of thinking has opened the door for using relational approaches to study the relationship of humans and other-than-humans with the material world. Jane Bennett is a key scholar for promoting and developing the concept of materialities and advocates for a "vital materialism", where matter is seen as vibrant and possessing its own force (Bennett 2009). In urban geography, materialities are central to how cities are understood and studied. Cities are not only humans and other-than-human beings, but also materialities – from more static materials like buildings and infrastructures to dynamic materials like water and waste. These material elements shape urban life in profound ways, influencing social interactions, economic activities, and ecological processes (Amin and Thrift 2002). In the field of UPE, the concept of materialities has been used to critically explore the physical and sociopolitical dynamics of urban environments. UPE scholars have studied the materialities of water (Gandy 2003; Swyngedouw 2004; Kaika 2005), waste (Moore 2012), and infrastructure (McFarlane and Rutherford 2008) to understand their roles in urban life and the political processes surrounding them. This also applies to the way that animal lives and realities are shaped by the materialities of the city. In relation to rats, this allows to study the interaction of rats with buildings, the sewage system or the way water is designed to flow through the city in rivers, streams and fountains.

Furthermore, there are more dynamic materials which function as food sources, often related to trash and waste management, which greatly influence the distribution and growth of rat populations. In UPE, new materialist perspectives have opened up novel ways to understand city dynamics. For instance, it allows us to see the city not just as a backdrop to human activities but as a vital participant that shapes and is shaped by those activities. Materialities like buildings, roads, or waste are not just inert structures or byproducts but actively participate in the making of the city (Amin and Thrift 2002).

These complex entanglements of material and social relations can be organised in networks and assemblages, which helps shifting the attention from humans to the roles of non-humans participants in shaping different environments (Latour 1993; Castree and MacMillan 2001; Brenner, Madden, and Wachsmuth 2011). UPE's focus on studying the interrelationships between urbanization processes, socio-political dynamics, and ecological change, and hence, inherently adopts relational approaches. Two influential relational approaches that are widely explored in the social sciences are Actor-Network-Theory (ANT) and assemblage theory. ANT, mainly developed by Bruno Latour, proposes that all actors, human and non-human, are integrated into networks through relations of symmetry, dismissing the nature-culture dichotomy (Latour 2005). It views the world as constellations of interrelated 'actants', where agency is the result of relationships rather than inherent to entities (Latour, 2005). Assemblage theory, heavily influenced by Deleuze and Guattari (1987), similarly posits that the world is composed of heterogeneous assemblages. However in comparison to ANT, it introduces an ontological pluralism that respects the inherent multiplicity of objects and subjects, with the notion of the 'rhizome' and an emphasis on contingency and emergence (Deleuze and Guattari 1987).

Both approaches facilitate the decentring of human agency, which allows for accommodating a more inclusive perspective that acknowledges non-human entities as integral constituents of social and ecological networks. Assemblage theory, applied to the study of urban rats, facilitates a holistic understanding of rat-urban environment interactions and emphasizes their interactivity with various urban elements, influencing policies, attitudes, and systems such as waste management. However, by uniformly attributing agency to all assemblage components, the theory may inadvertently neglect significant power imbalances within these structures, possibly underplaying the overwhelming influence of human activities on urban rat conditions. In the case of urban

rats, ANT encourages to consider rats not merely as passive inhabitants of urban ecosystems, but as active participants shaping, and being shaped by, their environments. Rats, humans, and various other entities including infrastructures, waste, policies, are all intertwined in the actor-network, together influencing urban dynamics.

While both theories promote non-dualistic thinking, they are different in their understanding of agency and relationality. In ANT, the interpretation of 'agency' can be quite different from other common understandings of the term, which is usually rooted in notions of intentionality and subjectivity (Müller and Schurr 2016). Agency in ANT is seen as distributed and relational, rather than the province of individual entities (human or non-human). Furthermore, many animal geographers scholar have criticised ANT for flattening out differences, potentially undermining the power dynamics involved in human-nonhuman relations and obscuring the unique experiences and capacities of animals (Lorimer 2010; Haraway 2008; Buller 2014). Assemblage theory on the other hand, has been critiqued for its vague definition of agency and an overemphasis on fluidity, which can overlook structural aspects (Müller and Schurr 2016). By distributing agency across human and non-human components, assemblage theory can end up negating important distinctions and subsequently struggles to adequately address the role of non-human entities (Lemke 2015). As the attribution of agency to non-human actors is crucial in understanding animal behaviours and interactions within urban contexts, both concepts are limited in their approach.

Despite their aforementioned benefits, relational approaches also introduced new challenges (Mansfield and Doyle 2017). The category of 'nature' as a notion of any space free of human influence and defined majorly through its opposition to humans, culture and the urban has been replaced with varied forms that allow the inclusion of all the previously 'in-between' and 'out of place' natures such as feral and urban animals, farmed and cultivated areas, gardens, and green spaces in the city. However, "not all kinds of nature are equally desirable in all contexts" (Angelo 2019, 8), as they can take very different material forms such as urban wasteland (Gandy 2013), the perfect lawn (Robbins 2012), unwanted street dogs (Narayanan 2017; Srinivasan 2019), urban parks (Ernwein 2021) or intensive river restoration projects (Lee and Anderson 2013). Yet, who gets to decide about what can thrive and where? The renegotiation of how to manage the newly found and emerging human-nature-entanglements is not just a matter of dissolving "the supposed

ontological divide between society and nature, human and nonhuman"(Castree 2017, 23) but also a question of political power over the idea of what nature is supposed to be.

Relational approaches removed the big categories of 'human' and 'nature' and left a vacuum to be filled in regards to the goal of conservation in a time where nothing is pristinely natural anymore (see Lorimer 2015; Braverman 2015). Especially in regards to newly established ecosystems, the lack of a 'natural' pre-existing reference point to go back led to ecological and political struggles in academic as well as practical fields about the negotiation of how to design or redesign those 'novel' ecosystems (Hobbs, Higgs, and Hall 2013; Hallett et al. 2013; Ross et al. 2015). The question of what belongs in novel ecosystems and how to manage them is a matter of debates in conservation of protected areas and urban natures alike (Mansfield and Doyle 2017). Common arguments are trying to replace the idea and value of 'natural' by shifting the focus towards different categories that bypass the nature/culture dualism such as biodiversity, ecosystem services and renaturalisation (K. Wright 2014; Head 2016). These categories allow to measure the value of an ecosystem for anthropocentric interests and serve to justify the implementation and protection of certain kinds of species and green spaces. However, many urban animals, rats included, do not fulfil the requirement of catering to human needs or ideas of urban aesthetics (see Salomon Cavin 2013; Shingne and Reese 2022). As a result, in a time where nature is 'called back' into the city in the form of greening and renaturalisation projects, rats are 'removed' and cleansed from the city with entire campaigns of pest control (Poon 2018; Willsher 2018). Both in dualist as well as novel ecosystems, anthropocentric focus of interest render city rats and other urban animals invisible and ignores them in planning urban spaces, consequently creating the foundation to accommodate them. Yet how to challenge those anthropocentric perspective of undesirable natures and the corresponding power imbalance that reinforces them?

Urban Political Ecologies of rats

> *"While there are many important ways that the false dualism between nature and society has been addressed, UPE offers a way of addressing this issue with specific attention to urban socio-natural form and spatial processes." (Heynen, 2017, p. 8)*

UPE has existed for over 20 years (Heynen 2017) and first began to take shape as a distinctive research field in Erik Swyngedouw's study of the water supply in Guayaquil, Ecuador in which he detailed how nature and the urban are part of each other, deeply connected in a complex network of infrastructure, politics and cultural practices (Swyngedouw 1997; 2004).

Swyngedouw first concluded the need for an explicitly *Urban* Political Ecology when he pointed out the connections between "ecological thinking, political economy, urban studies and critical social and cultural theory" and how they could "provide the ferment from which a new and richer Urban Political Ecology may germinate." (Swyngedouw 1996, 67). His argument was based on the conclusion that the complexity of social and ecological interrelations that constitute cities could not be grasped by research fields that were ontologically divided along dichotomous notions. Especially the observation that, until then, 'ecological' research had mostly been done in rural areas, while 'urban' research was not concerning itself with 'economic and political' processes. Advocating for seeing cities as entanglements of 'socio-natural' flows and processes, allowed for the inclusion and combination of ecology, politics and economy within one field and opened up urban landscapes to a variety of research approaches (Keil 2005; Heynen 2014). In consideration of the diversity of cities and the processes that shape them, talking about Urban Political Ecolog*ies* (UPE), rather than a single Urban Political Ecology, appears more appropriate (Zimmer 2010).

Many early strands of UPE were heavily influenced by neo-Marxian insights and approaches (Lawhon, Ernston, and Silver 2014). This is prevalent in idea that the metabolization of nature is necessary for urbanization and also in the tendency of UPE scholars to focus on processes which cause a disruption or inequality within a network (Heynen, Kaika, and Swyngedouw 2006; Gandy 2003; Bakker 2003). An important emphasis of UPE analysis of urban landscapes is its focus on capitalist urbanisation (Harvey 1996). This is used as the basis to explore "the processes and practices that

produce uneven and spatially differentiated environments" (Braun 2005, 644) and the uneven social power relations that arise through the interaction of political and ecological processes. Examples for this would be the exploitation of water sources in developing countries by industrial development or tourism, leading to water pollution, depletion of water sources and restricted access for local populations (Derman and Ferguson 2000; Bakker 2003; Cornea, Zimmer, and Véron 2016). The role of capitalism in the production of the urban space is one of the main driving forces with which UPE connects the exploitation of distant ecologies and the city in order to "untangle the interconnected economic, political, social and ecological processes that together go to form highly uneven and deeply unjust urban landscapes." (Swyngedouw and Heynen 2003, 898).

A "first wave" of UPE literature in the late 1990s and early 2000s integrated insights from political ecology, urban and environmental history and applied them in the form of neo-Marxian investigations into urban environmental issues (Heynen 2014). It was a critical inquiry of environmental injustice and system-based marginalisation with a focus on "the multiple entanglements between capital, ecology, and social justice at a variety of metropolitan scales." (Gandy 2022, 23). This first wave of UPE research stressed the importance of socio-natural ecosystems, while retaining/featuring a strong emphasis on the production and meaning of urban nature in the city. The contributions of the time were dominated by investigations of water and infrastructures in and to urban environments (Kaika 2005; Gandy 2003; Swyngedouw 2004), which was then extended to air (Véron 2006), sanitation (Bakker 2003), lawns (Robbins and Sharp 2006), parks (Heynen, Kaika, and Swyngedouw 2006) and many other features of the urban environment that had before been attributed rather limited agency. Urban animals were thus acknowledged as parts of those systems but they were not addressed directly as actors or attributed affective abilities.

The works mentioned above served the main purpose of showing how the historically deeply intertwined flows of material forms of nature have shaped the urban fabric and how the capitalist practices that have created those flows, use them and thereby create the basis for unequal power relations. For example, city rats are closely related with the presence and flow of water into, within and out of cities (Byers et al. 2019). There are many connections from the origination of the water supply, through concealed canalization systems, to the provision of potable tap water, and finally, to the processing and

management of wastewater (Gandy 2004). There is an especially strong correlation between poor sewage system maintenance and the occurrence of rats (Heiberg, Sluydts, and Leirs 2012). Therefore, urban animals are undoubtedly connected to the socio-natural flows that constitute the city but the focus of UPE research lies more on the environmental injustice towards the exploitation of material forms of nature and the resulting power inequalities focused on humans.

It was not until the "second", some argue even the "third" wave, of UPE research that the heavily neo-Marxian influence of the first wave UPE was addressed (Heynen 2014). In response, UPE scholars introduced feminist geography, queer theory, critical race studies, abolition ecology and more-than-human approaches and incorporated them into different or new UPE strands (Heynen 2016; 2018). While the political in UPE has been undeniably neo-Marxist by origin, there have been ontological shifts from class to race, environmental injustice, democratisation of environments and giving increasing significance to non-humans and matter (Keil 2005). This led away from the strong socio-economic focus, which is essentially anthropocentric at its core, to more-than-human ways of thinking (Greenhough 2014). As a result, UPE's research foci expanded over a wide spectrum of socio-ecological inquiries set in the urban environment and often work at the intersection with other fields including biology, ecology and urban theory.

With this new development, the field of UPE became even more interconnected with other fields which brought new challenges with it, such as the increasing struggle to identify itself with clear conceptual and empirical approaches. Matthew Gandy highlights these issues where he calls for a "critical reconfiguration" of UPE and bases his analyses on the observation of two main aspects in the development of UPE to date: the widening empirical scope of UPE research since 1990 and the strong increase of conceptual insights from other fields which compete with the dominant neo-Marxian analytical framework (Gandy 2022).

As established above, UPE scholars see cities as products of interconnected socio-material processes (Heynen 2017). By concentrating on the urban interactions between socio-political and natural processes, UPE breaks down dualist thinking by combining and extending the connections between nature and society. In doing so, UPE offers a framework that overcomes the nature-society dualism by regarding humans and non-

humans as co-produced within socio-ecological processes. When studying urban nature, a good summary of the early UPE perspective of nature is offered by Kaika (2002):

> *Cities are dense networks of interwoven socio-spatial processes that are simultaneously human, material, natural, discursive, cultural, and organic. The myriad of transformation and metabolisms that support and maintain urban life, such as water, food, computers, or movies always combine environmental and social processes as infinitely interconnected…this intermingling of things material and symbolic combines to produce a particular socio-environmental milieu that welds nature, society and the city together in a deeply heterogeneous, conflicting and often disturbing whole. (Kaika 2005, 22)*

The city in UPE is made up of interweaving social and environmental processes that make use of a functional narrative including "metaphors of networks, flows, metabolism, but, also, disruptions and heterogeneity" (Anderson 2009, 58). Placing nature in the city instead of the countryside and placing society in the countryside instead of the city helps to uncover the many ways in which the environment is co-produced by both social and natural processes. So how can UPE's perspective help analysing city rat places?

In the following sections, I focus on the foundational key concepts of UPE, namely the metabolisms, hybridity, discourses and imaginaries. I discuss these key concepts in detail in order to identify the gaps and weaknesses of the conceptual and epistemological approaches of UPE in regards to studying urban animals like rats.

Metabolism

The urban metabolism, a key concept of UPE, is probably the most common conceptualisation used to overcome the nature-society divide and is based on the relational co-constitution of cities with residues of dualist thinking, especially in the neo-Marxian strands of UPE. This concept draws on the analogy with biological metabolisms and considers cities "as a product of metabolic processes of socio-natural transformation" (Angelo and Wachsmuth 2015, 16). In more recent UPE literature, the socio-natural urban metabolism goes beyond the material flows, including social and political processes as well (Loftus 2007). The concept of metabolism puts an emphasis on the co-production of the urban through socio-ecological processes, while adding a political focus that helps to

"theorize the process of urbanization as a social process of transforming and reconfiguring nature" (Swyngedouw in Heynen, Kaika, and Swyngedouw 2006, 35). Within the socio-natural metabolism, the binary of nature-society has been replaced with "socio-natures" which implies that nature does not exist independently of the society and vice versa (Heynen, Kaika, and Swyngedouw 2006; Swyngedouw 1996). Urbanisation processes depend on the metabolisation of nature, through which the social and the natural are co-produced into socio-natures. For example, city rats could be considered as 'socio-natures', living and adapting within the urban environment, and their existence and behaviours potentially being shaped by the same socio-ecological processes that influence urbanisation. Most prominently are the interactions between rats and waste disposal practices, public health policies, and even architectural decisions around pest-proofing infrastructure.

Despite the fact that UPE rejects the idea of reducing nature to the status of a raw material, the framework of the metabolism struggles to account for non-human agency and focuses strongly on anthropocentric interests. While acknowledging that cities are co-produced by humans and non-humans alike, metabolisms are dominated and mediated by humans, and usually only a selected few at that (Zimmer 2010). Studying city rats within the framework would results in rats as 'by-products' rather than 'agents' in the urban metabolism which could limit the understanding of their role, impact, and potential contributions to the urban socio-natural landscape. Rats live off and through the urban environment, occupying the abandoned spaces and products of the urban life (Feng and Himsworth 2014). Spaces where rats live are created through the production of waste and waste-disposal spaces in the urban setting. The nature part of socio-natures is in this sense reduced to a material aspect of the abiotic environment rather than living, breathing other-than-humans with agency. Consequently, the commodified nature is subservient to the urbanisation process controlled by the elite and is used to express the uneven distribution of power in cities and the presence of inequalities. As the terminology already hinted at, this weakness is most prominent in the neo-Marxian dominant literature strand of UPE. The main critique is that UPE literature neglects the parts of the network, which do not contribute to topics regarding the commodification of nature, ecosystem services or access-related social injustice.

To conclude, while socio-natural metabolism provides a rich framework for understanding the co-construction of urban spaces, it requires expansion to fully account for the diverse agencies within urban environments. The metabolism concept reflects on the creation of rat habitats but it struggles to consider rat agency and rats as subjects of research unless they contribute to the commodification of nature or social inequality narratives (Zimmer 2010). Consequently, this can inadvertently sustain dualistic perspectives and an anthropocentric bias.

Hybridity

The concept of hybridity differs from the metabolism in the way that it considers everything as co-produced rather than packing it into flows and exchanges that then co-produce the city as a consequence of urbanisation processes (Whatmore 2002). It is based on the assumption that nature and culture are inherently inseparable and inextricable in its foundation and need to be studied as one thing (Swyngedouw 1996). Hybridity addresses the conceptual boundaries of dominant dichotomies that are based on binary divisions such as natural/urban by empirically focusing on things and processes that transgress them. As a result, many hybrid case studies are located exactly at the fringe of dualist tension points and are focused on the previous blind spot of urban nature. The "hybrid" suggests the mixing of two discrete components but hybrid geographies is not an interaction approach but instead creates something ontologically new by focusing on the 'between' and as such, displacing the boundaries of nature/culture or rural/urban (Wilbert 2004). Nature is considered a hybrid, meaning it is natural and social at the same time, which has also given birth to the term socio-nature (Latour 1993; Cornut and Swyngedouw 2000). Seen through the lens of hybridity, water becomes a co-product of a material form of nature which is socially induced with meaning and function given to it by humans. Taking this a step further, hybrid geography scholars insist that the human engagement with the world exceeds acts of representation and also involves interactions on the bodily level such as "touch, smell, hearing and physical interaction."(Castree 2017, 19).

Studying urban nature through hybrid approaches opens up many new possibilities then to consider the world on a deeper and more fine-tuned level of individual interaction. However, the origins of hybridity can be traced back to Marxist historical materialism and its dialectics and as such hybrid case studies have usually strong anthropocentric interests at their base (White, Rudy, and Gareau 2015). With nature being infused into the social

sphere, it no longer is assigned any purpose, such as making it subservient to urbanisation processes as in the metabolism, but instead it is categorized based on humanist values.

Applying this concept to rats, reveals an advantage in comparison to the metabolism in regards to accounting for non-human agency. This is essential, since rats are not just 'occupying' urban spaces passively, they actively engage with, alter, and adapt to these spaces, shaping their own habitats and human perceptions of urban environments. Furthermore, hybrid geography recognizes that nature escapes those categories and roles humans make for it and studies them to question them. Being urban animals, rats transgress the boundaries between nature/urban and also often physically invade what humans consider 'human spaces', ignoring cultural or material confinements. By considering city rats as socio-natural hybrids, researchers have an opportunity to study the complex interplays between rats and their urban environments.

However, placing humanity as central to hybridity heavily limits the concepts potential. Lulka addresses the limits of embracing post-structuralism and the need for a better representation of natural landscapes by arguing for a "thicker hybridity" that borrow from emergent theories that takes place outside of society's eyes and focus (Lulka 2009). The problem is that with humanist perspectives at the centre, human interests always outweigh non-humans. To illustrate this, consider how rats significantly impact urban environments by looking for shelter, burrowing in parks, looking for food in trash bins, seeking warmth in buildings and subways and more. However, under a human-centric view, the rat's everyday living suddenly is perceived as damaging infrastructure, spreading diseases, and disturbing waste management and generally inconveniencing human life. From this perspective, the roles of rats in urban environments may be reduced to nuisances, pests or vectors of disease - purely in relation to human interests and health. Hybridity does not attribute affective capacities (or the ability to affect and be affected) to rats or other-than-human beings. Instead, it lumps together all non-human entities, be they animals, plants, or inanimate natural elements like water, under the broad category of 'non-human'. This lack of specificity can limit scholar's understanding of the unique roles and impacts each of these entities have within socio-natural landscapes, thereby making the approach unsuitable for a nuanced study of entities like city rats.

Discourse and imaginaries

The concepts of discourse and imaginaries both facilitate a deeper understanding of socio-natural phenomena and the discursive construction of urban environments. Discourses, as described by Foucault, refer to the socially constructed narratives that shape and influence how we understand the world around us (Foucault 1972). Discourses can both enable and constrain ways of thinking and acting in relation to nature and the urban as they work to naturalise certain understandings and practices while silencing or marginalising others (Fairclough 1993). In regards to city rats, the discourse on rats as pests is very strong, branding them as dangerous and dirty. Therefore, analysing discourses can reveal how power dynamics and ideological viewpoints shape the representation and management of urban environments. Imaginaries, on the other hand, refer to collectively held and shared visions, ideas or understandings about the world. They are the socio-cultural constructs that shape how societies perceive and interact with their environment. Urban imaginaries can significantly shape urban policies and planning, impacting the socio-natural formation of cities (Gandy et al. 2006; Flaminio, Salomon Cavin, and Moretti 2023). For instance, an urban imaginary envisioning a 'sustainable' or 'resilient' city might foster urban policies promoting green spaces, renewable energy, or climate adaptation measures (Gibson, Rose, and Fincher 2015). Both concepts therefore offer powerful lenses to uncover the socio-cultural and political dynamics that shape urban environments. As such, they enable a critique of the socially constructed nature of urban issues and provide insight into the powerful role of narratives and visions in shaping urban futures.

However, at the same time both concepts are inherently anthropocentric concepts, mainly focusing on human perceptions, narratives, and social constructs. As such they are not suited to adequately address concerns relating to the agency, experiences, and perspectives of non-human entities (Greenhough 2014). Taking the example of nature: in these concepts, nature is a symbolic representation within a system of meaning differences and therefore considered as socially constructed (Cresswell 2012, 240). It is reduced to a reflection of cultural meanings attributed to it which leads to different discourses of nature struggling over signifying and legitimizing different political interests and positions (Gandy et al. 2006). Nature is encoded in human-made systems of representations and so humans decide on nature's role, purpose and right to be, all based on social value systems. Non-humans only have a voice where humans attribute them one, for example, considering the case of the different meanings that humans assign to rats such as the pet rat, the lab rat

and the wild rat. A pet rat owner who loves their rat will go to great lengths to assure its wellbeing and advocate for its intelligence and positive attributes. A lab rat as a research and study object is given a voice for its importance to the advancement of science and their ethical treatment is regularly challenged and questioned by concerned animal activists. And the city rat? It is seldom given a voice since dominant discourses of rats in urban spaces are those of rat as pest and vermin, not part of the desirable nature that deserves protection. Since the value of rats' life depends on human signification, they become abject and killable mostly due to this overly humanist perspective in combination with the disregard to the rats agency and ecology.

Having analysed the main concepts of UPE in regards to studying the urban environment, I have identified the main gaps of each. First, the metabolism offers a solid foundation for studying urban co-creation between humans and non-humans, but lacks inclusivity for the agency of diverse actors like rats. As a result, this shortfall maintains dualistic views and human-centrism when it comes to studying urban animals. Second, hybrid approaches recognizes the ability of urban animals to defy human-defined roles and boundaries and therefore does not exclude them from being involved. Additionally, this concept acknowledge rat agency and account for their active participation in shaping urban space, which offers unique insights into urban ecology. Conversely, the human-centric bias inherent in hybridity reduces non-human entities to broad categories, potentially oversimplifying unique interactions like those of rats. Third, discourses and imaginaries are inherently anthropocentric. Both concepts favour human values, oversimplify ecological relationships, lean towards abstract thinking, and are not suited to reflect the dynamic nature of non-human behaviours in urban environments. However, discourses and imaginaries offer powerful lenses to uncover the socio-cultural and political dynamics that shape public opinions towards rats. As such, they can be a useful tool to provide insight into the powerful role of narratives and visions which influence political decisions in regard to the management of urban animals.

UPE has certainly played a fundamental role in criticizing and breaking down the classic dichotomies of dualist approaches by showing "the extent to which cities are constituted by socio-natural metabolic flows and exchanges, in which the materiality and the agency of humans and non-human bodies, relations and infrastructures, are deeply entangled."(Brighenti and Pavoni 2020, 2). By exploring the 'recombinant' (Hinchliffe et

al. 2016) or 'cosmopolitan' (Gandy 2013) ecologies, scholars are acknowledging the vital contributions of other-than-humans to the urban environment. But might we not also ask how the lives of animals are shaped regardless of their use or value for any anthropocentric purposes or contribution to urbanisation processes? UPE approaches enable to study the broader setting in which urban animals live, but they do not allow for a more careful exploration of studying urban animals in their own realities and agency. While UPE research does certainly address non-human agency, it often focuses on broader socio-ecological themes rather than individual species. As a result, there is a lack for a multispecies perspective which would allow to study the specificities of different animal species, with their own behaviours, habitats, and ecological roles, co-existing and shaping the urban environment. Therefore, in order to analyse rats and rat spaces in respect to agency and more-than-human perspectives, I argue for an expansion of the UPE framework by combining it with the ontological approaches and methodologies from Animal Geographies – a path I will present in the remaining section.

Animal Geographies: more-than-human approaches

The development of Animal Geographies has its roots in cultural and human geography's transformation in the late 1980s and early 1990s. During this period, geography underwent a significant 'cultural turn,' which prompted a shift from a predominantly quantitative, positivist orientation to a more qualitative, interpretive approach (Buller 2014). This shift opened up new spaces for the consideration of non-human entities, including animals, within geographical research. Animal Geographies as a distinct field of study emerged in the late 20th century, along with the 'animal turn' in the social sciences and humanities. The 'animal turn' refers to the increased attention towards animals within academic discourses, recognizing animals as significant actors in social, cultural, and geographical research and was driven by a number of key publications (see Philo 1995; Emel and Wolch 1998; Philo and Wilbert 2000a). The 'animal turn' signifies a conscious shift in academic focus towards acknowledging animals as sentient beings with agency and individuality, rather than mere objects of human control or symbols of human culture.

Traditionally, most of the Animal Geographies research literature has been focused on 'wild' animals living in 'natural' habitats, which are considered more worthy of protection, such as endangered species (as pointed out by Buller 2014; Hovorka 2019). Driven by

concerns over climate change and debates about the Anthropocene led Animal Geographies and related fields such as urban ecology, conservation science, urban planning and environmental sciences, to take an increased interest in researching urban nature and reflecting a broader ideological shift away from human-centric modes of thinking to consider the lives and bodies of non-humans (Arcari, Probyn-Rapsey, and Singer 2020). The Animal Geographies research agenda strives for the acknowledgement of animals as integral parts of the social, economic, and environmental worlds, as subjects that contribute to the production of space and place, and as beings with their own experiences and geographies (see Buller 2017).

As a field, it advocates for more-than-human perspectives to reconfigure the ontological and epistemological reach of the mostly 'human' geography and challenges anthropocentric biases that pervade academic research and societal thought (Buller 2014). This is essential when addressing urban animals in particular due to the discourse on cities as 'human spaces' which supports imaginaries of a urban environments as serving to human interests. Dualistic thinking of this kind reduces complex socio-ecological systems to simplified dichotomies, thereby marginalizing or ignoring non-human actors and their agency. Emphasizing the entwined lives and shared vulnerabilities of human and other-than-human beings, scholars are advocating for a more relational approach to ethics and politics and to take responsibility for the ways in which human actions impact diverse species and ecosystems (Haraway 2016; Bellacasa 2017; Swanson 2019). Integrating Animal Geographies approaches in the foundations of a UPE framework on urban environments then offers a an extended conceptualisation of rats which accounts for the co-constitutive powers of rats and allows to address these anthropocentric biases at work.

As already addressed above, the context of urban animals, is that they are perceived as 'out of place' rather than belonging to urban environments (Philo 1995). Considering urban animals then "does not mean to simply add more actors to an already prefigured notion of the urban"(Brighenti and Pavoni 2020, 3) but to finally acknowledge the actors that already reshape the conception of the city (Arcari, Probyn-Rapsey, and Singer 2020). Connecting this with the UPE framework, adding animal agency to the analysis of urban animals reveals the hidden relations and interactions which are influencing the making of the urban environment but not *serving* any purpose of humanist interest, surplus creation or similar (Philo 1995; Wolch, Wilbert, and Emel 2002; Buller 2014). Animal Geographies therefore

shift the focus from human interests to animal realities to shed light on how their agency shape the environment they co-inhabit (Carter and Charles 2013). Cities are not solely human-made and human-inhabited but instead are home to multiple species living alongside each other in a multispecies co-existence. The concept of 'coexistence' is understood in this context not through the anthropogenic lens of conflict, but rather as a diverse framing of human-animal relations (Frank and Glikman 2019; Van Patter 2022a). Multispecies coexistence then aims to highlight the dynamic nature of coexistence and the consequential negotiation between humans and other-than-human species. Becoming sensitive to multispecies co-existence is to recognise the role of other-than-humans in the co-production of the world we live in and accepting them as full participants. Animals collaborate in the production of the urban, influencing urban knowledge, relations, spaces and atmospheres (Lorimer, Hodgetts, and Barua 2019).

The multispecies concept also challenges the traditional boundaries of justice, urging researchers to consider the rights, agency, and well-being of other-than-human beings (Ducros 2021). This is also part of the research agenda of scholars working on 'multispecies justice' (as defined by Plumwood 2001), which draws on a variety of disciplines, including anthropology, ecology, geography, philosophy, and political science, to explore how human societies can develop more equitable relationships with other-than-human life (Van Patter 2022b). The theory of multispecies justice is based on the moral and political obligation to take the interests of other-than-humans into account. In doing so, it prerequisites an extension of ethical consideration and political rights beyond the human (Celermajer et al. 2020). Multispecies justice addresses the marginalization, exploitation and extermination of other-than-human life forms and fundamentally critiques the rationalist assumptions that have contributed to human exceptionalism and environmental degradation (Plumwood 2001).

Similarly, Haraway has introduced the 'response-ability' to take an ethical stance rooted in the acknowledgement of our profound interdependencies and our collective participation in world-making as a "cultivating collective knowing and doing" (Haraway 2016, 34). She argues that ethical behaviour is not a solitary endeavour but a collective practice that involves different forms of knowing and acting that evolve from our relationships between humans and other-than-humans. This indicates that ethical sensibilities are developed within communities and are a product of continuous interactions and shared experiences.

Haraway's 'response-ability' is an important ethical tool for reflecting on the emerging relations between humans and other-than-humans. With it, Haraway emphasizes the cultivation of profound attunement to the diverse life forms with which we share our existence, and the orientation of our actions towards endorsing collective well-being and prosperity (Haraway 2016, 38).

While the concepts of 'multispecies justice' and 'response-ability' have a lot in common, they differ in their focus and their scale of action. 'Multispecies justice' centers around transforming conceptions and institutions, which establish and enforce the rules and principles that govern human-animal interactions, while 'response-ability' emphasizes the ethics of care, response, and responsibility of individual humans. An agenda of 'multispecies justice' for example entails a broader systemic call for the reform of justice institutions and paradigms to include the interests of other-than-human beings (Chao and Celermajer 2023). As such, it is inherently political in its aim to target and transform institutional bodies and broader systems and structures that shape societal norms, distribute power, and determine what is considered valuable or important. This is especially relevant for those species considered pests and vermin, who do not serve a specific purpose to human society and have been culturally degraded (Nagy and Johnson II 2013). Applying a 'multispecies justice' approach to rats then would entail an implementation or change of laws for animal welfare, challenging the biopolitics of rat control and subsequent guidelines for the application of lethal management tools.

In comparison, 'response-ability' is more focused on the individual or communal ethical obligation to respond to the needs and rights of other species based on our inherent interconnectedness. On a conceptual level, 'response-ability' involves shifting the cultural narratives and attitudes about rats and to underscore Haraway's philosophy that life is essentially a collaborative pursuit, involving 'becoming with' different beings and jointly fabricating our shared futures. Applying 'response-ability' to city rats for instance, urges researchers to see them not as isolated annoyances, but as part of a larger urban ecosystem that is heavily driven by human behaviour which affects rats. Furthermore, rather than viewing city rats solely as pests, this approach encourages to strive for understanding the reasons behind rat behaviours, such as the quest for food and shelter, which are often linked to human activities. Haraway argues that responses of becoming-with and "rendering each other capable" are elements that harmonizes the preceding aspects of her

conceptual framework (Haraway 2016, 58). This articulates her perspective that ethical action is an ongoing process of 'becoming with' other beings in a manner that endorses their worth, acknowledges their agency, and bolsters their capacity to flourish (Haraway 2016; 2008, 134). In essence, it is about fostering relationships that augment the potential of ourselves and other beings to coexist productively in our shared habitats.

The study of animals within the field of Animal Geographies is broad and encompasses a wide range of animals in different contexts. Due to the prevalent power dynamics between species, often dominated by humans, animals are culturally categorized into different groups such as pets, livestock, wildlife, laboratory animals, working animals, zoo animals, pests, to name but a few (Hovorka 2019). The formation of these categories are guided by anthropocentric orderings of attributing value to animals based on their utility for and appreciation through human eyes. The context in which animals and humans interact plays an essential role in determining these interspecies relationships and subsequent placement of animals within cultural and historical settings (see Hodgetts and Lorimer 2015). The consequences of these placements are highlighted very effectively in Hal Herzog's book 'Some We Love, Some We Hate, Some We Eat' (Herzog 2010). A similar observation has been made in fitting animals into one of the three groups of 'pet/pest/profit' (Taylor and Signal 2009), a categorisation that makes a seamless analogy to 'pet/city/lab' rats. These examples make apparent the importance of material environment, cultural context and multispecies interactions leading to different dynamics of the human-rat-relationship. It is within this entanglement of politics, economy and historical narratives that rats emerge into their different roles becoming either companions, utilised as research objects or killable as pests.

While rats are studied in various fields, their roles are often confined to either model organisms, disease vectors, indicators of urban decay, or sociocultural symbols. In the biomedical field, rats serve as essential models for understanding human disease and developing treatments. Laboratory rats have become one of the most valuable animal models in medical research due to their physiological and genetic similarities to humans (Birke 2003).The field of public health also extensively studies rats, largely because of their roles as vectors of zoonotic diseases. Rats have historically been associated with various disease outbreaks, such as the spread of bubonic plague, leptospirosis, and hantavirus, among others (Himsworth et al. 2013). Thus, understanding rat ecology and behaviour is

crucial to manage public health risks. In urban ecology literature, rats and other urban animals are recognized as an essential part of urban ecosystems (Salomon Cavin and Kull 2017; Byrne 2010). Researchers study how rats interact with the urban environment, focusing on their feeding habits, reproduction, and interaction with other urban fauna and flora (Feng and Himsworth 2014). Social sciences, particularly in disciplines such as sociology and anthropology, investigate the cultural and societal roles of rats. Here, rats often symbolize various social issues, from urban decay to moral transgressions (Biehler 2013). In such studies, the rat acts as a symbol, reflecting societal fears and anxieties rather than being studied for its intrinsic characteristics. There remains a significant gap in literature where rats are viewed beyond these roles, acknowledging their agency and the intrinsic value of their lives. This gap necessitates a more-than-human perspective, recognizing rats as co-inhabitants and co-creators of shared urban spaces. Animal Geographies therefore offers an alternative to studying rats as it seeks to understand the complex relationships between humans and rats within spatial and socio-ecological systems. Rats in this context then are acknowledged as co-constructors of urban spaces, challenging anthropocentric narratives and assumptions, which limit researchers ability to consider rats as co-constituents of urban environments and co-producers of urban life.

A more-than-human approach within the scope of Animal Geographies paves the way for a transformative understanding of rats and their relationship with humans and their environments. This perspective allows to transcend the entrenched anthropocentric biases that limit the exploration of rats' agency, identities, and roles within socio-environmental systems. These biases also affect researchers' ability to see rats as beings existing outside the narratives and discourses told about them (Philo and Wilbert 2000b). Overcoming these barriers is crucial for the advancement of research on urban rats within Animal Geographies. Approaching the study of rats from a more-than-human perspective allows researchers to see rats as beings who shape and are shaped by their interactions with humans and the urban environment (Haraway 2008). This not only broadens the understanding of rat lives but also challenges the anthropocentric norms within Animal Geographies and contribute to filling the existing gap in the literature.

First, in order to do justice to the agency of rats within urban environments, Haraway's concept of 'becoming with' offers an empowering theoretical framework to overcome the challenges which obscure the understanding of rats as more-than-human beings. the role

of rats in the urban environment and the way they shape and are shaped in their interactions with humans and the built environment is rarely thematised outside of literature on pest management and public health topics (a topic raised by these authors in particular Arcari, Probyn-Rapsey, and Singer 2020; Heiberg, Sluydts, and Leirs 2012; Brighenti and Pavoni 2020). Applying the concept of 'becoming with' to different sites which rats co-constitute and co-produce reveals the different roles that rats can emerge as. This 'rat multiple' of the lab, pet and city rat, is based on the concept of the 'body multiple' by Annemarie Mol (2002), refers to the way the body is enacted in different practices and thus becomes different things. It is rooted in the concept of 'multiplicity' by Deleuze and Guattari (1987) and highlights the different ways that rats are 'becoming with' in different relations with humans and their environment (Deleuze and Guattari 1987). Second, in order to understand how the historical and cultural perception of rats influence the way they are perceived and treated by humans, it is vital to look at how rats are placed in their relationship to humans within the material environment. Rats, as with many urban animals, are often exclusively studied within a 'pest' discourse that situates them as unwelcome intruders in human space (Brookshire 2022). This portrayal reflects deep-seated anthropocentric attitudes that deem rats as undesirable and deserving of extermination. With the help of Philo and Wilbert's concept of "animal spaces, beastly places" this process and subsequent treatment of rats can be examined and studied. This is especially relevant in the context where the perception of certain 'rat spaces' is intimately connected to Julia Kristeva's concept of the abject, with rats often associated with filth, waste, and death (Kristeva 1982). This negative imagery not only influences public attitudes towards rats, but it also impacts how rats are studied within the social sciences. Consequently, these associations have significant implications for the treatment of rats, including a societal readiness to kill them (Group and Group 2006). Additionally, due to their ecology, rats are often not perceived as individuals but as indistinguishable elements of a 'crowd' (Holmberg 2015). This further complicates the ability to study rats outside of their human-assigned 'rat spaces' and blends out the agency and lived realities of individual rats, especially in regards to multispecies justice. In the following sections I discuss these challenges and how to address them.

'becoming with' rats

Analysing rats through a more-than-human lens allows them to emerge through a process of 'becoming with' their complex entanglements (Isaacs 2020; Houston et al. 2018).

'Becoming with' refers neither to an imitation, nor literal transformation, but instead is a proliferation of multiple identities and ways of being in the world (K. Wright 2014). Stemming from the thoughts of Deleuze and Guattari and their concept of 'becoming animal', these two scholar have observed that "becoming animal does not consist in playing animal or imitating an animal and one does not 'really' become an animal any more than the animal 'really' becomes something else (…). What is real is the becoming itself, the block of becoming, not the supposedly fixed terms through which that becoming passes." (Deleuze and Guattari 1987, 238). Donna Haraway explored this concept thoroughly and highlighted the interaction and the interconnectedness of all living beings, human included:

> *"If we appreciate the foolishness of human exceptionalism then we know that becoming is always becoming with, in a contact zone where the outcome, where who is in the world, is at stake." (Haraway 2008, 244)*

The process of 'becoming with' then leads to infinite possibilities of encounters and entangled relations that 'emerge' between human and nonhumans, leading to a multiplicity of places, actors and relationships (S. Wright 2015; Kirksey 2015). A well-known example rooted in this approach is the concept of space by Doreen Massey who argued that space is a product of interrelations that is always continuously 'becoming', leading to a multiplicity of space (Massey 2022). These characteristics opened up new possibilities to study the complex realities urban animals and the processes they are involved in, without running the risk of having them fall in between the cracks of belonging to either nature or society. The goal is to avoid looking at nature *in the* city or at rats *in the* city as something which is placed there from a perceived outside nature into a social and anthropic domain where it is then consequently 'out of place' (Philo 1995). Doing so enables researchers to study specific sites within the city inhabited by urban animals appear and explore how these sites have emerged (Salomon Cavin 2022).

One way of addressing the deeply intertwined human-animals relationship is through the companion species concept made popular by Donna Haraway (Haraway 2003). It describes a mutually dependent relationship between humans and certain species of other-than-human animals. Haraway explains that the relationship between companion species is productive or co-constitutive and thus implies a mutual dependence of two or more species on each other "in which none of the partners pre-exist the relating, and the relating is never done once and for all" (Haraway 2003, 41). She takes the co-evolution of humans

and dogs as an example of companion species, explaining that the two species were dependent on each other and neither would have evolved as they did without the other. Of course, many other scholars have come forward suggesting that there are many other candidates for companion species such as cats (Crowley, Cecchetti, and McDonald 2020), mushrooms (Tsing 2012), elephants (Lorimer 2010) among others.

Haraway sees relationship between companion species as multiform, unfinished and consequential. For her, companion animals should not be reduced to equal pets, nor should they be humanised in any way, for both would deprive animals of a diminished role of self-empowerment and agency. Instead, Haraway uses the concept of "significant Otherness" to acknowledge difference that is not based on hierarchical value but nonetheless describes to non-identical counterparts. It is in the communication between the self and the other that the relationship emerges and it is in this interconnectivity and mutual, simultaneous emergences that Haraway sees the chance for an acceptable ethico-politics in the companion relation. As such she explains "that the origin of rights is in (the) committed relationship, not in separate and pre-existing category identities" (Haraway 2003, 53). As an example she names the seeing dogs as adults of another species instead of infantilizing them to furry children.

These relations are also dependent on the interaction which takes place between humans, other-than-humans and the material environment. Interactions can have different levels of depth based on repetition, psychical closeness and duration among other factors (Harrower 2005). Different intensities of interactions are generated through social human and other-than-human interactions (Brighenti and Pavoni 2020). Habituated interactions can be positive, in the form of strong bonds between working animals and their owners (Maurstad, Davis, and Cowles 2013; Lee Davis, Maurstad, and Dean 2015) or negative, such as humans killing animals for food (Waitt 2014; Tang et al. 2018) or due to human-wildlife conflicts (Margulies and Karanth 2018; Srinivasan 2015). Intense interactions have a habit of re-producing themselves across the interrelation in which they were formed, leading to them becoming intertwined and manifested in political, economic, legal and social narratives (Wolch, Wilbert, and Emel 2002; Biermann and Mansfield 2014; Deckha 2021).

The more frequently interactions between humans and animals take place, the better the communication and understanding of the other's ecology. Something that becomes apparent quite when comparing the lab and pet rats with the elusive city rat. Interactions with the latter often happen at a remove, either spatially or temporally, or both. For example, city rats living hidden in places and are active at night, when most humans sleep. Nevertheless, companion species are defined through their shared historical and co-constitutive relationship, both characteristics which are strongly present between rats and humans as well. While Haraway's companion species represents a positive form of an interspecies relationship, the opposite is also common, as has been pointed out before regarding the more lethal interspecies relations of humans and livestock, wildlife and pests. In the case of rats however, there are several categories present at the same time, namely that of pets, laboratory animals and pests. A more-than-human approach embodied in Haraway's 'becoming with' concept then also highlights how different roles of rats emerge within their relations with humans in the urban environment.

The 'rat multiple'

Rather than looking at the human-rat relation as a "result of inherent features of humans and rats who encounter each other", it is instead a "product of the practical actions of humans and rats in particular settings." (Beumer 2014, 13). In doing so, the human-rat relation emerges within situated practices which reveal contradictory human-rat relations between the laboratory rat, the pet rat and the city rat (Haraway 2008). This 'rat multiple' suggests that rats are not a single, uniform entity but rather exist in many forms, a 'multiplicity', which is based on the context and interaction with humans, other-than-humans and environments. The concept of 'multiplicity' and its relatively recent development in the field of geography has attained prominence through the philosophy of Gilles Deleuze and his discussions with Felix Guattari (Deleuze and Guattari 1987). The concept stems from the growing recognition that places and regions are not fixed or static entities, but are constantly changing and shaped by the people and cultures that interact with them. Therefore, places and regions can have multiple meanings and interpretations depending on the perspective of the observer. As such, it is associated with the development of human geography in the late 20th century, particularly with the emergence of critical and cultural geography, which emphasized the importance of understanding the social and cultural dimensions of geography (Lawlor 2008). The idea of multiplicity in geography is also closely related to other concepts such as spatiality, representation, and

power. As it highlights the role of humans in shaping the places they live and how the places shape the people, scholar recognised the potential of applying it to other-than-human beings as well and to study the places and relations that emerge around them through more-than-human perspectives (Srinivasan 2015; Greenhough 2014).

Annemarie Mol addressed the multiplicity of the body in medical practice through her concept the 'body multiple'. With it she explored the complexities of the human body as understood and interacted with in medical practice, arguing that the body is not singular but multiple (Mol 2003). In a hospital setting, for instance, the body is not just a biological entity but a site where various practices and realities intersect. A body can be understood and defined in numerous ways depending on the context: it can be a collection of symptoms to a doctor, a set of emotional experiences to a psychologist, a source of spiritual existence, and so on. She rejects the idea that there is a single, coherent body to be discovered or understood. Instead, she proposes that the body is more accurately described in the plural form – as 'bodies' as it is enacted through various practices and discourses that may not necessarily align with each other (Mol 2003). This concept challenges the notion of a single, objective reality, suggesting instead that reality is enacted through various practices. It has profound implications for how we think about subjectivity, agency, and the materiality of any 'thing' or 'being'. Mol's work encourages a more dynamic understanding of the body, one that is open to its many manifestations and the ways it is shaped by and shapes the world around it.

Similarly, the 'body multiple' can be applied to rats, revealing the 'rat multiple' most vividly expressed through the lab, pet and city rat, all of which belong to the same species of rattus norvegicus. The lab rat, for instance, is heavily regulated by human control, bred for specific characteristics, and used in scientific research (Krinke 2000). Its existence and behaviour are strictly controlled by lab protocols and conditions, shaping it into a specific type of rat - one understood primarily through its utility to human scientific endeavours. The pet rat, conversely, is socialised to human companionship. These rats are often specific breeds, cared for, and valued for their personalities and interactions with their human caregivers (see Hou and Protopopova 2022). Their behaviours and lives are molded by the human domestic environment they inhabit and the affectionate relationship they have with their human caregivers. And finally, the city rat is typically regarded as a pest or vermin, surviving and thriving in urban environments to the dislike of humans (Feng and Himsworth 2014). The urban environment significantly shapes their behaviours through

the spatial distribution and availability of water, food and shelter. Each 'rat multiple' is, thus, produced through its specific interactions and settings - be it a lab, a home, or a city. These differing 'multiples' highlight that rats are not just biologically determined, but are also shaped by the socio-material contexts they are part of. This understanding allows to more comprehensively study and engage with rats (and animals in general), acknowledging their diverse roles, experiences, and agencies.

The perspective of the 'rat multiple' within the concept of 'becoming with' then facilitates the challenging of too narrowly defined and static boundaries and categories in which rats are placed. The lab, pet, city rat labels can in this sense also be compared to the labels of 'domesticated' versus 'feral' , which are also based on normative anthropocentric categorizations. Depending on the context and the subsequently assigned label, the animals subjugated to them experience vastly different interactions with humans, as can be observed in other species as well. Feral cats and dogs for example, trigger violent responses with often lethal consequences for escaping the pre-constituted sociological and biological boundaries of showing up outside their 'domesticated' label (J. Johnston 2021; Srinivasan 2015). It is therefore vital to understand what those labels are, how they came to be and who is enforcing them. Different rat actors therefore emerge based on which specific traits the were assigned, what specific places in the urban they are allocated to through humans among other species. Ignoring that their reality is also relational and continuously becoming often leads to conflict when urban animals show up, where they are not expected:

> *It seems to me that … many animals (domesticated and wild) are on occasion transgressive of the sociospatial order which is created and policed around them by human beings, becoming 'matter out of place' in the process, and it is in this respect that animals often squeeze out of the places—or out of the roles that they are supposed to play in certain places which have been allotted to them by human beings. (Philo 1995, 656)*

In other words, the roles that animals are assigned to are "an emergent product that is practically shaped by how actors come together in given shared environments and spatial-historical situations …(and) in this sense, articulate the social boundaries with a more fluid, porous and mobile – that is realistic – quality."(Brighenti and Pavoni 2020, 4). This approach then allows to see rats in a more-than-human way, focusing on the realities of

rats in each particular setting. Doing so also highlights how rats continuously transgress their discourses, categories and settings both as a species as well as individuals as will be later explored in the empirical chapters.

The same way in which the different 'rat multiples' are emergent, so is the complexity of sites which are produced through the interactions of human and other-than-humans that inhabit them. This leads to a heterogeneity of sites that need to be considered as they are in turn influencing the type of interactions which take place in them such as the laboratory, the home or the sewers. The urban environment, and any other for that matter, is more than a place of multispecies co-existence, where other-than-humans live alongside humans, but instead every site itself is a product of multispecies becoming with, shaping their surrounding (Brighenti and Pavoni 2020). City rats co-exist as pests in cities, much to the dislike of humans, and are only dealt with when necessary, usually for extermination. However, the role that pests play in shaping both material realities and social narratives about places is often overlooked (see Biehler 2013). A great example is the branding of some urban animals as "trash animals", referring to their habit of rummaging through trash in search of food and consequently being associated with being dirty, smelly and disgusting (Nagy and Johnson II 2013, 4). Those connected to trash animals are often stamped with the same label: there is a high correlation of pest infested neighbourhoods with poverty and black minorities in the US (Biehler 2013; LaDeau et al. 2013), which leads to associations on the basis of 'trash' animals in 'trash' neighbourhoods, degrading animals, spaces and people alike. While the branding of city rats as pests and trash animals appears to be rather consistent worldwide, there are still exceptions to the responses they evoke based on both their own multiplicity as well as the specifications of spatial, social and historical contingencies of urban sites. City rats appearing in sewers are generally more in line with the narrative of the 'abject pest' while city rats appearing in green spaces at a river bank however might be considered more generously in regards to fitting in. The 'rat multiples' and their corresponding spaces then not only reveal the often hidden multispecies interactions that shape the urban environment but also the anthropocentric biases within which these spaces are perceived and controlled in regards to anthropocentric orderings.

'Rat spaces' and 'rat places'

One of the first important contributions in the field of Animal Geographies to address both the agency of animals and anthropocentric orderings they are subjugated to, came from Chris Philo and Chris Wilbert through their book "Animal spaces, beastly places" (Philo and Wilbert 2000a). 'Animal spaces' refer to the locations and environments inhabited by animals that are considered 'appropriate' or 'acceptable' by humans. They often overlap with or exist within human-dominated spaces but are seen as spaces of desired human-animal interactions, typically shaped by humans based on anthropocentric interests, values, and perceptions. 'Beastly places' on the other hand, are sites where the interactions between human and non-human animals become contentious and where humans deem the animals in questions as 'inappropriate' or 'unacceptable'. These places are usually typified by the material and symbolic struggles, negotiations, and transformations which occur when animals challenge societal norms of anthropocentric orderings by transgressing the boundaries of their human-assigned 'animal spaces'. For this reason, human-animal encounters in 'beastly places' are often fraught with conflict.

Philo and Wilbert's framework emphasizes the role of historical and cultural perceptions of and values given to animals when analysing the setting of human-animal interactions. Within the urban environment, 'animal spaces' are areas which are integrated into human spaces such as parks, lakes, rivers or other areas where animals can live and interact with humans in a controlled manner (Urbanik 2012; Brighenti and Pavoni 2020). Conversely, 'beastly places' are sites where animals are seen as nuisances or pests, acting against human interests, damaging human property, threatening human's health or wellbeing or simply causing disruptions of other kinds. As such, whenever animals create a 'beastly place' , the human reaction is to control, contain or repress it. This is usually done by either removing the animals or by returning them to their 'animal spaces'. However, the boundaries of and between 'animal spaces' and 'beastly places' are inherently subjective, as they based on human judgments of what is considered acceptable or unacceptable. These boundaries then are subject to a continuous negotiation process between spatial ordering of the human-rat relationship. Something to point out here, is that there are many similarities between the boundaries of assigned 'animal spaces' and 'more-than-human borders'. Scholars from critical border studies and related fields increasingly argue that borders are a "constantly moving space that is created, maintained and/or dismantled by the entanglements of human and non-human lives and things." (Ozguc and Burridge 2023,

471). More-than-human borders approaches enable researchers to study how other-than-human beings are controlled and managed through spatial practices. Additionally, other-than-humans also challenge, defy and alter borders through 'unwanted' spatial movements and thereby demonstrating that borders are produced by complex actor networks of humans, animals and other materialities (see Fleischmann 2020).

Applying this classical space-place conceptualisation allows to analyse the agency of animals by taking into account their appearance, their behaviour, and the effects they have on people (Lorimer 2007). This is important since the creation of these 'beastly places' frequently results in conflict, as it goes against the human-made idea of spatial ordering and is seen as a threat to the safety of humans and values of cleanliness and hygiene (Urbanik 2012). In many cultures, animals represent a more primal or 'beastly' way of life, and their presence in human society is often seen as disruptive or unsettling. 'Animal spaces' for pest species are often areas of exclusion, where animals are relegated to sites which are unappealing to humans. Those 'pest spaces' are often considered unclean or undesirable to begin with or are rendered so through the presence of the animal. Acceptable 'animal spaces' for city rats, such as sewers or narrow, waste collections and narrow alley ways, are generally a source of discomfort and disgust for humans (Holmberg 2021; Doherty 2019; Nagy and Johnson II 2013). As a consequence, animals are often eliminated from urban environments through urban biopolitics in the name of security civility and aesthetics' applied in an attempt to organise the governance of all species, humans included (Brighenti and Pavoni 2020, 2). For animal geographers, acceptance of animal agency then is at the core of approaches that aim to address the more-than-human sociality that can be found in human-animal interactions (Gibbs 2020). Overall, Philo and Wilbert argue that the idea of animals being 'out of place' is closely tied to humans expectations and assumptions about what is acceptable and unacceptable in human society, and that these expectations and assumptions are often shaped by social, cultural, and economic factors.

Unruly, dirty and abject

Using the example of the pigeon, Colin Jerolmack extensively explored how the cultural perception of a species can change over time. In his work he describes the fall from grace of the pigeon, once a symbol for peace and a useful bird for sending mail, and now reduced to having become "rats with wings" (Jerolmack 2008). With the help of a media analysis,

he examines the shift of how pigeons became framed as pests by being compared and aligned with rats and rat traits such as appearing in high numbers, being able to access the entire city infrastructure, damaging property and carrying diseases. Jerolmack strongly criticises the unethical and morally unjust practices of the media and those in power of steering the discourse of pigeons to the point of ruining their image and making them targetable for extermination. All the while, rats appear as the status quo of the label 'pest', the main point from which the 'pestness' of other species is defined with (Birke 2003). Humans have always ranked animals and assigned them greater or lesser value based on perceived traits such as intelligence, rarity, cuteness among others (Arluke, Sanders, and Irvine 2022; Kellert 1997). In the case of the pigeon, its downfall was enabled by collapsing the distinction between the two species by calling them 'rats with wings' and "essentially binding the moral and aesthetic baggage of the rat to the pigeon" (Jerolmack 2008, 87). Despite the fact, that there are a number of other pests, especially insect pests such as ants, cockroaches, bedbugs and wasps, rats wear the crown in the pest discourse. Rats have become extremely stigmatised as a threat to humans and branded as the most legendary vermin (Birke 2003; Patell 1996).

The concept of the 'abject' and 'abjection' was developed by the French psychoanalyst and philosopher Julia Kristeva in the late 20th century. In her work, Kristeva defines the 'abject' as that which threatens to destroy the boundaries of the self and destabilize the social and cultural order (Kristeva 1982). The 'abject' is often associated with bodily fluids, decay, and death, and is seen as something that is simultaneously repulsive and attracted to. Kristeva's concept of 'abjection' refers to the process of rejecting and expelling the 'abject' from the self and the social and cultural order (Kristeva 1982). This process involves a recognition of the limits and boundaries of the object in question, be it the self, a city, a home or laboratory, and a desire to maintain a sense of order and stability thereof. This order is usually based on anthropocentric understandings and ideals.

The process of framing an animal as 'abject' is highly context-dependent and is influenced by a range of cultural, social, and emotional factors. The process of abjection in regards to rats involves a rejection of the 'abject rat' as something that threatens humans. In the case of rats, it is the city rats that is most likely to become 'abject', based on two leading processes. First, as urban animals, city rats threaten and destabilize the social and cultural order of the city by being 'out of place' (Philo and Wilbert 2000a). In doing so, city rats are

disrupting the boundaries of what is considered 'orderly' and thus threaten the modernist perspective of the nature-culture dualism and need for clean cities (Emel and Wolch 1998). Second, through the association with disease, death and dirt, city rats are framed as 'trash animals', disposable and wastable (Nagy and Johnson II 2013; Holmberg 2016).

Animals that are framed as 'abject' are more prone to being rejected, expelled, or even killed in the name of maintaining the boundaries between the spatial and cultural ordering of human interest. Animals that are seen as 'abject' are frequently linked to the most undesirable urban spaces, such as rats are linked to sewers. 'Abject rats' are often the source of discomfort or even disgust when they "transgress the boundary between civilization and nature" when they invade human-designated spaces such as homes (Griffith, Poulter, and Sibley 2000, 60). This transgression of the boundary between civilization and nature can be seen as a violation of the social norms and cultural expectations of how animals should behave and where they should reside, highlighting the human's desire to control and manipulate the natural world to fit their own idea of order (Douglas 2001, 48). These emotions of discomfort and disgust towards the rat also relates to the historical association of rats with disease, which further adds to the revulsion they evoke when they enter human spaces.

The affective reactions of humans towards rats are also closely related to scalar biases of size and number. Bigger animals tend to be regarded with more admiration and respect than small ones and are more likely to be perceived as individuals rather than a group (see "scalar biases" in Brighenti and Pavoni 2020). The individuation of animals, recognizing them as distinct entities rather than homogenous members of a collective, plays a significant role in shaping relationships of humans with, and decisions concerning them (Holmberg 2015). The process of acknowledging the individuality of animals is rooted in the understanding that each creature possesses unique experiences, distinct behaviours, and potentially, subjective feelings. Such recognition, in turn, has profound implications for policy-making, legislation related to animal rights, and the formulation of conservation strategies, as it steers these constructs towards more ethical and humane treatments of animals. Mammals are usually attributed higher degrees of individuation in comparison to bacteria or insects, meaning that they are more seen and treated as individuals. However, the more individuals gather together and form a group, the lower their degree of individuation:

> *In this sense, individuals, packs, crowds and populations are not essences, but different degrees of individuation impacting upon how interaction between actors unfolds according to a given power of action. … Whenever certain animal actors are characterised as 'pests', their degree of individuation scores low: we deal with pests only as aggregates. (Brighenti and Pavoni 2020, 6)*

City rat populations are not treated as individuals but as a whole, representing a problem whenever their numbers are out of control. Tora Holmberg explains that when a group of animals begin to appear together as group, they get "transformed from individuals to an undefinable 'crowd' " (Holmberg 2016, 10). Furthermore, she observes that there is a close connection between how these groups are referred to and the formulation of a social problem. A group of rats for example is called a 'mischief', a word nowadays used to refer to a behaviour or an activity that creates annoyance or trouble and archaically even causing harm or injury ("Mischief" 2022). Aggregating individual rats into a mischief leads to transforming them into an identifiable unit that is then defined by its characteristics as a crowd rather than its single members, facilitating further degradation of rats to pests and vermin (Haraway 2008; Nagy and Johnson II 2013). The individuation is of course also tied closely together with the context of the human-rat interaction and therefore, the complexity of combining the 'rat multiple' with different sites in different cultural and material settings can result in very different outcomes, as Hodgetts and Lorimer (2015) explain:

> *Thinking the animal multiple topologically might help us attune to the biopolitics of governing animals. Configuring animals as individuals, as species, as cultures or as supra-organisms results in different and often incompatible outcomes for the organisms and ecologies involved. (Hodgetts and Lorimer 2015, 291)*

This is illustrated for example with lab rats, who are highly individualized in the sense that each rat is numbered and chosen for different research purposes.

Both scales and individuation play an important role in shaping interspecies ethics. Some animals possess what animal scholars have referred to as 'charisma', a kind of stabilizer for a higher mode of individuation (Lorimer 2007). Charismatic animals, to which many bigger sized mammals, such as the lion or the bear, belong, are more likely to be subjected to conservation and protection efforts (Jaric et al. 2020). The movie 'Ratatouille', which tells the story of the rat Rémy who wanted to be a chef, is an example of how animals can be

individualized by removing them from the aggregate and emphasising their individuality. The opposite however, is also possible, where animals are actively de-individualised to 'livestock' – for example cows, pigs, chickens – which facilitates and legitimizes their mass-production and slaughter (Buller 2016). The level of individuation has a strong influence on the way humans are treating other-than-humans, but the agency of other-than-humans, whether acknowledged or not, remains unaffected. Even for animals living under tamed and exploited conditions such as lab rats, it has been shown that they still portray complex and unpredictable behaviour often leading to unexpected events (Birke 2003; Despret 2016).

Some species, especially those living in urban environments, are more likely to clash with humans due to the close proximity and are thus involved in human-animal conflict situations. The concept of 'problem animals' is grounded in the context of human-wildlife conflict, where specific animals are perceived as nuisances or threats due to their behaviours that interfere with human activities or jeopardize human safety or property (M. N. Peterson et al. 2010). 'Problem animals' can be understood as species whose behaviours or mere presence pose challenges or risks to human safety, health, or property (A. Peterson 2019). This perception arises when animals disrupt human activities or generate negative perceptions due their own activity, leading to tensions as studies have shown in regards to attitudes towards coyotes (Draheim et al. 2013) as well as predation in pet cats (Hall et al. 2016). Examples of problem animals in urban environments include rats, pigeons, and foxes among others. 'Problem animals' emerge due to a combination of ecological, social, and political factors, which contribute to conflicts between humans and animals in various settings and have implications for animal management and conservation.

The concept of 'problem animals' has become increasingly relevant in academic literature as urban environments have expanded and human-animal interactions have become more complex, leading to conflict situation between human and animals (see Soulsbury and White 2015 in regards to human-wildlife conflicts). Especially predatory animals who endanger human safety are often the focus of studies which explore the tolerance of humans in regards to co-existing with such species (see Treves and Bruskotter 2014). Other conflicts related to property damage and species posing a threat to human health have led to various management strategies, including the control, relocation, or extermination of animals in question (see Kaltenborn, Bjerke, and Nyahongo 2006; Crowley, Hinchliffe, and

McDonald 2018). However, the concept of 'problem animals' is not without controversy, as it often leads to simplified and polarized views of human-wildlife interactions (see Clement 2003 in regards to the issue of ethics and care for wildlife). In some cases, for example, a species as a whole can be labelled as a 'social problem' (Best 2018). This label is closely related to the depiction of some species as 'pests' and similarly reduces the animal to a single perception of them. Many pests are considered problem animals but not all problem animals are considered pests. According to Best, there are four ways that animal species are constructed as social problems, which are as "pests that threaten people or their social arrangements; as endangered species whose survival is threatened; as invasive species that pose a threat to some new environment; and as deviants that misbehave" (Best 2018, 1). City rats, then, by being invasive pests that misbehave, fit into three of the four categories. Whether or not rats as a species are considered a 'social problem' or just a 'problem animal,' both labels are rooted in human perceptions and values that reveal the cultural and spatial dimensions of human-animal relationships.

Thus, the strong historical discourses and categorizations for rats, especially the ones relating rats to the 'abject' and to 'pests', continue to obscure the ability of researchers and other stakeholders to see rats as other-than-human beings in their own rights and experiences. This further highlights the need for concepts like 'multispecies justice' and ' response-ability' to study rats in ways that extend ethical considerations. This also aligns with the research made by scholars of the field of invasion ecology, who argue for a shift towards away from the field's reliance on strict categories like native/invasive and instead take into account the human influence on ecosystems and their role in defining what species are considered problematic (Salomon Cavin and Kull 2017; Kull 2018; Jaric et al. 2020).

The goal of this chapter was to conceptualise rats as emergent and co-constitutive of urban environments and within the human-animal relationship. I argued that rats are actors who emerge through their relations and interactions with humans, other other-than-humans, matter and space, recognize that their existence significantly contributes to the character of urban spaces. Having identified how anthropocentric biases limit rats' roles as 'pests' within cities, I advocate for a more nuanced understanding of rats that goes beyond their perceived detrimental impacts on human spaces, drawing upon theoretical frameworks from UPE and Animal Geographies.

In understanding the challenges of studying urban animals, this chapter presented a critical exploration of UPE and its shortcomings which concluded in the need for a more comprehensive theoretical framework. Indeed, UPE has paved the way to see the urban environment as an entanglement of materiality, humans and other-than-humans and therefore allows to locate rats within the complex interactions with the urban environment. Additionally, UPE literature rejects the idea of an "undifferentiated, singular or foundational nature" (Buller 2014, 310) which facilitates thinking through emerging relations and vital connections between human, other-than-humans and matter (Whatmore 2006). I provided an in-depth analysis of the concepts that emerge from addressing and overcoming the nature-society dichotomy and review their ability to account for urban animals by identifying the gaps and weaknesses such as the strong neo-Marxian influence and often implicit humanist focus (Zimmer 2010; Gandy 2022). These gaps underline the need for a multispecies perspective, and thus, an expansion of the UPE framework to shift the focus away from humanism and present alternate ways of studying the complexity and emergence of other-than-human stories. A more-than-human lens, a key tenet of Animal Geographies, enables a deeper understanding of rats as it helps to overcome anthropocentric limitations by accounting for rat agency and acknowledging the impacts of rat-human interactions on urban spaces. In particular, Donna Haraway's concept of 'becoming with' and Deleuze and Guattari's concept of 'multiplicity' provide the tools to comprehend the co-constitutive nature of rats' existence in the city - the 'rat multiple' (Haraway 2008; Deleuze and Guattari 1987). Moreover, examining the historical and cultural perceptions of rats contributes to how they are treated and valued in human societies. This is reflected in the frequent association of rats with "abject" (Kristeva 1982) spaces and materials, solidifying their roles as pests in urban discourses. By utilizing Philo and Wilbert's "animal spaces, beastly places", these perceptions and their consequential effects on societal attitudes and treatment towards rats can be addressed (Philo and Wilbert 2000a).

In summary, the combination of UPE with concepts from Animal Geographies, together with a more-than-human perspective, provides a robust theoretical framework for understanding rats in Zurich. This approach acknowledges the roles and identities of rats as co-constructors of urban spaces, while challenging anthropocentric norms and enhancing the understanding of rat lives. With this conceptual framework then I have laid

the foundation on which I base my empirical discussion on rats through a multispecies enquiry sensitive to the characteristics of more-than-human approaches, letting them emerge in their multiple and co-constitutive roles within rat-human interactions and rat spaces in Zurich.

A Multispecies Ethnography of Rats

Following the conceptual framework outlined in the literature chapter, I adapted ethnographic methods such as observation, participant observation, narrative and discourse analysis, and ethnographic interviews to contribute to a more-than-human methodology. A key methodological question of dealing with the more-than-human is: how to make heard and conceptualise the voices of those who cannot speak for themselves? Animal geography stands out in this sense for its efforts to identify animals not as powerless beings who are passively being acted upon but rather very active agents who are as much influencing their socio-ecological systems as they are influenced by them (Urbanik, 2012). These understandings of human-animal relations and their epistemological ramifications form the basis from which I have developed my research methodology. I chose my methods to reflect and respect the multiple voices of the human and non-human co-constitution of place and the emerging stories that both humans and non-humans tell. My study draws on participant observation, interviews, field notes, and document and media analysis to explore the creation of rat places and the everyday lived human-animal relationships emergent within them.

This chapter is structured as follows: In the first part, I begin with a review of the way that animals complicate human epistemologies. I draw on the concepts taken up in the literature chapter to highlight the methodological consequences of those epistemological challenges of doing animal research. I then show the ways that I address these through the choice and adaptation of my methods and present the resulting methodological framework of multispecies ethnography. In a second part, I focus on describing my main methods and how I applied them in the field. I go deeper into contemplating my own positionality during my field research and I review the challenges of putting more-than-human theory into practice. My main methods for a multispecies ethnography were observation and participant observation, semi-structured interviews, and field notes supported by field diaries and photography. I discuss my approach to the interviews, formally and informally, and how I dealt with issues of positionality and humanism and the advantages of 'staying with the trouble' (Haraway, 2016). Finally, I explain how I processed and analysed the data and discuss the presentation of the results within my empirical chapters.

Towards a multispecies ethnography

The majority of literature on human-animal relations focuses on the human side and consequently uses human-focused and human-directed methodologies to study it (Lindgren & Öhman, 2019). But those same approaches that researchers use to study humans cannot be applied to animals, at least not directly. Animal geographers have long recognized the difficulty in studying animals and other non-humans, and tackling the challenges of accounting for their agency, arguing for shifting the anthropocentric gaze and finding alternative ways of engaging with non-human research subjects (Buller, 2015; Hovorka, 2017; Lorimer & Srinivasan, 2013). In practice, the limit of human knowledge and knowledge acquisition becomes even more prevalent when working with animals and demands reworking existing epistemologies. The following paragraphs discuss the main issues of studying animals related to communication, knowledge acquisition, moving beyond representation and humanism, explaining why these points are problematic and how we can attempt to overcome or avoid them.

How animals complicate our epistemologies

That humans do not speak 'animal' and animals do not speak 'human' is one major challenge of researching animals. Animals have remained passive research objects for most of scientific tradition, merely serving as a backdrop of human projection and representation (Buller, 2014). The marginalization of non-human animals in academic discourse can largely be attributed to anthropocentrism, which is a traditional academic approach that treats humans as the most significant entities in the universe, often excluding non-human animals from active consideration (Buller, 2014). This anthropocentric perspective, combined with speciesism – the assumption of human superiority leading to the exploitation of animals – has contributed to a bias that neglects the agency of animals in academic discourses. This problem is exacerbated by the prevalence of dualistic thinking which results in perceiving the world in in a binary or dualistic ways such as nature/culture, wild/domestic dichotomies, which tend to cast humans in one category and animals in the other. An absence of interdisciplinary approaches, which blend elements of social sciences, natural sciences, and humanities, has also constrained our understanding of animals as active agents in their own right. This is further compounded by a deep-seated scientific tradition that often treats animals as objects for study and experimentation rather than as subjects with their own agency. This is also due to anthropocentrism in research which apply utilitarian perspectives that focus on animals in terms of their usefulness or threat to

humans, rather than considering them as beings with their own experiences and perspectives. These longstanding biases and practices have together perpetuated the portrayal of animals as passive research objects, merely serving as a backdrop for human projection and representation. Above all however, the exclusion of non-human animals is reinforced by limited methodological approaches that are unsuited for capturing the experiences and agency of non-human animals, such as reliance on verbal language as the primary means of communication in research. Rats and other animals cannot be 'interviewed' and their knowledge is not as easily accessible compared to humans. In order to close this gap, it is therefore vital to develop and apply methodologies "that will allow us to move closer to the animals themselves as individual, subjective beings." (Urbanik, 2012, p. 186).

As pointed out in the literature chapter, a more inclusive and intersectional approach is needed to encompass the deeply entangled lives of other-than-human beings and their surroundings. As Matthew Gandy pointed out, an expansion towards the fields of natural sciences such as biology and ethology can offer important contributions to a deeper understanding of non-human lives (Gandy, 2022). This includes learning about the rats behaviour, diet, population dynamics, movement patterns, temporal and spatial activity, social interactions and much more. Despite being among the most ubiquitous urban animals in the world, surprisingly little is known about the ecology of Norway Rats in urban settings (Feng & Himsworth, 2014). The complex social skills and behaviour of Norway Rats as research subjects in laboratory settings has been revealed in several studies but the social behaviour of their brethren in the wild remains under-studied (Schweinfurth, 2020). This lack of knowledge is due in large part to the difficulty of staying on the tail of city rats who have a habit of living in places that are difficult to observe for humans. Being active at night, able to squeeze through tiny openings and cracks, quick on their paws, the most that people notice about rats is a rustling of leaves or a scuffling in the trash. However, compared to the social sciences and humanities, the natural sciences are not know to accord their objects subjective status. Making use of the knowledges from ethology, ecology and biology of rats, it is important to be reflective about the consequences of studying animals as a research object and not fall into the pitfalls described before.

There is certainly room for improvement in learning about rats. Drawing on the expertise of fields from natural sciences opens up alternative ways of learning 'about' rats while the

social sciences and humanities allow for new ways of 'being with' rats on their terms by redirecting the focus from human to animal in a first step. Schweinfurth (2020) recommends that the knowledge of rats from laboratory or even pet animal settings can be used as a first approach to better understand and predict the behaviour of city rats. As many scholars admit, the lack of knowledge on certain species is mostly due to a lack of interest based on anthropocentric perceptions of value, usefulness and profit (Arcari et al., 2020; Biehler, 2013; Buller, 2016; Gandy, 2019). Applying this in the field would mean to take a step back from humanist approaches and, based on the literature on Animal Geographies, to commit to alternative ways of becoming-with animals and exploring the co-constitutive environments we share (Haraway, 2016; S. Wright, 2015).

Despite efforts in the fields of behavioural biology and neuroscience, humans cannot claim to know what animals think, need or convey to us (Despret, 2016). The inability of animals to speak to humans, has highly problematic ramifications for their placement and power relations in regard to human interests. As Buller explains, it is because animals do not 'speak' like us, that their ability to think and feel is questioned as well, leading them to remain "nature's silent objects to humans subjects" to be decided upon whether they are worthy "of care and moral consideration" (Buller, 2015, p. 375). Using more-than-human approaches allows for a reconsideration of these ontological and epistemological positions regarding animals (Nimmo, 2019). Humans cannot see, hear, smell or feel like animals, but the gap can be narrowed through careful attention and use of 'more animal ways' of studying them (Dowling et al., 2017). For example, Donna Haraway's approach to studying her dogs as companion species is based on the understanding that both dog and human are co-becoming through their interactions rather than one acting upon the other (Haraway, 2003). It is based on the idea that identities, characteristics, behaviours, and experiences of both human and non-human entities are continually shaped, influenced, and transformed through their ongoing interactions with each other. Rather than seeing relationships as unilateral or hierarchical, where one entity (usually the human) acts upon another (usually the non-human), this perspective acknowledges that both parties in a relationship are mutually affected and transformed by the other. This process is mutual and ongoing, challenging traditional notions of humans as distinct and superior actors and recognizing the significant roles that non-human entities also play in these interspecies entanglements. As such, Haraway's approach opened new ways to see the human-animal-

relation not from a species-species but from an individual- individual perspective and led to a richer discussion on ethics, empathy and affect.

Methodologies therefore function as the mechanism through which ontological and epistemological positions are maintained or changed, creating their own ontological consequences (Taylor, 2012). The choice of methods for doing animal research in particular is therefore very important, because it can have political and ethical consequences, as we have seen above. In the case of city rats, those consequences can be deadly. City rats complicate the question of ethics as their representation as pests, disease-carriers and dirty animals is deeply embedded in the cultural knowledge of humans throughout history (Burt, 2006; Hendrickson, 1983). A major step in a methodology for studying city rats is therefore to find ways to get closer and acknowledge every animal as an individual and as such, let go of generalizing practices attempting to group them into anonymous groups or reduce them to livestock or objects (Brighenti & Pavoni, 2020). No two humans are the same and that is true for non-humans as well. Trying to generalize animals' behaviour, looks, or places, would therefore only repeat the mistake of abstracting their reality and establishing categories for them, which they will undoubtedly ignore (Donaldson & Kymlicka, 2016).

Instead, focusing on animals as embodied individuals that live lives entangled with humans in the urban environment leaves much more room to account for the variety of relations that shape their lives (Taylor, 2012). The same is true for the creation of knowledge and narratives that are created through these interactions. Donna Haraway's concept of 'situated knowledges' argues that all knowledge is specific to particular situations and perspectives, and that there is no such thing as a 'view from nowhere' (Haraway, 1988). Furthermore, all forms of knowledge reflect the particular conditions under which they are produced and the social identities and locations of the knowledge producers (Haraway, 2006). The creation of knowledge therefore is not objective but influenced by the circumstances of its creation such as the social context, personal identities, and physical locations of those producing the knowledge, including non-human animals.

This interaction between humans and animals leads to a relational emergence of new stories which is told *through* animals rather than *about* them. These stories, as observed and interpreted by humans, directly impact the knowledge we create about these animals.

Animals are therefore not just passive recipients of human actions but active agents that contribute to our understanding of them. They are co-creators of the knowledge and narratives about them, hence emphasizing the importance of multispecies ethnography, where researchers try to understand and interpret the world from the animal's perspective as well. The concept of 'animal stories' in the context of acknowledging non-human animal agency can be attributed to various scholars working in the field of animal studies and multispecies ethnography. Two such scholars are Thom van Dooren and Deborah Bird Rose, whose work often centres on the idea of 'storytelling' as a method for understanding and conveying animal lives (Dooren & Rose, 2012). Another scholar, Steve Hinchliffe, although not directly referring to stories, offers several empirical examples in regards to nature conservation in which he explains a practice of 'making' non-humans present rather than merely 'pointing out' and 'revealing' their presence (Hinchliffe, 2007, 2010; Hinchliffe et al., 2016). Rather than a truth that is to be uncovered, the very act of engaging with each other leads to the emergence of a new relation that acknowledges and accounts for non-humans' agency. It underscores the dynamic, co-constructed nature of human-animal relationships and the importance of recognizing non-human agency in these processes. This differentiation is important because it puts the emphasis on the recognition of animals being instrumental in forming, or 'constituting', the shared spaces, experiences, and relationships they inhabit.

The stories of non-human animals unfold in intricate and unexpected ways, often challenging human assumptions and prompting novel insights. The issue at the heart of the question "How do we make room for others?" (Pignarre & Stengers, 2007, p. 63) lies in breaking down the boundaries and categories that prevent humans from including the stories of non-humans who already exist whether we humans pay attention or not. I therefore focused my approach to data collection on inclusivity through "additive empiricism" in an attempt "to add, to complicate, to specify, and, whenever possible, to slow down and, above all, hesitate so as to multiply the voices that can be heard." (Latour 2016, ix). Latour's approach encourages the accumulation and layering of evidence in research, adding complexity and detail to the study. This is done in an effort to enhance the richness and depth of understanding, and avoid oversimplification by imposing pre-conceived ideas upon them. It requires the researcher to be available to the subjects they study by staying curious and generous throughout their approach and "give them all the chances" to let their stories emerge (Despret, 2016, p. 360). As such I am opting for a

methodological framework that opens up data collection from a wide variety of sources and allows me to fill the gaps through a reflective and inclusive position of a multispecies ethnography. In doing so, it becomes possible to truly make room for 'others', creating space for multiple perspectives, including unexpected or contradictory ones, thus promoting a more nuanced understanding.

A multispecies ethnography

Ethnography as a methodology includes both the practices employed during the participant field research as well as the highly reflexive report produced afterwards (Watson & Till, 2010). In doing so, ethnography is as much an epistemological as well as a methodological endeavour that concerns both the way that empirical research is done as well as the writing process and the presentation of the analysed data (Atkinson et al., 2001). Compared to other methodologies in human geography, the advantage of ethnographic research is the vast amount of emotional, affective and between-the-lines data that can be obtained. As such it allows to approximate for not being able to speak to animals by exploring the interactions, environment and relations of the individual research subject (Urbanik, 2012).

Doing ethnography affects the research process in three parts as it is a "critical theoretical practice", an "improvisational practice" and a "quotidian ethical practice" at the same time (Malkki, 2008, p. 164). First, ethnography is a critical theoretical practice due to the open and immersive way that the field is approached. Instead of attempting to prove or disprove a predetermined theoretical framework, the engagement with theory and empirical findings happens continuously during field research and also after. Rather than trying to match the data to the theory, "order should emerge from the field rather than be imposed on the field"(Herbert, 2000, p. 552). Approaching the field with an open theoretical attitude is especially useful for more-than-human research as it considers the multispecies setting that pushes the academic and epistemological boundaries that are often taken for granted (Hamilton & Taylor, 2017a).

Second, having the flexibility of an open theoretical framework, there is more room for improvisational practices that allow ethnographers to remain open to unexpected discoveries and explore previously unknown connections (Müller, 2012). The improvisational side shows itself in the ability to adapt during field research and changing

focus on to unanticipated relationalities. Keeping an open mind and staying receptive to their surroundings allows ethnographers to discover the ways in which humans and non-humans are entangled with each other (Kohn, 2013). Using one's own body as a starting point, these practices also help to reconsider spaces and relationalities through the lens of more embodied, sensory experiences (Hamilton & Taylor, 2017b).

Third, ethnographers are in constant dialogue with themselves regarding the ethical challenges of their research. This quotidian ethical practice refers to the continuous reflection and reassessment of the researcher's positionality that takes place during interactions in the field and encounters with other species. This allows an ethnographer to extend the ethics to the more-than-human participants and informants, and engage with them in an "ethical-political space" rather than ignoring them as hidden masses in the shadows (Braun, 2005, p. 647). It is precisely these ethical practices at the heart of ethnography that make it such a fitting methodology to start from as it allows for more-than-humans to be accounted for and considered on their own terms.

In bridging these ethical practices of ethnography with the need for innovative methods in studying animals, the field of animal geography has seen a considerable shift. Over the past decade, the rising interest in studying animals has led to the development of numerous novel approaches and methods. These methodologies, which blend insights from diverse fields such as biology, anthropology, political ecology, and actor-network theory, represent a turning point in how we engage with more-than-human participants (Buller, 2014; Gibbs, 2019; Haraway, 2016). Animal geographers were quick to adopt the aforementioned ethnographic practices for their potential to gain insight through their immersive, relational and observative approaches (Lien & Pálsson, 2019). In an attempt to go beyond the limiting practice of seeing human-animal relations as purely representational, animal geographers used ethnographic research methods to account for animals' presence and agency as well as the "hybrid communities comprised of humans and animals sharing meaning, interests and affects" (Lestel et al., 2006, p. 155).

It was within the fields of environmental studies, animal studies, STS and Animal Geographies that "multispecies ethnography" originated and then spread and developed further again in anthropology and adjacent fields (Kirksey & Helmreich, 2010; Locke & Muenster, 2018). Multispecies ethnography is a more-than-human research approach that

is attentive to the agency of non-humans and engages with them through an emergent and relational approach with specific theoretical and methodological characteristics (Locke & Muenster, 2018). As a project, multispecies ethnography seeks to engage with a variety of intellectual projects from philosophy and social theory such as decentring the human, rethinking nature-society relations and experimenting with alternative epistemologies (Ogden et al., 2013).

The qualifier 'multispecies' specifies the main distinction from the kind of ethnography that is practiced in anthropology and other social sciences and indicates a reconsideration of the human. First, multispecies ethnography points to an ontological shift by decentring humans and shuffling them together with other species of non-humans (Swanson, 2019). As such it considers the understanding from the perspective of multiple beings and takes into account the agency of all beings in relation with each other, which leads to ethnographic research and writing that are "attuned to life's emergence within shifting assemblages of agentive beings" (Ogden et al., 2013, p. 6). This widening of ethnographic research to different species has led to a variety of examinations of human and non-human beings in exchange with each other and essentially challenges the "humanist epistemology upon which conventional ethnography is predicated, specifically its ontological distinctions between nature and culture, human and nonhuman, subject and object." (Locke & Muenster, 2018).

Second, 'multispecies' also challenges the epistemology of the human as a given fixed entity. Following Ogden et al. (2013) the human in multispecies ethnography is understood as emergent through the relations with other organisms and non-humans. As they explain "the ethnographic of multispecies ethnography writes the human as a kind of corporeality that comes into being relative to multispecies assemblages" (Ogden et al., 2013, p. 6). As such, humans are reconceptualised and with it, many other categorise that have long governed our way of thinking for a long time:

> *"The goal in multi-species ethnography should not just be to give voice, agency or subjectivity to the nonhuman—to recognize them as others, visible in their difference—but to force us to radically rethink these categories of our analysis as they pertain to all beings." (Eduardo Kohn as cited in (Kirksey & Helmreich, 2010, pp. 562–563)).*

Besides its differences, multispecies 'ethnography' is understood as a distinct intersubjective research and writing tradition that describes its own methodology (Harrison, 2018). Doing ethnographic research means that the researcher immerses themselves within the context they study. Historically, within the field of anthropology, the focus is to understand the interaction of people with their environment and "how people create and experience their worlds through processes such as place-making, inhabiting social spaces, forging local and transnational networks, and representing and decolonizing spatial imaginaries." (Watson & Till, 2010, pp. 121–122). With more-than-human approaches, instead of talking, writing, observing and reflecting on animals, the goal of an animal researcher is to address the fact that an animal also addresses them (Derrida, 2008). Methods that consider or heavily rely on anthropocentric interests or needs tend to ignore how much animals affect humans and shape human environments and practices (Latimer & Miele, 2013; Lindgren & Öhman, 2019).

Methods and Rats in the Field

Following the theoretical groundwork of multispecies ethnography, we now turn to its practical application during my field research spanning three years. This journey began when I first went into the field on July 2018 to conduct an initial pilot study of two weeks. During this small-scale preliminary investigation I evaluated the feasibility of doing my research in Zurich. My main goal was to first find rats and then to conduct initial observations and data gathering to understand the landscape of rat populations in Zurich and the key human actors interacting with them. This pilot study not only offered me a baseline understanding of the 'rat spaces' and 'rat places' in Zurich, it also helped me identify research questions and secured me access to key individuals in Zurich. Following my pilot study I spent on average one to three days per week in the field until September 2018. My case study city Zurich was only a two-hour train ride away from where I lived, which gave me flexibility for visits. I knew the city well, having studied there for eight years before, so I also had ample background information to begin my strategic approach. After , I first went back to focus on reviewing literature. For spring and summer 2019, I went back to the field mainly for walk-along visits for cases of rat infestations as well as self-exploration of places that were frequented by rat populations. In fall 2019, I had an intensive 2 week course at the University of Zurich for working with lab animals, including rats, where I studied the regulations and ethics for treating and interacting with rats in the research laboratory. By the end of 2019 I realised, that going back and forth for specific

visits kept me from exploring some connections more deeply. I thus decided to do an intensive 4-6 week stay in Zurich in spring 2020 to gather data more efficiently. In March 2020 the lockdown in Switzerland began. My mental health plummeted and I found myself lost in between supporting my friends and family until I myself had to seek professional help. My field research stay was cancelled and for the following two years I struggled to keep up with my professional work. Between March and May 2021 I returned to the field for occasional visits and held phone call interviews in order to supplement my already existing data and to pursue some promising leads.

Following the ethnographic practices described previously, my methods reflected the explorative approach I took in the field, not knowing what I would find. Guided by the fundamental principles of multispecies ethnography, my field research was conducted in alignment with the theoretical considerations discussed above. Embracing a humble stance necessitated the acknowledgment of the agency, subjectivity, and intrinsic value of non-human animals, thus necessitating the deconstruction of anthropocentric biases and encouraging a genuine exploration of more-than-human animal experiences. Respecting agency, subjectivity, and intrinsic value of other-than-human autonomy shaped the mode of inquiry, leading to an open-ended approach where research trajectories were not confined by predefined hypotheses. As such I did not have a fixed approach or strict choice of methods but instead followed the rule of adapting one's methods to what is there (Sperschneider, 2007). This was important because while authors have described various ways in which a multispecies ethnography can be enacted in the field as conceptual tools (Dooren & Rose, 2012; Kirksey & Helmreich, 2010), there is no real practical fieldwork guide available for multispecies ethnography yet. The most helpful guidance for my methods came therefore from imitating and adapting other researchers' work for their own case studies as well as in-depth analysis and reflection on the gathered data (Hamilton & Taylor, 2017b; Hartigan Jr., 2021; Kopnina, 2017; Locke & Muenster, 2018). I learned that at this stage the choice of methods to study more-than-humans and their relations with humans and other more-than-humans, depends heavily on the researcher's interpretation and experimentation and is also very specific to the field context and more-than-human research focus. I therefore opted to use a multi-method qualitative approach (Seymour & Wolch, 2010; Taylor, 2012). Employing a qualitative multi-method approach allows to take advantage of the strengths of each method, while also mitigating their respective weaknesses. Examining the research field from multiple angles and different methods

allows more-than-human researchers are more likely to gain a rich, detailed, and comprehensive understanding of the other-than-human being they are studying (Dowling et al., 2017).

As such, my main methods to engage with the field were field observation and participant observation during accompanied visits to sites with 'rat problems' or constant rat surveillance. Additionally, I did formal and informal interviews with practitioners working with rats and applied field notes with thick descriptions and photography throughout my observation in the field, to document my reflections and thoughts. As mentioned above, to stay in constant conversation with the theory, I continuously reviewed scientific literature in between my field days as well as analysing different media reports and headlines related to rats, both in Switzerland as well as globally. I also implemented ethological practices to study the behaviour of rats and better understand their ecology and biology. For this, I studied rats in the lab and pet rats and learning about the behaviour of city rats through documentaries and literature research. While in hindsight these methods turned out to complement each other very well, the process in the field was much less neat and straightforward as it was. Thankfully, despite the sudden disruption of my field work due to the pandemic, the data I gathered still allowed me to discover many valuable connections and explore the rat-human relationship in the case of Zurich, even though I was not aware of it before analysing my data in detail.

From talking 'about' rats to letting rats 'emerge'

For my field research, participant observation combined with semi-structured interviews, field notes and photography were my most used methods. Participant observation is basically ethnography in practice: it is the core process of interacting with humans and non-humans, observing them and ourselves, analysing and recording and taking notes while being part of the very process and environment that we study (Emerson et al., 2011). Participant observation is a particularly useful method to adopt for more-than-human research due to its explorative nature and its ability to produce data, that would usually be missed in other methods such as interviews or questionnaires (Laurier, 2016). Doing a multispecies ethnography, however, means to also adapt participant observation as a method to include and account for the more-than-human lives and their agency. In my case, this meant to visit places where rats were present, even if they could not be seen most

of the time, and to register the rats presence and agency through the environment and the people who had encountered them.

Interviews are an important complementation to this process, as they allowed me to find clues and signs of rats, that I would not have found otherwise. I conducted 12 recorded interviews and 57 informal interviews/encounters over the course of 2 years: 5 with the members of the Urban Pest Advisory Service in Zurich, 3 with Professors and Responsible of the Ethics and Management of the Laboratory Animals at the University of Zurich, 3 with Members of pest control companies active in Zurich and 1 with the president of the association of rat friends in Zurich. A full schedule of interviews can be found in the appendix. These interviews were the ones that were recorded, with the knowledge and consent of the participants, and later transcribed for data analysis. All interviews were conducted in Swiss-German dialect and also transcribed as such. An additional 57 informal interviews were conducted which were not recorded but instead, information was secured through note taking and voice memos, which were later also analysed.

Interviews are a widely employed method of geographical research and can provide general information as well as more detailed understanding of cultural and personal experiences and attitudes (Clifford et al., 2016). I used semi-structured interviews, meaning that I had a prepared schedule of questions that helped me focus on rats and rat-related topics that would not come up in a casual conversation otherwise (Longhurst, 2016). Compared to strictly structured interviews, semi-structured interviews encourage flexibility and openness, allowing the conversation to unfold and develop more naturally and creating a conversational flow (Gorman, 2017). This allows for the interview to be carried not just by the questions but also by the interest of the participant, which makes it possible to explore emergent topics as the conversation progresses (Arksey & Knight, 1999).

For my own research, interviews were used to capture how the participants think and understand the aspects of their experiences with rats. In a first phase of data collection, I selected interview participants based on their knowledge and involvement with rats in the city of Zurich. When I began my pilot study in summer 2018, I broadly approached a number of people, from trash collectors, pest managers, university staff to friends, asking for information about rats. I was quickly redirected to the Urban Pest Advisory Services of Zurich and contacted them, which led to many conversations and encounters with the

members of UPAS, including 4 recorded interviews. Due to the pandemic, UPAS remained my main source of information and encounters.

Using a multispecies approach, interviews as a method can be adapted from their conventional methodological approach to be re-imagined for more-than-human research. Haraway points out that everyday encounters are more telling than extraordinary events as they formed over a longer time period and show the intrinsically connected relationships that evolved through many encounters (Haraway, 2008). Similarly, Barua and Sinha point out that "working with those who are 'with' animals can offer us some of the best possible indications of how such narratives may alternatively be told." (Barua & Sinha, 2019, p. 1166). Interviews therefore allowed me to gain access to the particular perspectives, and situated and contextual knowledge that my interview partners had on rats. Despite the rats' ubiquitous presence in Swiss cities, encounters between humans and rats are often limited to specific spatial and temporal activities (Bühler, 2020; Byers, Lee, et al., 2019; Cerutti, 2009). The choice of interview partners reflected this, as I chose people who were working with rats or were prone to encounter them in everyday life. Exploring the experiences and the connections between people and rats allows to tap into the dwelt and situated knowledge of those who close to rats leading to deeper understanding and insight about their relationship (Tsing, 2010).

Using a multispecies approach, interviews as a method can be adapted from their conventional methodological approach to be re-imagined for more-than-human research. In practice, a multispecies approach to interviews differs from conventional semi-structured interviews by extending the focus beyond just the human perspective, aiming to capture insights into the interactions, relationships, and affects between humans and other-than-human-human species (Seymour & Wolch, 2010). Instead of only gathering informational content from the human participants, these interviews aim to unveil the embodied and affective relationships that exist between the human interviewee and the non-human subject, in this case, rats. For example, questions were not just about the person's experiences with rats, but also about the ways they perceive rats' behaviours, responses, and interactions within shared environments. This included asking about how rats respond to certain stimuli, their observable patterns of behaviour, and the ways in which the individual's actions influence or are influenced by the presence and actions of rats. It is important to note that although rats cannot participate in the interview directly,

the focus on their actions, behaviours, and the relationship with the interviewee essentially makes them an indirect subject of the interview, as their 'voices' are inferred through the observations and experiences of the human interviewees (Ramon & Srinivasan, 2021). This makes the process distinct from regular semi-structured interviews where only human perspectives are typically considered.

The exchange during interviews and conversations leads to a process where the researcher becomes involved in the co-production of knowledge (Brinkmann & Kvale, 2018; Edwards & Holland, 2013). While talking to people about rats, I was learning about rats through the experience of other people and due to my questioning and my background, my conversation partners were also reflecting on themselves. As such, the outcome of each interview was a mixture of strengthening knowledge I already had while expanding it and putting it in relation with knowledges I did not have before. This is an important part of more-than-human research that feeds into the process of approaching rat knowledge without being able to actually talk to rats. I therefore gave special attention to the generative possibilities following the interviews to maximise this effect of knowledges co-production (Dowling et al., 2017). By taking advantage of these generative possibilities, researchers can maximize the co-production of knowledge and deepen their understanding of the complex and intricate relationships between humans and nonhuman species. This is particularly important in more-than-human research where the goal is to challenge anthropocentric views and understand the world from a more holistic, multispecies perspective. These possibilities included activities such as the note-taking of observations, the backgrounds of the participants and reflection of the influences on the situated co-production of knowledge due to the positionality of both researcher and interviewee.

Some of my interviews were also conducted by phone. Due to the pandemic, it was difficult to talk to people face-to-face even after the lockdown was lifted in Switzerland. Besides the fact that people were very careful with whom they were interacting, there was also a general tiredness and unwillingness to spend extra time at work to talk to a researcher. Face-to-face interviewing is still considered the gold standard for interview practices (McCoyd & Kerson, 2006). However, many researchers have successfully confirmed that a variety of valuable data can be collected through the use of phone or online mediums for interviews (Janghorban et al., 2014). And while some aspects such as observation and environment analysis might fall away as additional methods, the lack of visual cues can also

be useful as it allows focusing on note-taking and forces clearer articulation and richer description (Holt, 2010).

Many conversations I had were informal and non-recorded. The few recorded interviews I had were semi-structured interviews (Dunn, 2000), meaning that I had always a set of questions and sub-questions prepared but that I let the conversation develop in a natural way. Sometimes, that meant going completely off-course of what I thought I would be talking about. For example, one of the pest control managers I interviewed turned out to be a hobby rat-breeder when he was younger. His answer added an interesting twist to my interview questions regarding relations with city rats and we ended up comparing the multiple roles of rats, their similarities and differences. Those unexpected surprises were often the most interesting interviews I had. Those conversations happened most of the time in the absence of rats, where humans were talking about rats and not with them. Nevertheless, the transcribed interviews form an important data source for my analysis because they inform the narratives and stories that emerge through human-rat interaction and the resulting reactions to them. As such, talking about rats is also a co-constitutive part of the creation of rat places. Careful attention is required to not overly emphasise the words and opinions expressed by my interviewees but to stay alert and generous to subtle traces of rat lives emerging from those conversations. However, this can be a difficult task, especially when the subject of study is an animal that many humans have complicated, often negative, feelings towards. Moreover, understanding and interpreting non-human behaviours and subtle environmental changes necessitate a certain level of expertise and interpretive skill. These nuances can easily be overlooked or misinterpreted without careful consideration and a deep understanding of rat behaviour and ecology. In addition, the results of this kind of research might not be as immediately quantifiable or comparable as more conventional, human-centred research methods. Ultimately, this kind of research helped me reveal surprising aspects of rat behaviour, rat-human interactions, and the ecological dynamics that shape multispecies co-existence of rats and humans in Zurich.

Participant Observation: Field Notes, Photography and Reflections

Within my participant observation and interviews, I made use of field notes and left voice memos to myself in order to keep track of some key moments I was experiencing. I would listen to the voice memos and add them together with my field notes into different word files or field diaries that I kept. They included ideas, thoughts, reflections as well as notes

of experiences or impressions that I found particularly striking. These field diaries served me to combine the different aspects of what ultimately influenced my research such as my personal background and experiences, my observations, the literature and spontaneous reflections and ideas (Punch, 2012).

The analysis of participant observation data and field notes within a multispecies ethnography framework presents distinct opportunities and challenges, largely due to its commitment to decentring the human in ethnographic research. Emphasizing the agency and interactions of a wide range of species, this approach necessitates innovative methods of data collection and analysis (Kirksey & Helmreich, 2010). When analysing participant observation data and field notes, multispecies ethnographers are attuned to the ways in which non-human species shape and are shaped by social, political, and ecological circumstances. This involves tracing the intricate relations and entanglements that exist among various species and understanding how these relations influence broader social and ecological systems (van Dooren et al., 2016). In practice, this involved a degree of interpretative and theoretical flexibility through which data is read not only for insights into human-animal relations, but also for evidence of non-human agency and subjectivity. This can lead to the production of 'thick descriptions' of multispecies encounters, as well as the formulation of novel theoretical insights (Ogden et al., 2013).

I engaged with the practice of 'thick' descriptions, a method that aims at adding context from the perspective of the researcher on top of the description of behaviour and sites (Geertz, 2008). In comparison to 'thin' descriptions which contain the elements of observation, description and outline of a situation, 'thick' description adds a fourth key element, which is the analysis of a situation. This analysis aims at providing cultural context and meaning to the actions, objects, words and things that were encountered by the researcher. This practice is a very powerful tool in the hand of a more-than-human researcher as it allows to invite the reader to shift the gaze together towards places and actors invisible to human interests. Since city rats are highly elusive, I was often only able to see a tail disappear before I could even think of taking a picture. My direct encounters with city rats in the field were rare and for all of them I have only descriptions of encounters to show. They are not only testimony to my encounters, but also a reflection of my own positionality that would feed into my approach, my focus and my interview

questions later on in an attempt to get closer to the rats scurrying around me invisibly and hiding under the ground of my feet.

Using thick descriptions also allowed me to witness humans and rats in relation to each other and to their environment, witnessing the various emotional and affective reactions that emerged and then analyse them at a later stage. The following fieldnote was taken after an encounter with rats on a construction site. A pest advisor had been called there due to a fast-growing rat population. The rats were active during the day, showing how comfortable and safe they felt. The pest advisor placed a trap under one of the containers to catch one of the rats and take a closer look. It was a common impact trap, bigger in size than the one used for mice, and stronger too to make sure the individual is killed immediately. He placed a piece of food in it to attract the rats. After setting it, we walked around and looked for clues around the construction site. The following excerpt illustrates the tension of brutality and empathy prevalent during the following human-rat-interaction.

> *"The trap snatched!" he said with excitement as a loud clapping sound could be heard once. But when I turned to him, his face looked serious and concerned. "Let's go see and make sure it's dead", he said. He told me it was rare that they survived the trap, even if it was primitive, but that he wouldn't want the animal to suffer. (Field Notes, July 2019, Construction Site with UPAS)*

The given excerpt exemplifies a 'thick description' through its detailed portrayal of an incident, its participants, and the layered meanings it entails. The field note reflects the researcher's reflexivity and demonstrates an awareness of the researcher's own role and presence in the field, as indicated by the inclusion of the researcher's response ("when I turned to him") in the account. Moreover, the excerpt is deeply embedded in the subjectivity and relationality of the human-animal encounter. The pest controller's excitement about the trap's success followed by his concern for the rat's suffering highlights the emotional complexities inherent in these interactions, reflecting the layered and relational focus of multispecies research. It also embeds the complex emotional and ethical nuances associated with human-animal interactions as I have often encountered in the field.

During my field research I also had many opportunities to talk to people for whom a rat encounter was something new and unusual, an 'extraordinary event' (Haraway, 2008). For

those people, seeing a rat or becoming aware of a rat's presence generated a variety of different emotional responses, which in turn allowed me to witness a very fascinating process of 'making sense' and 'rationalising' a place for the rat in that person's world view. A person working in an architecture office in an upper-middle class neighbourhood in Zurich reported the following thing:

> *Yes, they run around in the street, usually from bush to bush. At first, I was mostly fascinated. I didn't know we had rats here. I mean they are not bothering me at all. I just figured, since I started seeing this rat, or maybe they are not the same ones, but since I saw it 3-5 times during the day, in daylight, maybe, just maybe, I should tell someone. I mean they don't seem to be doing any harm and I find them funny. But I heard things about rats chewing cables and before they enter any buildings, let me just give responsibility away and let someone else worry about that. (Field Notes, July 2018, Hallwylerstrasse Zurich)*

The woman in question was mostly fascinated about the rats, she smiled as she described them, was surprised and yet at the same time, she was concerned about what it meant for the neighbourhood and for the buildings. She tied together things she heard about rats destroying infrastructure and identified the presence of rats as a threat because of it. But her mind was not made up about it, as she jumps back and forth between saying that she finds the rats 'funny' and that 'someone else should worry about that'. I encountered people like her usually by chance, as they were either present on sites where there was a rat infestations participants of the university lab animal course or passers-by while I was exploring rat spaces in Zurich. Those encounters were usually short and conversations were not recorded, but they provoked many new perspectives and input for theorizing the societal placement of rats by humans.

I chose to anonymise all of my interview partners as well as people I spoke to informally on the streets. As a researcher, I bear the ethical responsibilities of the consequences that could arise from publishing any information about the people who talked to me. While I did make oral agreements with everyone I interviewed regarding the publication of the data I was gathering, I still felt more comfortable by protecting their identify. Especially in regards to topics such as killing rats, I felt there was a risk that my interview partners could be targeted by groups which did not agree with the practices of pest control management. Furthermore, many of the people with whom I engaged in casual conversations during my

field research, were not aware of the fact, that they might be contributing to my thesis. Often, neither did I know in the moment that a conversation would be critical for later. In case where the circumstances of the conversation are important, I use descriptive measures to refer to a person such as 'the head of the construction managers'. In the case of my interviewees, I use only initials which refer to code names that I made up for them such as 'JB' for Julia Baumann, who I introduce as the president of the 'Club der Rattenfreunde'. In this last example as well as with the members of UPAS, it is well possible to find out the real identity of the person I am referring to due to the limited possibilities of actual candidates at hand. However, since these people have given me their consent to use their real names beforehand, I am merely adding an extra layer of shrouding their identification. For some key figures of my thesis who are part of vignettes, such as UPAS member 'Simon', I am using a first name to facilitate the reading process and to refer to them more easily during the thesis.

No matter how many humans I met and talked to about rats, my data from these encounters and from the semi-structured interviews mostly reflected the accounts of how humans related to rats and nature and not how rats related to human or their environment. I never thought to remove the humans completely, but I attempted to diversify my methods and shift the focus to more-than-human experiences as much as I could. With city rats being so highly elusive, I visited all the places where I knew rats were currently or frequently living and recorded those "rat places" with my camera or phone. This interaction of putting myself in the field and practicing observing as exploring leads to a relational emergence of a "story" which is told through animals rather than about them. In practice, this involves shifting the focus from an anthropocentric viewpoint to a more multispecies-centric approach. Instead of interpreting animal behaviours and interactions strictly from a human perspective or narrating about them as passive objects, the researcher strives to understand and portray the world from the animals' perspectives, acknowledging their agency and interactions with humans and other species. By positioning oneself in the field and observing with an open, exploratory mindset, the researcher allows stories to emerge organically from the interactions and relations unfolding in the multispecies assemblage. The stories are not pre-determined or based on human-imposed narratives, but evolve out of the dynamic, complex, and often unexpected relations between the researcher, the animals, and the environment. adopting such an approach in practice involves deeply engaging with non-human animals and their environments, respecting their

agency, and allowing them to guide the narrative that emerges from the research. It entails a commitment to relationality, reflexivity, and an ongoing re-evaluation of anthropocentric biases, enabling a richer and more inclusive understanding of our multispecies world.

With this in mind, I conducted my multi-species ethnography all across Zurich based on the idea that "knowledge practices and objects are entangled, and that being differently positioned produces different perspectives." (Fortun, 2009, p. 83). I used my own field notes as well as photography to capture rat presence and rat environments. Photography, as an ethnographic method, has been widely embraced within human geography, offering valuable insights into how places are experienced, inhabited, and made meaningful (Crang, 2010). Yet, in multispecies or more-than-human research, the use of photography introduces unique opportunities and challenges, as researchers strive to step away from anthropocentric perspectives and honour the agency of non-human animals.

Rose (2016) provides a compelling theoretical framework for understanding the potential of photographs as a research method within human geography and encourages to consider photographs not just as representations of reality, but as performative artefacts that shape our understanding of the world and our place within it (Rose, 2016). According to her, images do not passively reflect the world, but actively produce meanings and realities, which depends on the context in which they are seen, the audiences viewing them, and the intentions of those who create them. Taking cue from Rose's perspectives on photography, multispecies researchers can utilise photographs to unravel the complexities of human-animal relations, engaging with the performative nature of images to highlight the agency of non-human animals and the interconnectedness of human and non-human lives.

Photographs can offer a rich medium for 'showing' rather than 'telling' about these intricate relations, encouraging viewers to engage empathetically with non-human subjects (Kirksey & Helmreich, 2010). However, using photographs in multispecies research also presents some significant challenges. The first is the risk of re-inscribing anthropocentric perspectives. Even as we attempt to document the lives and experiences of non-human animals, we are still doing so through a fundamentally human medium, shaped by our human senses, technology, and cultural norms (van Dooren et al., 2016). Moreover, there is a risk of reducing animals to mere visual symbols, thereby stripping them of their agency

and individuality. The following is an example of the kind of data that resulted from a day in the field following rat traces:

Figure 1: Lake front at Seefeld in Zurich. In the dense vegetation along the water there are many rat burrows to be found. In winter, many of the burrows are empty but during summer months they well used by rats. (source: author)

> *It was the middle of the day so I assumed that they (rats) would be sleeping in their burrows, waiting for the protection of the night to hide their activities. And yet, climbing down to the lake shore through the trees and bushes, I emerged from a particular thick shrubbery only to see a brownish rat run away from the water front back into the safety of the pile of stones, disappearing almost immediately between a narrow crevice. (Field Notes, June 2019)*

Figure 2: A dead rat is floating in the water close to the shore. Most likely, it died through ingesting rodenticide from one of the many poisonous baits which had been laid out to reduce the population. (source: author)

> *In the clear water of the lake, floating among some brown leaves, was the bloated body of a rat, face down. Rats are excellent swimmers and they can hold their breath for a while too. Its body looked unharmed, besides the fact that it was obviously dead. Chances are actually very low that this rat drowned. More likely, the rat ate some poison and ended up dying and being washed away. I was glad I didn't have to see its face. (Field Notes, October 2019).*

The photos and field notes were both the most human and most non-human data that I gathered at the same time. It was the most human because it reflected my positionality and focus as a researcher like none of the other methods. At the same time, it offered the most potential for engaging with city rats, getting into the 'mud' (Haraway, 2016) and letting more-than-humans emerge in their own right. In multispecies ethnography, photograph analysis offers a means to delve into human and non-human interplay. Instead of viewing photographs as mere representations, they can be seen as artefacts revealing the relational and affective aspects of multispecies encounter (Rose, 2016). Analysis may entail a detailed inspection of the photograph's aesthetic qualities and an understanding of non-human participation (Haraway, 2008). The conditions under which the photographs were taken

and the photographer's field notes further enhance these insights (Pink, 2009). However, reflexivity is required to address challenges, such as the potential for anthropocentric bias.

For my interviews, I transcribed the majority of my recordings shortly after I had conducted them. My reason for doing so is that Swiss German, despite being officially termed a dialect of German, has many smaller words and notions that do not exist in High German. Translating them would therefore either mean that I would lose the subsequent meaning of the emotional and affective tinge of what my interviewees were saying or that I would have had to spend even more time trying to convey the meaning through additional notes. The practice of translation is not just a straightforward conversion from one language to another, but rather a complex process that involves different systems of meaning, cultural nuances, and power dynamics (Müller, 2007). It is therefore a matter of interpretation and negotiation, where the meaning of words and concepts may not necessarily map perfectly from one language to another due to cultural, contextual, or semantic differences. For this reason, I decided against translating my interviews, keeping them in the original language. Instead I chose to only introduce translated excerpts of my interview in my thesis when accompanied by the necessary, descriptions, notes and analysis for each citation used. This way, I can control and limit the risk of subtle changes or misinterpretations that could impact the overall understanding or presentation of my research findings.

For the analysis, I followed a grounded theory approach where coding of data starts early and is then continuously reassessed and compared with the theory and other findings (Charmaz & Mitchell, 2007). I did a first round of coding for my interviews and then added more data sources such as legal documents, educational documents from the university and the pest control course and conference, information sheets and photos. For my data analysis I used the software Atlas.ti, as it allowed me to organise and categorize different types of textual and image data. I used a mix between inductive and deductive coding during my process of analysis . I started my analysis with inductive coding, a process where I derived my codes from my data without any preconceived notions or expectations of what I want to find (Atkinson, 2007). I would let the narrative of my research emerge from the raw data from the ground up and then group my codes into categories and later into themes which would then inform my research results. (Saldana, 2021). Deductive coding is the process where one generates ideas of codes based on what they are looking for. In

my case, I had already noted down some of my observations from my field research as well as some hypothesis based on which I formulated my research questions. I came up with different clusters that were focused on different aspects of rat-human relations such as *lab/pet/city rat*, *rat history*, *rat places*, *(in)visibility*, *number (singular/plural)*, *affect/emotions*, *problem rat* and *killable rat,* to name but a few. I arranged the codes in a horizontal manner, without too many sub-categories in order to be able to connect them more freely.

Being Human among Rats: Reflections and Positionality

While the word 'human' did not appear in my coding directly, it was always clear that my data analysis was heavily influenced by the rat-human relation that was me. The way a researcher chooses to analyse the human-animal relation heavily depends on their understanding of it, shaped through their positionality and self-reflexivity. As Seymour and Wolch (2010) explain:

> *Selfreflexivity about epistemological standpoints to animal geographic research not only illuminates for our own benefit why we may be approaching our project and analyzing our data in particular ways, but also clarifies for readers why we researched, analyzed, and drew conclusions in the way that we did. (Seymour & Wolch, 2010, p. 306)*

From my own background, there was plenty of ways that I knew I was relating to animals differently that many of my colleagues due to my upbringing.

> I have grown up in an old farmer's house in a small village. We were no farmers since we had no cattle or livestock, but we had horses, cats, dogs and smaller pets like guinea pigs and rabbits, that came and went. My grandparents on my mother's side used to be farmers. Having lived and grown up with a lot of animals, my mother taught me and my sister how to take care of them. This was a rewarding experience but also a lot of hard work: cleaning stables, being outside regardless of the season and weather, working in the field every now and then, tending to the house and garden, having to take responsibility and care for the animals no matter what. Our animals were part of the family and we had deep bonds of affection to them. When one was hurt, we worried, when one died, we cried. As most animals do not outlive humans, I learned early on what death meant and how sometimes, it could be relief. I also learned to understand animals and no matter how much I loved them, I knew

that it was always better to respect them first, especially when they are bigger and stronger, like horses tend to be. I realised only in my late teens, how much of what I knew about horses could not be read or learned from a book. The last horse I bonded with, was a mare. I could read her body, feel the tension running through it when she spotted something she did not like, ready to flee. I could judge by different combinations of ear movements, head tilts and rhythms of her step what her next move would be, whether she was gonna jump to the side, run forward or try to bolt. Knowing what she was going to do next had saved me many times from being thrown off and speaking to her in a soothing voice sometimes did the trick to calm her down. However, it is difficult to reason with an animal as there are quite some hurdles for communication. In fact, while I was able to read my own horse very well, the moment I was confronted with a different horse, most of my knowledge was void.

As an individual who grew up around animals, I have learned to understand their behaviours and emotions, which has significantly shaped my epistemological standpoint. This standpoint influences my approach to and understanding of how knowledge is acquired and what knowledge is valued in my research on rats. Being self-reflexive means that I consciously reflect on my own beliefs, experiences, and biases and consider how my experiences and understanding of animals - based on my upbringing with various pets and livestock - inform my approach to studying rats. I inherently view animals as individuals with their own personalities, emotions, and communication methods, and these views shape how I design my research, interpret my findings, and interact with the rats in my study. Seymour and Wolch summarise this as follows:

> *Unsurprisingly, our personal characteristics and experiences as researchers – cultural and class background, race/ethnicity, gender, religion, urban or rural upbringing, exposure to institutional messages and media, and past experiences with animals – mediate roles in human-animal relationships and how we think about the relationships we study. (Seymour & Wolch, 2010, p. 305)*

By acknowledging the influence of my experiences on my research, I recognize the way my own preconceptions shape my research approach and interpretations. This transparency provides readers with a clear understanding of the perspective from which I'm coming, which can help them to better understand why I've conducted my research in the way I did and arrived at the conclusions I did. For example, since I am accustomed to

observing animals closely and interpreting their non-verbal cues, I approach my research on rats from a similarly observant and interpretive standpoint, looking for non-verbal cues in rat behaviour and communication, and being more open to viewing rats as individuals. This is a different approach from a researcher who views animals more instrumentally or is less comfortable interpreting non-verbal cues.

Both my methodological approach as well as my data analysis are based on practices that demand openness and inclusivity in order to invite the more-than-humans to emerge. In conducting multispecies ethnography, the guiding principles of openness and inclusivity are reflected in every stage of the research process, from methodology to data analysis (Kirksey & Helmreich, 2010). The emphasis is on acknowledging the agency and inherent worth of non-human animals, demonstrating a departure from anthropocentric biases. The practice of 'becoming with', or open-ended inquiry (Haraway, 2003), allows research to be shaped by the animals themselves, necessitating an immersion in the field, engaging with animals in their habitats for a prolonged duration (Despret, 2016). I ultimately chose to organise my data on a spectrum of the rat-human relationship in regards to power and agency and reflected this in my empirical chapters as well.

The first empirical chapter focuses on the rats relationship to humans, exploring the ways rats have been framed throughout history and placed within different contexts as city rats, pet rats and lab rats. My analysis highlights the emergence and governance of three distinct 'rat multiples', underlining the spatial, legal, and political contexts that shape their existence and relationships with human spaces. These 'rat spaces' are defined and maintained through specific laws and ordinances, influencing how rat treatment is justified. Anthropocentric values, manifested in economic and cultural representations, also significantly impact the shaping of these rat multiples. The chapter also retells the story of how rats came to be such close co-habitants in the urban environment and what 'rat spaces' they ultimately inhabit in Zurich. I utilise data from personal field observations, encounters, interviews, and official legal documents related to pest management and animal welfare. As secondary literature, I draw upon historical social science literature in order to explore how history and culture of the rat-human relationship have shaped human-imposed classifications, 'rat spaces' and legal documents of the Swiss laws regarding rats. By creating their own 'rat places', particularly evident in the urban context, the rats resilience and adaptability often leads to conflicts, reinforcing their perception as

pests. Comparing secondary literature on human-animal conflicts with my findings in Zurich, the concept highlights the discourse on 'pesthood' and the related designation of city rats as 'abject', laying the groundwork for subsequent chapters focused on the processes and justifications surrounding city rat extermination.

The second empirical chapter introduces the concept of 'rat places'. When rats transgress the boundaries of their designated 'rat spaces' and enter human-designated spaces, or 'rat places', they often provoke conflict and discomfort. This disruption of established boundaries often leads to the decision to kill the rats, in an attempt to restore order and control to these spaces. The primary data utilised includes site observations of 'problematic' rat cases in Zurich and interviews with pest control managers. These sources provide a robust analysis of the circumstances under which rats are deemed pests and threats, thereby making them 'killable'. The spatial and temporal relations contributing to city rats as a problem are retraced through these primary data, revealing how the intersections of animal, pest, and problem frames shape the fate of city rats. Secondary data is gleaned from a range of academic literature, which enriches the understanding of the subjective construction of 'rat spaces', the emergence of 'rat places' when these boundaries are transgressed, and the concept of the 'problem animal'. Furthermore, it is instrumental in analysing the complexity of decision-making processes regarding rat extermination, encapsulating ethical, political, and legal considerations. The chapter concludes by examining the ethical implications of various rat extermination methods and proposing alternative approaches, including integrative pest management practices. These discussions are supported by primary data gathered through interviews and field observations, presenting a comprehensive and pragmatic perspective of urban rat management.

Finally, my third empirical chapter shifts from an anthropocentric view to examining the mutual and co-becoming relationship between humans and city rats in Zurich. Instead of focusing on rat-human conflict and its lethal consequences, this chapter investigates the potential for multispecies coexistence and aims to move beyond solely anthropocentric perspectives and towards a just multispecies co-existence. It uses the lens of a multispecies justice approach, which entails revisiting the idea of integrated pest control based on understanding rat ecology and factors influencing rat behaviour. The primary data in this chapter is derived from field research that investigates how human behaviour impacts rat

populations. By studying the essential needs of rats - water, shelter, and food - the study illuminates how human actions and infrastructure, such as sewage systems and waste cycles, affect rat populations. The chapter also re-examines previous rat cases in Zurich, functioning as a secondary data source, to illustrate integrative pest control measures in practice. This analysis enables a deeper understanding of 'becoming with rats', an approach that values the relations and shared spaces between humans and rats. By weaving together primary field research and secondary case analysis, the chapter underlines the importance of human responsibility in regards to coexistencing with rats and acknowledging how human behaviour influences rat populations. It concludes by highlighting practices in pest management which take into account the rat's ethology and ecology and therefore enables to 'becoming with rats' in a sustainable way for both species.

Making Rats

> *"Yes, the plague, but also Hollywood. So you often see people walking through the sewers and then thousands of rats come and attack people and things like that, so I have to say that's such nonsense. Or the dark alley full of rats to show that a place is abandoned and deserted, and of course dirty and so on." AA, pest control manager*

This chapter responds to the first research question of how rats are made through their relationship with humans. Based on the context of the organisation of animal-human relations and the spaces they co-constitute, the focus of this chapter lies on the making of the three different rat multiples that I identified in my case study in Zurich: the lab rat, the pet rat and the city rat. The rat multiples are the expressions of different rat narratives which emerge through the rats interaction with their material environment and the cultural and historical meaning that humans attribute them in specific contexts. Using the concepts of 'animal spaces' and 'beastly places', I analyse the discursive construction of rats into three categorizations and the 'rat spaces' they are allocated to, leading to them being seen as either in or out of place (Philo & Wilbert, 2000a). The conception of 'rat spaces', then, refers to the joint conceptual and material placements of rats in abstract spaces that are based on human classification (Philo & Wilbert, 2000b). These culturally accepted spaces to which rats are confined by humans are considered the rats' 'proper' place. However, rats occasionally escape from these spaces and show up in places unforeseen by humans, disrupting the anthropocentric orderings of their classifications in the process (Philo & Wilbert, 2000b). The resulting notion of 'rat places', then, refers to the actual concrete places where rats live that do not fit the categorizations of 'rat spaces'. Emerging 'rat places' often have a high potential for conflict, as I will discuss in detail in the next chapter.

As a multiple, the rat constitutes and is constituted by an interplay of laws, materials, emotions and actions in order to create the 'rat spaces' that correspond with human ideas of where rats belong (Luther, 2013). Subsequently, examining the accepted 'rat spaces' like the laboratory, the home and the city reveals these underlying human spatial orderings, norms and values which define rats in their ascribed roles, both in a discursive and an embodied physical sense. By exploring the cultural, political and ecological processes in

Zurich that have contributed to and shaped the categorizations of the rat as a lab animal, a pet or a pest, I highlight the connection between rat ethology and different symbolisms and cultural associations about rats. The main data I use stem from my own observation, encounters and interviews in the field as well as official legal documents on pest management and animal welfare. Based on this data, I examine how the three rat multiples are brought into being in regards to the 'rat spaces' they occupy and how they are governed in their assigned roles.

This chapter is structured along the lines of the three rat multiples. As I introduce each, I first lay out the spatial, legal and political contexts from which the rats emerge into their different expressions. The spatial analysis describes the 'rat spaces' as spaces of inclusion where rats are integrated into human spaces under human control. These 'rat spaces' are controlled, defined and subsequently reproduced through laws and ordinances, which also have significant ramifications on how the treatment of rats is justified. Both treatment and making are also strongly influenced by political factors, based on the economic and cultural representations of each of these rat multiples, which reveal anthropocentric perceptions of value such as use for human interest or ecosystem services for humankind. An overview of the findings and traits of the rat multiples can be found in Table 1, which serves as a scaffold for the analysis and discussion of this chapter.

After analysing how humans determine and design the desired 'rat spaces', I present how rats challenge the emotions and associations linked with each of the rat multiples. The analysis of how humans think about rats and how the resulting 'rat spaces' are established builds the foundation for the following chapters. These cultural narratives of the rat multiples manifest in the material and embodied boundaries of where rats belong and also where they do not belong. When rats transgress these constructed boundaries of their categorization, they create their own 'rat places', which signify their 'beastliness' and render them 'out of place' (Philo & Wilbert, 2000b). The significance of 'rat spaces' versus 'rat places' becomes particularly apparent in regard to the city rat. The city rat's strong resilience and high adaptability to the urban environment make it difficult to contain it in the designated 'rat spaces' causing human-rat conflict in contested urban spaces. Subsequently, city rats are perceived as pests due to the threat they pose through their mobility, reproductive and transgressive qualities. The chapter then finishes by discussing 'pesthood' and 'pestilence' (Arseneault & Collard, 2022, p. 91) and the consequent

designation of city rats as 'abject' (Kristeva, 1982), which lies the foundation of the next empirical chapter, focusing on how and when city rats are killed.

Table 1: A simplified overview of the three different rat multiples and their comparable traits based on the findings of the case study in Zurich, Switzerland.

	LAB RAT	PET RAT	CITY RAT
where	laboratory	home	home
perceived as ...	research tool	companion	pest
adjective	useful	cute	abject
emotions	pity	love	disgust, fear
legal protection	high	medium	low
environment	controlled	semi-controlled	no control
agency	low	medium	high
comparable species	mice, birds, fish (lab animals)	cats, dogs, rabbits (other pets)	mice, cockroaches, wasps (other pests)
human-rat interaction	experiments, feeding, cleaning cage	playing, feeding, cleaning cage	observing, avoiding, killing

Lab Rat: Intelligent, clean and useful

Notes from the field, Laboratory Practice Room, 9th of September 2019

> When we entered the room, the rats were already there this time. There were 12 boxes, and each box contained 3 young rats. They were distributed one box per table and one box per student. (…) The student nervously put her hand in the box and tried hard not to move it, as instructed. The rats immediately came to curiously sniff and lick the new object. The student's body tensed. 'Are you scared?' I asked. 'No, it tickles', she replied, smiling.

This vignette is taken from the field when I, as a researcher, joined the students and attended a university course on how to work with laboratory animals, specifically mice and rats. On the first day with the animals, the students were instructed to place their hand in the box of 'their' rats to make first contact. The students in question had never touched a rat before, and the rats had not had much human contact before either. After students had spent previous lectures learning about ethics and how to read rat emotions, the first contact between student and rat was established in that moment. For rats, acclimatisation to their human researcher takes several different steps, including the researcher repeatedly placing their hand inside the cage for the rats to get comfortable, removing their hand again and letting the rats rest before moving on to touching them, lifting them, and holding them. Amidst an entanglement of other humans and other rats in a windowless room with sanitized tables, the student's attention was absorbed by the small creatures in the box in front of her. And despite all the preparation and precautions, no one had prepared her that the soft nuzzle of the rats would tickle.

Lab rats are bred to grow fast and be very timid and friendly. The most common strain for lab work is called 'Sprague Dawley' (SD). This strain is used in almost all disciplines of biomedical research, as it is known for its reproductive strength and being especially easy to handle. Most of the rats used at the University of Zurich are also SD. They are albinos with white pelts and red eyes, a colour combination that would greatly disadvantage city rats by making them easily spottable for predators. In the laboratory, however, the white colour makes veins and arteries more visible and facilitates physical examination as wounds or skin conditions are more noticeable (Krinke, 2000). The white rats appear to belong

there, in their sterilized surrounding surrounded by humans with white coats. Neatly put in their boxes in a well-lit room, lab rats blend in so well that they are as much associated with the laboratory as city rats are with big cities. The narrative of the lab rat revolves around this association with a controlled environment and cleanliness, in opposition to the narrative of the city rat as the dirty street rat. Instead of carrying diseases, lab rats help cure them. It is ironic that 'many of the traits that make Norway rats a pest in the wild are the same traits that have contributed to its success as a model organism' (Modlinska & Pisula, 2020, p. 8). Lab rats are praised for their intelligence and their social abilities, which are comparable to those of other, more popular animals such as dolphins and elephants (Connor, 2007; Lorimer, 2010). Most strikingly, researchers have also attributed high levels of empathy to rats. Several experiments have shown that, when given the option between food or protecting a fellow rat from harm, rats would choose to protect other rats, even if the rat was not from their family population (Preston & de Waal, 2002).

The management and use of lab rats in Zurich are subject to strict rules and researchers working with rats have to comply with a variety of ethical standards and learn practical skills to safely handle lab rats without harming them. In order to ensure the health and wellbeing of the lab animals, the University of Zurich strictly follows the 3Rs approach, 'Replacement, Refinement and Reduction of Animal Research', which aims to improve the management, handling and execution of animal research (Clark, 2018). These approaches have been introduced as a response to the increased attention given to the wellbeing of laboratory animals within the revision of the Swiss Animal Welfare Act (TSchG)[7] in 2005:

> *Experiments on animals that may cause pain, suffering or harm to the animal, cause it fear, significantly impair its general well-being or otherwise disregard its dignity, shall be limited to the indispensable extent. (S455, Art 17).*

The implementation of animal dignity prohibits highly cruel treatments or killing methods, or denying an animal of its essential natural needs such as water, food, shelter and social contact. However, exceptions can be justified by strong interests and benefits for the greater good of humanity, as is the case within authorisation procedures of animal experimentation. During the approval procedure, the competent authority conducts a harm-benefit assessment to define, rate and evaluate the conflicting interests (Hehemann,

[7] For an overview and introduction to the Swiss Law, see the annex of this document.

2018). The harm-benefit assessment is the key to a sufficient protection of laboratory animals and their dignity and well-being. It is therefore important to weigh the instrumentalization of lab animals against the human interests as a severe infringement of animal dignity cannot be justified by law (Hehemann, 2018).

In accordance with the law and the 3R approach, a poster on the wall in the practice room of the lab at the University of Zurich summarises the content of a mandatory course where students learned how to recognize their rat's pain (Figure 3). The rows of the poster stand for different areas to focus on such as eyes, nose, ears and whiskers, while the columns show the changes in the rat's face when not in pain at all to showing moderate to obvious signs of pain. Narrowed eyes, stiff whiskers and ear position all provide clues as to whether the rat is suffering. Besides minimising pain, there are also measures taken to increase the lab rats' wellbeing that are not strictly included in the 3R approach but have been proven to increase the participation and performance of lab rats, especially in behavioural experiments (Kirk, 2016). These measures include preparing rats before picking them up and holding them in a way that has been proven to be safe and comfortable for the rat and human alike (Figure 4). The so-called 'three-finger-hold' has been confirmed to be the ideal way to hold a lab rat without hurting it while at the same time allowing for easy handling and the administration of simple procedures such as blood sample taking. Another, rather delightful and new finding has also shown that care-takers tickling their rats helps to increase well-being and trust towards human and even produces an equivalent to laughter in rats (LaFollette et al., 2017).

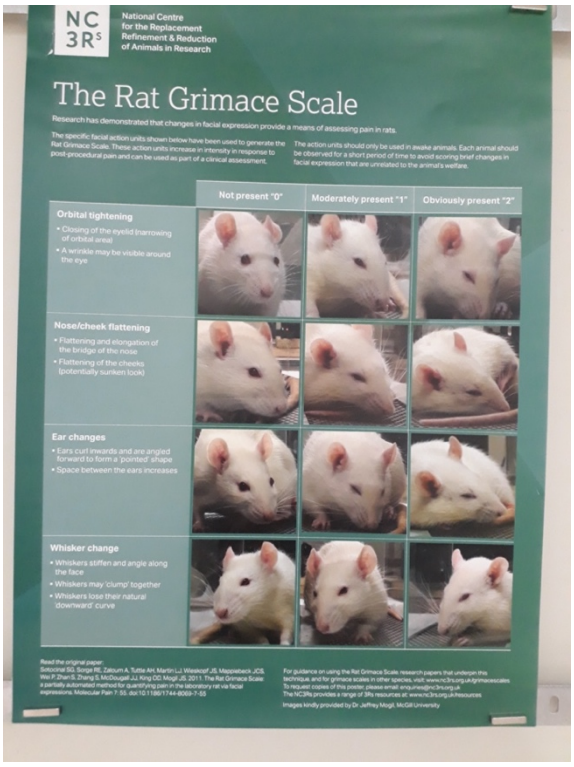


Figure 3: A poster hung in the laboratory room to help students interpret the grimaces of their rats correctly and know whether they are in pain or not. (source: author)

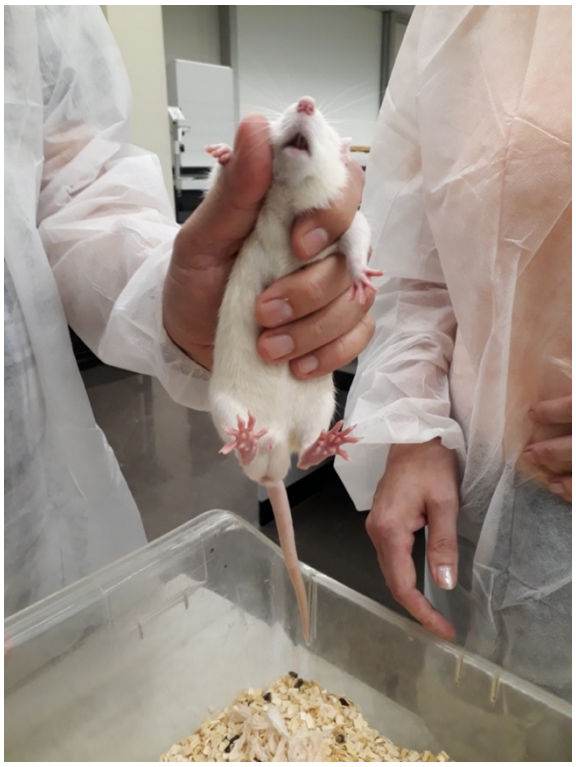


Figure 4: The correct way to hold a rat, stabilizing its head so it cannot bite while carrying its main weight under the shoulders between thumb and middle finger. (source: author)

Even through there are many measures to ensure that suffering is minimised, sometimes it cannot be avoided when the interests of human wellbeing outweigh the dignity for lab rats. Therefore, despite the many indicators and regulations that are aimed at reducing the suffering of laboratory animals, the Swiss Animal Welfare Act specifies an exception if it is unavoidable:

> *Pain, suffering or harm may only be inflicted on an animal or it may only be placed in fear if this is unavoidable for the purpose of the animal experiment. SR 455 Art.20*

But who gets to decide whether pain is unavoidable? In Switzerland, anyone who conducts animal experiments is required to have a permit from a competent cantonal authority. These permits are often limited in time and can be linked to conditions and requirements. Researchers must submit an official form specifying how many animals they need, exactly what experiments they plan to do and what outcome they expect. Furthermore, institutes and laboratories that carry out animal experiments are subject to strict conditions and must always keep count of the animal population and report them back to the authorities. Based on the application for an experiment, a committee decides whether to grant or deny the

request, weighing the benefit for humanity against the lives of the laboratory animals. The Swiss Animal Welfare Act does not further defined what circumstances or interests could justify 'unavoidable' pain and suffering, but the bottom line of animal testing suggests that animals lives are beneath human interests (Buller, 2016; Lynn, 1998).

The question of whether the suffering of laboratory animals is justified is causing much debate among animal protection organisations. Globally, organisation such as PETA, Four Paws and World Organisation for Animal Health are calling for the complete abolition of animal testing (Phelps, 2007; Wilkins et al., 2005). In Switzerland, the main organisation focused on the wellbeing of animals is the Swiss Animal Protection (SAP). The political voices against the use of animals in research in Switzerland are mostly focused on informative pamphlets which call attention to improve animal wellbeing in the lab and demand transparency and consideration of alternative options (Schweizer Tierschutz STS, 2013). There have been several attempts of initiatives launched by animal protection groups to completely abolish the use of laboratory animals but the population always voted against the all or nothing approaches (Flükiger, 2008). Instead, as the history of animal protection in Switzerland has shown, the population approves of implementing measures to increase well-being and limit unnecessary suffering (Evans, 2010). The rejection of more extreme measures is tied to the understanding that the use of lab animals is a necessity that comes with an economic advantage for the science and pharmaceutical sector of the country (Hehemann, 2018). One possible explanation is that the conditions for laboratory animals in Switzerland are much less precarious than in other countries such as the US or China (Su et al., 2022). Due to the implementations of the 3R approach in the law, the number of laboratory animals has been reduced and remained constant for the past two decades, despite the strong development of the pharmaceutical sector in Switzerland for which many experiments are required (Krinke, 2000).

The 'animal space' of the lab rats is the laboratory. Laboratories are spaces designed to keep animals in extremely controlled conditions, leaving little room for moving around (Neville et al., 2022). There are designated areas within the laboratory where rats are kept in cages, waiting to be used for scientific experimentation. Within their cages, lab rats are integrated into the laboratory environment and perceived as 'proper' since it is their purpose to be used for research (Birke, 2003). As such, lab rats are generally seen as objects rather than as sentient beings (Kirk, 2016). Lab rats are so strongly associated with their

human-given purpose that the laboratories become the only place where they are accepted. For example, a study has shown that their appearance is a deciding factor in whether a rat is seen as a lab rat or a pet rat. Albino rat strains like the lab rats are perceived as 'unnatural' compared to their ubiquitous black or brown brethren or their multicoloured pet versions (Hou & Protopopova, 2022). The mutation leading to the expression of Albino animals occurs only rarely without targeted breeding effort and if it does, it usually comes with a disadvantage for the individual as they are more likely to be spotted as prey and sometimes even rejected by their own kind for their different appearance (McCardle, 2012). The assumption then that animal albinism is bad for animals is adding to the narrative of the dualist perspective of 'good nature' and 'bad humans', where the natural occurring colours are seen as 'healthy' and the white colour is seen as a sign of a sick animal. A study on the adoption of rats from shelters in Canada, for example, has shown that the adoption waiting time for albino rats was 79% longer than for white rats due to assumptions and concerns of potential owners that there was something wrong with these animals (Hou & Protopopova, 2022). This is also due to the circulation of visual material of extreme experimentation results such as the mouse growing a human ear on its back. These kind of examples are often used by animal rights organisations such as PETA when using a tactic called 'shock advertising' to gain the public's attention for their cause (Matusitz & Forrester, 2013). While this approach is effective in gathering support against animal suffering, it also strengthens the perception of lab rats being 'unnatural', reduced to tools for research rather than being a regular animal (Birke, 2003).

Despite the public's reservations about lab rats, there is a way for lab rats to shift their categorisation. At the University of Zurich, in addition to the 3Rs there is a 4th 'R' that is applied when possible: the rehoming project. Lab rats that served in the introduction course or who were used a reference group have the chance to be rehomed as pets. The transformation from lab rat to pet rat is possible, but it takes some time. The animal welfare organisation for rats, Club of Rat Friends CH (Club der Rattenfeunde CH), located in Zurich, is the main actor in rehoming lab rats and helping them to adjust to their new life as pets. The president of the organisation explains that the animals need to go through an adaptation phase to get used to their new environments:

> *"Well, they are coming here (interviewee's home) from those university rooms, sometimes even those sterilised rooms and sometimes they had human contact, sometimes not so much. And the cages and the objects and set-up and their whole*

lives really, it is completely different as a lab animal and then as a pet. They need some time to get used to that." JB

The president of the Club of Rat Friends CH is one of the few people who take in lab rats to prepare them for their new homes. The younger the individual, the better its chances to successfully transmute from lab rat to pet rat. The lab rats arrive in their small lab cages and are moved into the cages for pet rats, which tend to be bigger and more richly decorated with toys, entertainment structures and a bigger variety of materials such as clothes, paper, cardboard and other things to chew on. The home of the president functions as a transitional space where lab rats become pets. As lab rats, the living conditions, the type and amount of food, the interactions with humans and the external input of stimulation have to be strictly limited and controlled in order to make sure that all individuals have the same foundation for experiments, especially behavioural experiments (Birke, 2003). As pet rats however, the individual rat enjoys more freedom, being offered a variety of activities and food to choose from. In addition to the material features of the rats' environment, there are also many additional sensory inputs that change such as noises, smells and a bigger visual field. At the beginning, the lab rats stay in their small group of 3–4 individuals that they lived with in the lab and once accommodated, groups are sometimes combined. It is common for pet rat groups to consist of six to ten individuals and city rats can have even bigger populations (Schweinfurth, 2020). As rats are very social animals, groups of three animals are the absolute minimum demanded by the law in Switzerland (Swiss Federal Constitution, 2008).

As pet rats, the lab rats also have to shift their function from being a research object to becoming a companion animal. While in the laboratories, some lab rats are only taken out every few days for a blood sample; otherwise, they do not have any human contact besides being fed or having their cages cleaned. While transitioning to pet rats then, the interaction with humans changes as well. The fact, that lab rats can become pet rats shows that the human-made classifications are variable and change depending on the context, environment and personal background of the people who encounter rats. This observation is also in accordance with the findings that rat 'spaces and places' are both the results of 'unstable, relational productions, formed through diverse actions and interactions' (Philo & Wilbert, 2000b, p. 7). This switching of categorizations from the human's perspective becomes apparent through the rehoming of lab rats as well. As I observed at the University of Zurich, people who work with lab rats usually do not have pet rats or plan to adopt the

rats they work with. An exception was the Master's and PhD students, who worked with a very low number of lab rats over the short amount of time of their projects, especially for behavioural studies. As I was told by a lab technician, those students would often bond with their animals and when given the chance to adopt them, they were more likely to do so compared to the long-term researchers working with rats. For many bigger projects, there are several researchers conducting the experiments and the number of lab rats is higher and changes every couple of months. As a result, the lab rats are more objectified as research tools by those who are used to work with lab animals (Neville et al., 2022). In comparison, the students, who spend more time with individual lab rats and pay attention to social performance and behaviour rather than just taking blood samples, tend to see them more like companions (Haraway, 2008). The moment humans bond with an animal through these different interactions, the categorization of the animal shifts in their eyes.

Pet rat: cute and smart

Notes from the field, Home of a pet rat owner, 13.01.2020

> Claire tapped herself on the shoulder and clicked her tongue. 'Fred, Freeeed, come here. Come', she said in a higher voice and a tone that most people use for small children. Meanwhile, Fred looked at her curiously from the kitchen table, with one paw resting on her finger. She lowered her other hand and showed him the little treat that was waiting for him and then moved the hand back onto her shoulder and tapped again. This did the trick. Fred walked onto Claire's hand and climbed up her jumper. She laughed as he struggled through the folds in the material. Once on her shoulder, he eagerly searched her hand and was rewarded. "He is a smart one, isn't he? Either that or a glutton", she proudly proclaimed. 'Do rats get fat?', I asked. 'Yes, unfortunately that happens quite often when they don't have enough entertainment or live alone. A rat should never be alone', she answered seriously. (…) She continued to show me pictures of rats that were overweight. One picture was a rat that got stuck in a hole because it underestimated its own size. 'I know I shouldn't laugh, but it looks so cute', Claire said sheepishly before explaining to me how to put a rat on a diet.

I observed this vignette during a visit with Claire, a friend's colleague, who has had pet rats for several years and recently adopted three former lab rats as well. Claire's most beloved rat was a pretty caramel-coloured male rat named Fred. He was a so-called 'fancy rat', as pet rats are called. She had been training him to perform tricks and follow orders, which he would usually perform as long as there was a good reward. The closeness of their relationship became apparent in the way Claire speaks to him and the gentle manner in which she approaches him. Fred, like other pet rats, is seen as a companion (Haraway, 2003). His owner is delighted with his looks, his climbing skills and his intelligence, and proudly praises him. At the same time, she expresses concerns for his wellbeing, pointing out that she would not want him to become overweight, which is a common risk for pet rats who are not given the necessary equipment or care (Kasper, 2013). She also points out that rats are social animals that should be kept in groups since rats are very social beings and can get depressed and lonely (Neville et al., 2022). Both points are not just suggestions from an experienced owner but are also defined within the Swiss Animal Welfare Act regarding the treatment of pet or livestock animals:

> *Any person who keeps or looks after animals must feed and care for them properly and provide them with the activities and freedom of movement needed for their well-being as well as shelter where necessary. (S455, Art.6)*

Taking care of pet rats, then, means that owners need to be aware of the needs of their pets and tend to them accordingly. Detailed instructions are also found in the Animal Welfare Ordinance (TSchV), which concretises the Swiss Animal Welfare Act. The annex of the Animal Welfare Ordinance states the size of the cage, the type of food, the number of tools and toys, and additional specifications. Because rats are very intelligent, they can get bored easily and attempt to entertain themselves by any means. This is a challenge that many new pet owners often underestimate, thinking that a small animal such as a rat would be easier to keep than, for example, a cat. One often underestimated challenge is controlling the reproductive ability of rats. As I have mentioned in the introduction, rats can reproduce very fast and efficiently when their needs are met. Since a litter size typically ranges between eight to twelve pups, a group of three females and one male can quickly swell to a population of 30 individuals within a month if the litter is not noticed.

This exponential growth and the subsequent loss of control is experienced as especially threatening by humans because pet rats are usually kept in people's homes and not in separate entities or rooms as livestock animals would be. The human home is often

subjected to very individual understandings of comfort, cleanliness and safety (Power, 2009a). While rats' great reproductive ability is very useful for scientists in the lab, it often poses a problem for pet rat owners who do not have sufficient experience or information. This is a common issue since anyone can have a pet rat without any knowledge or preparation.

The environment for pet rats is less controlled in comparison to the lab rats but there are still a number of similar material features that they share. For example, pet rats are also kept in cages, which confine them into a well-defined and human-controlled space. However, while lab rats are seen as research tools, pets occupy a liminal space between 'human' and 'animal', often humanised by their owners as family members as 'capable of rational thought and emotion, yet also treated as objects or possessions to be discarded if they do not conform to human expectations' (Fox, 2006, p. 526). As pets, rats are expected to be cute, cuddly, emotionally responsive and smart (Hou & Protopopova, 2022). Like lab rats, pet rats are valued for their intelligence and ease of maintenance. Humans cater to pet rats' intelligence by entertaining them with interactive toys and material in their cage. Many pet rat owners also enjoy teaching their companion tricks. The liminality of 'human' and 'animal' is also performed when humans allow their pet to come out of the cage, melting the space between human-controlled and animal-invaded. This expression of a human-companion bond is only possible with the participation of the rat, which is why pet rats are often bred to be very open and friendly. While lab rats do not necessarily have to possess an interactive nature, for pet rats, curiosity and playfulness are well-liked attributes (Neville et al., 2021). For the most part, the desired traits of lab rats and pet rats overlap, meaning that the SD strain makes for great pets as well, as Fred's owner Claire points out in the following observation of her own three former lab rats:

> *"Well, the ones I have here, they are very young but they are real treats, the sweetest. They are curious and lively; they are always sticking to the cage door when I am coming and then I can rub a belly here and there. They are really just … a strain to fall in love with. (…) They have potential; they quickly become trusting, and they make formidable pets." Claire*

The 'potential' that a future pet rat needs to live up to is usually related to their ability to interact with humans by being trusting and curious, as well as initiating and desiring

physical contact. As the interviewee puts it, pet rats are ideally there to 'fall in love with' and to respond to human needs of comfort.

Limits and overflow

Interestingly, it appears that the ability of bonding through curiosity and playfulness is not limited to pet or lab rats but can be found in city rats as well. The president of the Club for Rat Friends CHF mentions that under special circumstances, city rats can become pet rats too. She already had two city rats; both were no more than a couple days old when two different strangers had found them and brought to her. The first city rat she took care of was a male and the second one a female:

> *"If you take a little wild rat, like a rattus norvegicus or a sewer rat, and you nurse it and feed it up, they become completely hand-tame. (…). He [the male rat] took life super easy. You touch him behind the ears and he would flatten like a pancake and pass out. Asleep immediately. Delightful. And the girl, she is the pure opposite. She is like a Duracell battery. Never a quiet moment. Always something going on. She needs to be busy and entertained, there has to be action." JB*

The two rats had vastly different characters, one being timid and lazy, the other being full of energy. She explained that with rats, it is like with people: there are different characters, regardless of where someone is coming from. When asked whether city rats are different as pets compared to lab or pet rats, she said that besides being brown, there was not really any difference. This suggests that young rats are strongly influenced by their environment and their interaction with humans. Subsequently, the rat's identity and behaviour emerge through their interactions with their environment. In the case of rats, of any origin, adopted by humans, their becoming responds to influences of other pet rats, human caretakers, rat cages and pet food (Modlinska & Pisula, 2020; Neville et al., 2022). As such, it is not only the human perception of the city rat that changes it to a pet rat, but also the city rat itself that becomes a pet. The rat responds to the stimuli and learns behaviour that is encouraged by humans such as tricks. While innate characteristics such as being shy or overly active still find their expressions in the rat, the general learned behaviour and co-becoming as pet-owner and companion involves both species (Haraway, 2008). While rats are known for their adaptability, it is easier to change the younger the rat is. While from a human perspective, the rats are transmuting their categories, for rats, it appears to be more of a 'growing into' a new role. This becomes apparent as younger rats appear to have an easier

time adapting, since their behaviour and experience are less fixed. The expression of any of the rat multiples then is not necessarily given with birth but acquired through interactions.

This prompts the question: when does a baby rat grow into a lab rat, pet rat or city rat? The president of the Club for Rat Friends states that there is a limit to the ability of city rats to become pet rats. When certain behaviours and instincts have already settled in the city rat in response to growing up with other city rats in the urban environment, there is no chance, according to her, that it could be turned into a pet:

> *"If you get them like this [when they are very young], I mean if you find them, then there is a good chance that they can become good pets. But yeah, taking a grown wild rat out o nature and trying to tame it; first o all, it's illegal and second, it is also simply not possible. They have learned and lived a different life." JB*

She clearly advises against trying to hunt down city rats and adopt them as pets. A 'grown wild rat' cannot be re-categorized or taken out of its environment and placed in a new one, transmuting within their surroundings like a chameleon changing colours. Instead, having 'learned and lived a different life', city rats establish themselves in their own categorisation. resisting human attempts to change their placement and therefore creating their own 'beastly rat places' outside of human control (Philo & Wilbert, 2000b).

Whenever animals display their agency through the transgression of boundaries, it usually causes conflict, regardless of whether it concerns city rats, lab rats or pet rats. Any form of transgression, disruption or resistance to their categorization by humans is perceived as a threat. This becomes especially apparent in the case of less informed pet rat owners who face a problem with quickly reproducing and consequently overflowing pet rats. Some owners are willing to take desperate measures to get the situation under control again, even killing their now estranged pets. The moment rats no longer fit into their discursive frame of a cute and easy pet, maybe even beginning to evade their physically assigned space within the cage, their perception changes in the eyes of their owners. What was once a companion suddenly becomes a threat.

However, those who believe they can get rid of their pet rats by simply killing them could face severe penalties if they are caught. The Swiss Welfare Act discusses "Cruelty to Animals" and states:

> *A custodial sentence not exceeding three years or a monetary penalty shall be imposed on anyone who intentionally (…) kills animals in a cruel or wanton manner. S455, Art. 26*

In Switzerland, pet rats do not have papers or a pass like cats or dogs, which makes it difficult for authorities to control who owns rats and what they are used for. According to Swiss law, a person can own up to 300 rats, mice or gerbils as long they follow the regulations of the Animal Protection Act (S455). It is therefore challenging to protect pet rats from being killed or sold as food for snakes and other reptiles. Nevertheless, the law against cruelty to animals sends a clear message that humans have a responsibility to protect and care for their pets.

Owners who are overwhelmed by their pet rats and looking for a less lethal solution abandon their pet rats in the wild, often thinking that they are setting them free. In order to help rat owners take care of their pets, the Club of Rat Friends CH supports new owners if they have questions and also assists with adopting, neutering and rehoming pet rats. The president of the club told me that people abandon their pets less often these days, but that it was fairly common in the 1990s and 2000s. Often, abandonment leads to the death of the pet rats before they can be found and saved. As the president explained to me:

> *"Wild rats learn everything they need to know from their mother and their siblings. (…) If we take care of it and give it everything it needs, nursing it by hand, how on earth would I teach it which worm is good and which seed and what not? That's impossible." JB*

Both lab rats and pet rats are directly dependent on human care for their survival. As they have not learned to feed or hunt by themselves, they struggle to find food for themselves. Far more often, however, they fall prey to birds due to not knowing that they are in danger. Despite being from the same species, pet rats cannot survive when left to fend for themselves outside of human care like city rats can. Unlike the lab and pet rat, the way of life of a city rat cannot be taught by humans. Instead, knowledge and behaviour is passed down from city rat to city rat (Hartigan Jr., 2021). Rats learns to survive in each given environment, be it a laboratory, a pet cage or a sewer. While it is possible to adapt to a new

environment, the learning process must be taught. When going from the lab to the pet cage, rats can adapt to the new way that food is provided, new sensory input and interactions with humans. Compared to the urban environment where rats take care of themselves completely, in the laboratory and the home, it is the human who has limited the rats agencies and provides them the need for survival. Going back to life in sewers or at the lake front, however, is not teachable by humans. Surviving as a rat is a knowledge that humans cannot access, an issue discussed in the literature chapter regarding the limits of embracing more-than-human methodologies and multispecies ethnographies (Hartigan Jr., 2021; Sands, 2019). While it is possible then to make an animal dependant on humans and tame it, the opposite in the form of teaching independence and autonomy cannot be induced by humans, an issue generally faced by wildlife rehabilitation services (Grogan & Kelly, 2013). The goal of wildlife rehabilitation is the 'treatment and temporary care of injured, diseased, and displaced' animals and the subsequent release of recovered animals back to their appropriate habitats (Miller, 2012, p. 3). As pet labs and lab rats have never lived independently from humans, there is no place to return them back to.

However, some species, such as dogs or cats, are known to often successfully become 'feral'. The feralization of cats and dogs is the process of domesticated animals becoming feral, meaning that they escape or are forced out of domestication and succeed to live independent and autonomous lives without intended human care (Griffith et al., 2000; Srinivasan, 2019). Feral animals often continue to live close to humans, having already adapted to the urban environment and using the availability of food and water to their advantage (Barua, 2022). Having left their intended purpose as pets, whether willingly or forced, feral animals are occupying a space where they do not belong according to humans. Appearing outside of their assigned category as pets, feral animals are sometimes caught in an attempt to convert them back into pets. However, more often than not, they are targeted for more lethal management methods, similar to the city rats (Srinivasan, 2019).

City Rat: despised and abject

City rats live in the urban environment and do not really have a 'space' where humans would want them at all. In Switzerland, the members of the Urban Pest Advisory Service (UPAS) would still assign them to one specific place, however:

> *"In the sewage system we don't fight the rats anymore. Why should we? It's all closed up." GB*

The first members explains that they used to invest a lot of time and effort into trying to reduce the rat population in the sewers. Humans themselves have very little direct control over city rats, their whereabouts and their activities. However, there is a lot of power in the material environment, such as a well-maintained sewage system. The better the sewage infrastructure in Zurich was managed, the lower the risk for rats to escape it. Therefore, unwanted rat populations were successfully relegated to the hidden spaces of waste flowing through and out of the city (Heiberg et al., 2012). Another member adds by pointing out that rats might even be useful down there:

> *"Yes, well, in the sewage system, I don't care. If they eat things that we flush away and so on, then they even kinda help somehow, no?" LK*

The city rats' spatial ordering thus follows the motto of 'out of sight, out of mind.' As long as they are out of sight, far removed from humans and not causing any problems, they are tolerated and neglectable.

Conflict arises when city rats make themselves comfortable in places where humans do not want them, usually because they are mingling in the same space as well. In that case, the perception of city rats is strongly influenced by their 'beastliness', the fact that they invade and transgress human-assigned boundaries and cannot be controlled (Philo & Wilbert, 2000b). As such, city rats are often seen as 'out of place' whenever they show up anywhere other than the hidden sewers in Zurich or even just become visible at all. Being 'out of place' refers to the ways in which animals are often seen as disrupting the social and cultural norms and expectations of human society. By showing up outside their designated spatial and cultural ordering, those animals not only become 'out of place', but also 'improper', transforming 'in-between' spaces to 'beastly' places (Philo & Wilbert, 2000a).

One way in which city rats are seen as being 'out of place' is through their presence in urban environments, which are predominately considered human spaces. Urbanization often involves the displacement of animals from their natural habitats, and animals that adapt to living in urban environments are often seen as a disturbance and not belonging (Byrne, 2010). As discussed in the literature chapter, in modern society, there is a strong emphasis on maintaining a clear boundary between nature and culture, particularly in urban areas. This often involves creating a sense of order and cleanliness in the city, and anything that disrupts this sense of order is seen as a threat, particularly when it comes to animals (Emel & Wolch, 1998). For example, animals that invade or occupy spaces that are not designated for them, such as rats in the city, can be perceived as a disruption of the societal order and as such are often met with disgust or fear. Urban animals are the first to fall through the cracks of the dichotomy between treasured nature and the destructive urban landscape (Holmberg, 2016), as I discussed in the previous chapters. Some urban animals are celebrated because they are beautiful (deer), endangered (Peregrine falcon), rare (owls) or useful (bees), but the well-adapted species that thrive abundantly in urban environments tend to be interpreted as pests (Patell, 1996; Sabloff, 2001).

Schädling is the German word for pest or vermin and refers to 'organisms (especially animals), who damage humans due to their way of living' (*Schädling*, n.d.). Per this definition, a pest can only be a pest if it has a human counterpart that is harmed. Rats, in this sense, are not pests in all situations, but rather the pest rat is made through certain interactions with humans. Even though city rats are homogenously grouped together and perceived as pests, not every individual or population might actually always be a pest. The worst 'pestering' traits of city rats are their ignorance of human-made boundaries, their tendency to cause damage to infrastructure and food supplies and their transmission of diseases.

While cities like Paris report 'hordes of rats taking over public parks and metro stations' (Willsher, 2018), the city rats in Zurich live a quiet life hidden from most of the population's attention. In fact, most people I talked to outside of my rat-specific field research said they had never seen a rat and many asked me if there even were any rats in Zurich at all. Despite the city rats' incognito presence in the city, the global pest discourse is strong in Zurich as well. The stark contrast between the narrative of city rats as a dangerous pest versus the useful lab rat and the cute pet rat highlights the role that human-

animal interactions play in shaping human's attitudes towards different animal species. In the case of city rats, it is their proximity to humans and the potential for negative interactions such as property damage and disease transmission that drives the negative perception. This is highlighted especially in the reaction of residents when learning about the presence of rats compared to the presence of mice. One of the exterminators I talked to explained that mice and rats are head-to-head when it comes to damaging property and being difficult to get rid of. Mice are much smaller, so they can fit through even tinier spaces than rats. She explained that inhabitants seem equally concerned by mice and rats, but the difference is that they perceive rats as more disgusting and a bigger threat:

> *"When a cable has been nibbled on, then it doesn't matter whether (it was) rat or mouse. The urine and faeces stink the same and both damage food storages. So, the damage is the same. (…) I think people are repulsed by rats and they fear them. But I think it is mostly fear. To be bitten." ES*

Both mice and rats are known to damage infrastructure and the extent of their damage has similar consequences. However, rats are perceived as more dangerous than mice. Rats are bigger than mice and therefore their bites are potentially more painful, but that is not all. The framing of the rat as a health threat plays an important role in how inhabitants react to learning of the presence of rats in comparison to mice. As the exterminator explained, inhabitants would often 'react relieved when they learn that they only have mice and not rats in their homes' (KS). Rats instil more fear in the inhabitants than mice, and they are seen as disgusting and a danger to human health. Inhabitants believe that rats are harder to get rid of than mice and that they are more likely to expand and invade their home further.

In addition to the strong emotional reaction towards city rats and their perception as a bigger threat than mice in terms of damage, they are widely known and feared for being a health threat to humans (Byers, Cox, et al., 2019; Connollya et al., 2017). City rats, like any animal living outside of sanitised human homes or controlled laboratory rooms, are likely to carry mites, fleas and diseases (Lindahl & Magnusson, 2020). The danger usually stems from zoonotic diseases, which can also be carried by feral cats and dogs. In Switzerland, the greatest health threat in regard to disease is leptospirosis, while globally the hantavirus poses a bigger threat (J. Clement et al., 2019). Leptospirosis is a bacterial disease with a wide range of symptoms that affects humans and mammalian animals and is transmitted

through soil or freshwater (Ellis, 2015). It is typically excreted through urine and enters the body through the eyes, mouth or cuts. Humans often get infected by swimming in contaminated bodies of water. Although very rare, cases of leptospirosis have also occurred in Zurich, where city rat populations thrive during the summer months along the lake shoreline where people sometimes swim.

From pest to abject

The problematisation of rats as pests is deeply embedded in Western modernist conceptions of 'proper, morally appropriate, spatial relations between animals and society' (Jerolmack, 2008, p. 73), which demand a strong division between 'animal spaces' and 'human spaces' (Philo & Wilbert, 2000b). With the strong ideal of clean, sanitised and controlled spaces, there is also the opposite: unwanted, neglected and dirty spaces. These can come in many forms, such as unproductive wastelands (Gandy, 2013), undesired informal settlements (Koster & Nuijten, 2016) or spaces of waste disposal and sanitation (Millington & Lawhon, 2018). Therefore, animals that are seen as 'pests' are frequently linked to the most undesirable urban spaces, just as rats are linked to sewers. As a result, the animals are associated with the negative traits and framed as 'abject' in the process (Kristeva, 1982).

This spatial logic closely translates into metaphors about unwanted species. Disrupting the social and cultural order of the city is not limited to just showing up 'out of place' but also leads to association with other matter, objects or situations that are unwanted, undesired and derogatory. Framing an animal as 'abject', then, is highly context-dependent and is influenced by a range of cultural, social, and emotional factors. Examining comparisons and metaphors about animals, for example, reveals a 'cultural anxiety about disorder and a deeply felt need for a sanitised city' (Jerolmack, 2008, p. 73). Metaphors for the rat are plentiful, and most of them are not flattering. The president of the Club of Rat Friends CH explains:

> *"Yes disgusting, but nothing is actually disgusting, is it. People just associated it. There is just something deeply rooted inside, that we connect rats with something negative, right? Like if someone does you bad, you think 'you are a dirty rat', but actually, they are not really dirty." JB*

The term 'dirty rat' (german 'dreckige Ratte') is often used to describe someone or something that is dirty, unclean, or morally corrupt. This metaphor can be traced back to the Middle Ages, when rats were commonly found in overcrowded and unsanitary living conditions in cities, and the association of rats with disease was solidified (Patell, 1996).
The narrative of pest, vermin or *Schädling* goes beyond just labelling city rats as 'dirty'. Instead, the politics around pests appears to degrade the socionatural ecosystem of which they are a part, leading from 'dirty rats' to 'dirty spaces' (Du Plessis, 2019). The connection to the flows of urban waste that allows rats to succeed in the city is at the same time the reason for their fall from grace, from simply being 'animals out of place' to 'trash animals' (Nagy & Johnson II, 2013). Although frequently compared to cockroaches and bed bugs, city rats do not have an animal subordinate in the same way that they themselves have become the animal subordinate to pigeons to illustrate their fall from grace. However, just like Jerolmack's pigeons have been degraded to 'rats with wings', rats can be degraded to 'trash'. As rats are commonly found in areas where poor living conditions are prevalent, they are also associated with poverty, squalor and the lower class (Biehler, 2013). Often, poor infrastructure and badly managed waste disposal offer shelter and food to rat populations, leading to a conflation of 'trash animals' in 'trash neighbourhoods' with 'trash people' (Du Plessis, 2019).

Associating rats with dirt, trash and disease, as well as framing them as 'out of place' in the urban environment, are the main processes that brand rats as worthless, useless and disposable. While in public discourse, the term 'pest' and 'rats' might be used almost synonymous, the term 'pest' is never defined in any of the Swiss legal documents. Instead, on the website of the Swiss Confederation, one finds references to the animals on which pest control focuses. The 'ordinance of the EDI (Eidgenössisches Departement des Innern, "Federal Department of Home Affairs") on the Specialised Licence for General Pest Control' sets out regulations for the use of toxic substances to control pests such as pesticides, insecticides, acaricides and products against other arthropods. The ordinance is relatively new, having been enacted in 2008, and has led to the creation of clear conditions and procedures for pest control and the standardisation of the approach and implementation of control methods. While it extensively describes the knowledge and competences required to practice pest control and apply pest control products, the actual 'pests' are not described in the document besides one brief mention. In the appendix under 'Required skills and knowledge' it says:

> *Pests: Being able to name the most important storage pests and pests in and around the house. Being able to describe the biology, way of life and harmful effects of the most important pest species and to identify specimens. SR 814.812.32, Appendix*

Besides doing damage and posing a threat, there are some pests who become targets for being 'out of place' in the sense of being 'from out of place' as invasive or non-native species (Philo & Wilbert, 2000a). In this case, an animal showing up 'in and around the house' and additionally having 'harmful effects' adds to the pest classifications. The idea of animals defying their assigned spaces also highlights how society tries to control and manipulate nature to fit into its own idea of order. Nature is only accepted in a subdued and neatly compartmentalised fashion, and so many urban animal species are experienced as 'out of place', producing discourses that reflect some sort of 'moral panic' (Goode & Ben-Yehuda, 1994, p. 149; Philo, 1995). This is especially true in the case of household pests, pests that invade human homes and pests that trespass in places where humans require high levels of control and sanitation. Power writes that the creation of such domestic spaces involves a process in which some non-humans and materials are included while others are excluded, depending on how their unruliness can be managed (Power, 2009b). Kaika (2005) explains similarly that some parts of nature are 'allowed to enter after having undergone significant material and social transformations'. What cannot be transformed or kept under control therefore has to face the consequences of being too 'unruly' (Tsing, 2012) to cohabitate, leading to the exclusion of pests while others animals are 'accommodated as enhancements to domestic life' (Paxton, 2017, p. 56). For humans to enjoy and appreciate rats, then, a certain distance and controlled way of interaction is needed, such as specific contexts with lab rats and pet rats have shown.

This also corresponds with the responses I have received from interviewees from different pest control companies, who said that it all comes down to the definition of what a pest is in practice. Whether or not a population of rats is a threat only becomes apparent when performing pest control checks and analysing the circumstances through which the population has established itself. When asked about a definition from pest control managers, I got the following answer:

> *"Pests are then, in principle that is, harmful to hygiene, like rats or cockroaches. However, there are also storage pests that contaminate food. Those also falls under pest or material pest, like the rat actually, because they also eat things." PA*

The first person described the situation in which animals emerge as pests due to harming human health, threatening hygiene or destroying or contaminating material goods. In this case, the 'pest animal' damages human property and threatens human wellbeing at the same time.

Another interviewee from a pest control firm presents an even shorter definition:

> *'Simply put, pests are the ones we are allowed to kill.' RM.*

In his short answer, the interviewee concludes that being categorised as a pest reduces an animal's value to the point of worthlessness, signalling that they are disposable or 'killlable'. The 'being made killable' is in close relation with the aforementioned examples in which the 'abject rat' is rejected and expelled for two reasons: first, because city rats threaten humans and destabilize the social and cultural order of the city. Second, their widespread association with disease, death and dirt renders city rats 'trash animals', making them disposable and wastable (Holmberg, 2016; Nagy & Johnson II, 2013).

Who is killable?

The Swiss Animal Welfare Act also states that the 'killing of animals in painful ways is forbidden' (SR 455, Art. 4). This is further concretised in the Animal Welfare Ordinance in Art. 178 of the chapter on 'killing and slaughtering of animals', which states that killing an animal requires compulsory stunning or, should this not be possible, doing everything necessary to keep pain, suffering and fear to a minimum. There are three exceptions to this rule in the cases of 'hunting', 'within the framework of permissible pest control measures' or 'if the killing method used immediately and without pain or suffering puts the animal into a state of insensibility and unconsciousness' (S455.1, Art. 178a).

While rodent control must therefore be carried out in such a way that the animals suffer as little pain and suffering as possible, a loophole lies again in the question of when an animal becomes a pest and in what circumstances removing the animal is more important than reducing its suffering. For example, the use of poison to control and reduce animal populations is strictly regulated and requires a permit which can only be obtained by trained pest control managers. In order to work at pest control companies in Switzerland, it is mandatory to attend training and become licensed managers.

Using poison as a killing method in the case of city rats is extremely painful, a process that will be discussed in the next chapter in more detail. Considering that the first introduced law of the Swiss Animal Welfare Act specified that 'no one shall unjustifiably cause pain, suffering or harm to an animal, put it in fear or otherwise disrespect its dignity', it seems rather contradicting that the painful poisoning of rats is legal (SR 455, Art. 4). Despite there not being a legal definition of pests in the swiss laws, an overview of species that are considered pests can be found in another subsection on the use of biocides, with a reference to 'integrated pest control'. This section has further subcategories with detailed descriptions on the following animals, listed in order: rats and mice, cockroaches, ants, other storage pests (other insects), bed bugs, mosquitoes, other bloodsucking gliding pests, textile pests (other insects), wasps, flies, spiders, silverfish (and cellar lice and dust bugs), insects hibernating on buildings and wood pests (other insects). Apart from rats and mice, which top the list, no other mammals or vertebrates are named.

In the law, mammals are put above insects based on the argument that mammals are able to feel emotions and have affective consciousness (Panksepp, 2010; Preston & de Waal, 2002). It is therefore surprising that despite these circumstances, rats and mice are classified as pests and allowed to be killed with poison. Taking a closer look at other similar species such as martens, rabbits and birds indicates that size might play an important role in the legal definition of pests.

Bigger animals like martens or foxes do not fall under the pest control laws but under the hunting laws, which means that the use of poison is not allowed as a method of killing. Rodents are not included in the Swiss Hunting Law, which applies to birds, carnivores, cloven-hoofed animals, lagomorphs, beavers, marmots and squirrels. While the Swiss Hunting Law describes how and when certain species are under protection during breeding time, they also define the circumstances under which individual animals or populations become killable:

> *They [cantons] may at any time order or permit measures to be taken against individual protected or huntable animals that cause significant damage. They may only entrust persons authorised to hunt and supervisory bodies with the implementation of these measures. (…) If a protected species has an excessively high population and this causes great harm or a significant threat, the cantons may, with*

the prior consent of the Department, take measures to reduce the population. (SR 922.0, Art. 12)

The concept of species relations of power refers to the ways in which different species interact and the power dynamics that exist between them (Hovorka, 2019). The example of overlaying laws and ordinances that apply similarly shows how species relations of power might be examined in terms of how different species influence each other's behaviour, distribution, and survival, and how these interactions are shaped by human activities. Questions of authority and power play a central role in determining the way animals are managed and how their interests are weighed against those of humans, as we have already seen in previous sections. These negotiations are often subject to a combination of different legal frameworks and issues of anthropocentric interests such as financial gain, political advantages or economic benefits (Jerolmack, 2008). This can include both interspecific (between different species) and intraspecific (within the same species) interactions, and may involve issues of dominance, subordination, exploitation and cooperation (Hovorka, 2019).

Species hold political power either due to their importance to anthropocentric interests or due to displays of agency that transgress spatial boundaries and cause conflict. The concept of 'charisma', as developed by wildlife biologist and conservationist Jamie Lorimer, refers to the ways in which certain species are seen as more worthy of protection or concern due to their perceived value or attractiveness (Lorimer, 2007). Lorimer argues that this concept of charisma is shaped by a variety of social, cultural, and economic factors, and that it can have a significant impact on conservation efforts and policy. According to Lorimer, an animal needs to have certain characteristics to be seen as having charisma. These characteristics may include being large or visually striking, being seen as important to human interests or values, or being associated with positive emotions.

In contrast to the species that gain political power through anthropocentric interest, there are species that ignore or even act against those interests. These can be dangerous or aggressive species who pose a threat to human lives, such as wolves or sharks (Poerting et al., 2020) or overflowing species that abundantly impose on human settlements, such as foxes, raccoons, pigeons and rats (Čapek, 2005; Rautio, 2017). It is important to note that power is often relative and can shift over time. Pigeons for example used to be of great importance as messengers and held great value among traders and breeders before becoming 'rats with wings' (Jerolmack, 2008). This indicates that factors such as changes

in human attitudes, population trends and environmental conditions can all impact the power dynamics between species (Hovorka, 2019).

Escaping rat spaces

Human attitudes towards species are playing a vital role then in the way that species is treated. As a species, humans hold the most power and have learned to manage and control other species for economic benefits. Species who have not proven useful to human interest tend to be ignored while those species which are in the way or even causing resistance to humans, are quickly considered as problematic (Sutton & Taylor, 2019). On top of being useless and resistant, species like rats, pigeons and other urban animals, have also proven to be particularly resilient against management or eradication attempts. The way human think about species then has direct ramifications for the subsequent 'animal spaces' to which there are subjugated to (Philo & Wilbert, 2000b).

The 'rat spaces' introduced in this chapter are a manifestation of the spaces which humans imagine rats to belong. They reflect the rat's relationship with humans and the anthropocentric orderings which humans force on rats. 'Rat spaces' are designed by humans for rats and respond to the human's need for control, order and safety. Depending on the constellation of the designed spaces, each 'rat space' presents its own set of material features, legal foundation and subsequent management and treatment rules. The 'lab rat space' for example is a strict environment where humans controlling almost every aspect of the lab rats. It is designed for the purpose of human advancement is science and lab rats are tools to serve the greater good of humanity. In return, the highly organised setting and the legal requirements for animal testing ensure that measures are taken for the well-being of the rats. Furthermore, there is also a lot of compassion towards lab rats for their service to humanity and a desire to end their suffering (Phelps, 2007). In comparison, the 'pet rat spaces' are spaces of communication and interaction between humans and rats as companion species. They are designed to cater to the needs of the rats as social and smart animals, providing them with toys, food and shelter. The purpose of the pet rat is to serve as a companion to humans by providing love, playfulness and curiosity. The law requires rat owners to take care of their animal and protect them from harm but due to lack of control from official services, pet rats might suffer hidden from sight. Considering that up to 300 animals are allowed to be kept without a permit, keeping control of the population growth can be very difficult. Last but not least, the 'city rat spaces' are predominantly

imagined as marginalised, unused spaces in the urban environment such as the sewers. However, city rats tend to escape their 'rat spaces' and invade spaces where humans do not want them. City rats serve no apparent purpose to humans and are largely classified as a pest within the legal and cultural perspective. Furthermore, city rats survive and thrive in unsanitary conditions, they multiply quickly and they are difficult to control which brands them worthless 'trash animals' (Nagy & Johnson II, 2013) and even 'abject' (Kristeva, 1982). In short, city rats do not comply with the 'complex spatial expectations being imposed upon animals' (Philo & Wilbert, 2000a, p. 26) which threatens the boundaries of anthropocentric orderings and ultimately renders them killable.

The main theoretical insight of this chapter then is the realisation that while humans might have imagined 'rat spaces' as ideal spaces where rats would be accepted, the reality is that animals do not conform to the cultural, political and economic boundaries that humans have created for them (Donaldson & Kymlicka, 2016). This becomes apparent when rats escape their assigned 'rat spaces', for example when the lab rats leave their laboratory space to become pets or when pet rat populations grow out of control for human management. In the case of city rats, their continuous transgression of their 'rat space' boundaries in the urban environment has led to ongoing conflict due to contestation of shared spaces. The subsequent framing of city rats as abject, worthless, disposable pests builds the foundation of the practices of pest management and control. The next chapter focuses on the geographical sites in the city of Zurich where city rats emerge as co-constitutors of their own 'rat places'. As opposed to the human-imagined 'rat spaces', that chapter examines how and when 'rat places' become sites of conflict and examines the ambiguities and nuances of rat management and the circumstances under which city rats become killable.

Killing Rats

This chapter aims to highlight the complex dynamics between humans and city rats in urban environments by analysing where and how rats become killable. As I have shown in chapter 4, city rats are framed as abject pests and their lives are subsequently reduced to the value of trash. As 'wasteable animals', rats are subject to lethal management practices in the name of cleansing the city and keeping humans safe. However, as chapter 4 has shown, the legal definition of killing animals is not straightforward and depends on the subjective perception of the spaces and circumstances where rats co-exist with humans. In practice, for the actors directly involved with city rats, managing rat populations involves negotiating economic, political, and ethical factors to decide when and how to kill rats. In order to explore current lethal management practices and the processes that inspired them, this chapter focuses on 'rat places,' the geographical locations and contexts where rats emerge outside the boundaries of the assigned 'rat spaces' to which humans seek to allot them (Philo and Wilbert 2000). Despite thriving in urban environments specifically, rats have also adapted to living in places like riverbanks, forests, and grasslands around urban environments, where their presence is deemed more acceptable in comparison to their presence in city parks, where humans are more likely to mingle. In some cases, specific urban areas may be designated for wildlife, providing a space where rats and other animals can coexist without generating conflict with humans (Soulsbury and White 2015). However, conflicts with city rats arise when they transgress the boundaries of their assigned 'rat spaces' and show up in unassigned 'rat places'. For example, when city rats enter homes and residential areas, they can cause property damage, contaminate food, and spread diseases, leading to fear and disgust among residents (Himsworth et al. 2013). Additionally, the presence of city rats in parks, playgrounds, or public transport can generate negative reactions from the public and raise concerns about public health and safety (Byers, Cox, et al. 2019). Additionally, rats found in restaurants, grocery stores or food processing facilities can pose significant health risks and damage the reputation of these businesses (Corrigan 2001).

The perceptions of these places change when humans notice the presence of rats. Through the appropriation of certain spaces also shared by humans, city rats change the very place itself by transgressing boundaries and transforming city parks and playgrounds "from safe

to risky, from civilised to unruly" (Bull and Holmberg 2018, 1). In order to return to the urban order then, a 'sanitation' of these invaded places is performed in the form of eradicating the rats and restoring human control. Considering the cultural-spatial logic of where rats are accepted and where they are not, this chapter explores the context-dependent factors that shape the human-rat relationship and with it the negotiations of how and where to kill rats.

Overall, this chapter follows the city rat and retraces the spatial and temporal relations and characteristics that lead to the construction of the city rat as a problem, rendering it killable. The chapter uses data from site observations of 'problematic' rat cases in Zurich and interviews with pest control managers to analyse how the overlapping and interchanging frameworks of rats as animals, pests, and problems are negotiated and under which circumstances rats become killable. Using examples from the field, I show how spatial and cultural 'rat space' boundaries are subjectively constructed based on the underlying rationalities of anthropocentrism explored in chapter 4. By exploring the different ways that city rats are transgressing the boundaries of 'rat spaces' and subsequently creating their own 'rat places,' I establish the context and factors in which city rats cross the threshold to becoming killable before introducing the concept of the 'problem animal' (Best 2018; A. Peterson 2019; Jerolmack 2008). Based on the analysis of different rat cases in Zurich, I identify the circumstances in which rats become a threat to human health and damage infrastructure. The justification and subsequent decision of killing the rats is based on a complex negotiation of ethical and political factors and ultimately as well, in the definition of the law for how to deal with pests.

Finally, I examine how rats are killed and what the ethical implications are for different methods. On one hand, the law demands that all animals, even pests, are to be killed as painlessly as possible. On the other hand, city rats have to be killed efficiently for the protection of humans. This struggle between human interests and ethical treatment of rats becomes visible not only through the pest control managers who execute the demands of rat extermination but also through the people who give the command to remove rats from their home and garden. Using interviews and field observation as a basis, I show how difficult the ethical killing of city rats is. The chapter concludes by proposing alternative ways of killing rats and alternative solutions to killing rats by exploring integrative pest management practices.

From 'Rat Spaces' to 'Rat Places': Perceptions of Rats

As established in chapter 2, 'rat spaces' refer to locations and environments inhabited by rats that are considered 'appropriate' by humans. In contrast, 'rat places' are the result of rats transgressing the spatial and cultural boundaries of human-assigned 'rat spaces' and appropriating spaces in which they are not welcome or are deemed inappropriate. As such, rats living in 'rat places' challenge the subjective nature of human perceptions regarding the acceptability of rats, the boundaries and transgressions involved in their placement, and the nature of human-animal interactions in each type of space. Conflicts and negative perception of rats emerge in relation to 'rat places' as rats are deemed 'inappropriate' or 'unacceptable' by humans to be there. The distinction between 'rat spaces' and 'rat places' is inherently subjective, as it is based on human judgments of what is considered acceptable or unacceptable. 'Rat spaces' usually involve a level of mutual acceptance between humans and animals as they are often controlled by humans, whereas 'rat places' are characterized by tension and conflict due to rats' perceived negative impacts on human health, safety or property. The boundaries between 'rat spaces' and 'rat places' are not fixed but move along a spectrum between when and where rats are tolerable or killable. This fluidity is illustrated in the following fieldnote, which is an example of one of many similar situations that I encountered in Zurich:

Fieldnote, 24.07.2019, Construction Site with Urban Pest Advisory Services (UPAS)

> Today, Simon and I went to examine a rat case at a construction site next to the train tracks. A large area of containers had been arranged to provide space for the construction workers, including office spaces for the site and construction managers. The head of the construction managers welcomed us and showed us around. While walking through the corridors between the containers, I saw little shadows scurry around. The containers had been placed on logs and were thus hovering over the uneven terrain, leaving a gap between the freshly dug up soil and the metal floor of the container bottom. As we cut a corner, I saw two rats running under one of the containers. When I peeked under it, I saw a rat looking back at me while two others retreated into the dark shadows. The head of construction management stopped at the lunch area, which had little tables with hooks beneath them to hang jackets or bags (Figure 5, p.143). He explained that the rats were everywhere and active in the

daytime around the construction site and especially the container area. Standing in the lunch area, he showed me and Simon a video that had been taken where we were sitting the previous day. It was set in the lunch area (see Figure 2) and showed a plastic bag from the supermarket chain Coop hung under one of the tables about half a meter above the ground. "One of the workers had left their lunch here. Two buns of bread and a package of salami", he explained. In the video, an adult rat accompanied by a smaller rat approached the bag. They sniffed the air, ran back for cover and then returned, with the bigger rat mostly leading the way. After repeating this a couple of times, the bigger rat jumped up to the bag. After three tries, the rat managed to bite a large hole in the bag, and with the fourth attempt it bit into the bun, hanging onto it and wiggling its body until the bun was freed and the rat fell to the ground, bun still in mouth. The smaller rat eagerly joined the bigger rat, trying to bite into the bun as well. The adult rat turned and dragged away the bun, which was the same size as itself. With the smaller rat in tow, they scurried off under a container.

The head of the construction managers put his phone away and excitedly looked at us, asking, "Isn't this incredible? It is just amazing! I mean, have you seen this? They are so agile! I mean, such a big rat, but she jumps so high with ease. They are so smart too." Admittedly, both Simon and I had laughed during the video and were impressed at the boldness of the rat to steal someone's lunch in broad daylight. Simon said he needed to walk around some more to get an idea of just how many rats there were and where they came from, so we left the head manager, who retreated into his office.

Simon carefully examined the places where the sewer system was newly connected to see if the rats came from to the construction site through unclosed sewer pipes but found no indication of a possible entry. He searched for holes in the ground to see whether there were underground leaks in the pipes that had gone unnoticed but also did not find any. Simon mused whether the rats had come from the train tracks, which would offer a good undisturbed nesting ground but not much food. In comparison to the train tracks, the construction site was a paradise. Better to have construction noise than to have a train run over your house every five minutes, and also there was more food and water available here. We walked around the area and took note of the number of rats. Simon said, if you count 10 adult rats, then you can be sure that the total number is at least twice as high, since most of them probably

have a litter somewhere. Being active during daylight shows both how comfortable the rats feel here and how badly they need food to feed their babies. Within a month, the number of rats could explode exponentially. Right now, the rats seem content to stick to the area of the construction site. However, the bigger the population, the higher the likelihood of the colony spreading to other buildings in the neighbouring residential area. Then, according to Simon, the situation would be really out of control.

After scouting the area, Simon and I went back to report to the head of the construction site on what we had found. After giving a quick overview of the situation, Simon explained how to proceed in a case like this in four points: hire pest control managers, make changes to the trash management, keep food away from rats, and provide sanitary safety for the construction workers. Simon stressed the severity of the situation and stressed that immediate action was needed from a professional pest control firm that could intervene quickly. Simon further pointed out that it was better to act quickly and invest in a thorough approach to get everything under control now than risk an invasion of other areas around the construction site. This could quickly become expensive and the construction site would be responsible for the cost of additional rat exterminations, as they would be blamed for not taking care of it. The head of the construction managers nodded seriously and said "Yeah, no, they are definitely a problem. I mean … I was walking by a trash can last week and a rat jumped out of it. I was really surprised and disgusted; they are such dirty animals. We have to take action. That's why I called you."

Figure 5: The lunch area of a construction site in Zurich close to the train tracks, which had been populated by a fast-growing colony of rats. (source: author)

The construction site was located next to the train tracks leading into Zurich's busy central station (see Figure 1). As the train station is located in the heart of the city, the train tracks leading there divide the city; the only way to cross them is to go under by tunnels or over by bridges. The train tracks are off limits for humans, except for track workers, since trains are moving at high speed at almost all times though less frequent at night. Some of the train tracks end in the 18 platforms at the main station of Zurich, but others go into the subterranean part of the station and continue through tunnels. As is visible from the satellite image (see Figure 1), there is also a train depot west of the station, widening the space which is inaccessible and off-limits for humans. The location of the train tracks has also influenced the surrounding neighbourhoods, making them less attractive due to the noise. This is especially relevant in connection with Langstrasse, a very busy street connecting the two districts north and south of the train tracks through an underpass, also known for its nightlife and long history of street prostitution.

Especially towards the train depot, some of the train tracks are in less frequent use and the trains move slower or are stationed for days without moving at all. As such, this area is not under any human surveillance when it comes to plant or animal control, leaving them to live there 'undisturbed' by human interreference, except for the occasional train thundering by. However, it does not offer many sources of food and water which limits the kind and number of animals it can support. For rats, then, it would be a compromise of living around the train tracks in the grassy slopes and finding food close by without having to invade people's homes for shelter. This way, they could go unnoticed unless they multiply

due to a newly discovered nesting ground with a greater food source, such as the construction site provided.

The construction site itself is an interesting in-between of a human space and a marginalised space as it does not cater to the needs of humans (yet), though it requires human activity to achieve a built environment that does. While in the process of becoming a human space, the presence of rats was tolerated for weeks at the construction site before someone decided to take action. This liminality reflects the fluidity of the boundaries between 'rat spaces' and 'rat places.' Even though the rats were present and visible in high numbers, the construction workers did not seem to mind them and mostly ignored them. Seeing the rats run around and steal someone's lunch did not invoke feelings of disgust but rather of delight. As the head manager reported after showing us the video, the rats were seen as fascinating creatures and praised for their agility and intelligence. However, by the end of the day, the same person reported that they had encountered a rat jumping out of a trash bin and were 'disgusted,' labelling the rats as a 'problem.' The question, then, is: when and why did that perception change?

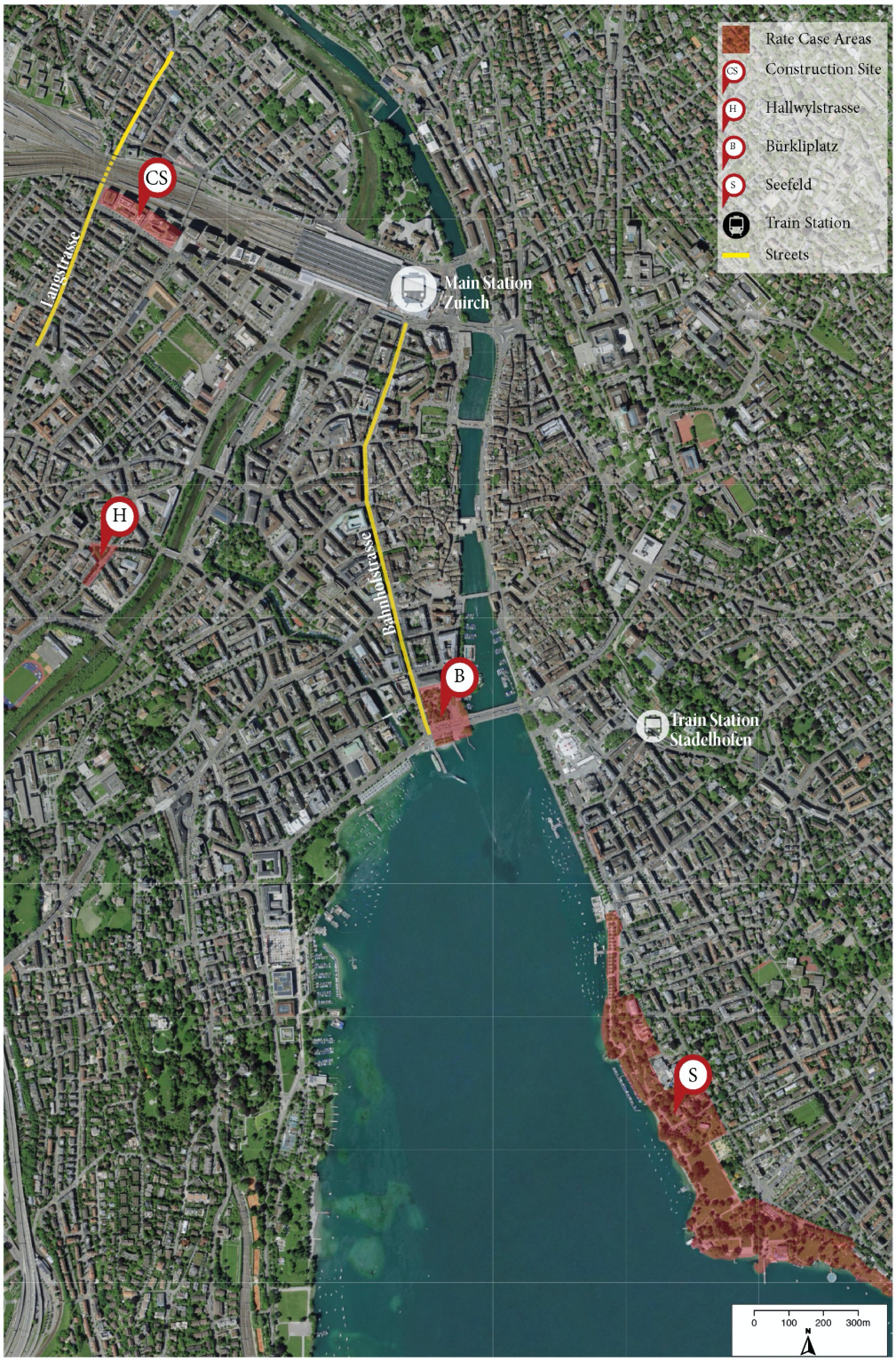


Figure 6 Overview of Rat Places in Zurich and the main areas of reference [8]

[8] Base map copyright by Swiss federal authorities: www.geo.admin.ch is a portal provided by the Federal Authorities of the Swiss Confederation to gain insight on publicly accessible geographical information, data and services. Illustrated by author.

Pest-imistic Attitudes: The Problem Rat

As discussed in chapter 2, species like rats, who continuously transgress human-designated boundaries and challenge societal norms, are labelled 'problem animals' as they cause friction leading to human-animal conflict (M. N. Peterson et al. 2010). The negative perception and low value attributed to 'problem animals' is often culturally informed and closely tied to emotional and embodied experiences of humans with these animals. Especially in the urban environment, where human and animal bodies coexist in close quarters, the role of affective experiences plays an important role in the way rats are perceived. This is not only true for rats, but also for other urban animals. In the case of pigeons for example, Jerolmack (2008) demonstrates that their classification as 'rats with wings' is a result of the cultural-spatial logic that associates them with filth, disease, and disorder. This labelling process is further influenced by the spatial distribution of pigeons in the city and the human activities that attract tem to specific areas, such as feeding, leaving food sources around in the form of trash, or not cleaning up after eating. When applying these perspectives to city rats, it becomes clear that their designation as 'problem animals' is influenced by both the cultural-spatial logic described by Jerolmack (2008) and context-dependent factors, as will be detailed further in Figure 4. The association of rats with disease and property damage contributes to their negative perception and classification as problem animals. Moreover, the spatial distribution of rats in urban environments, including their presence in sewers, abandoned buildings, and waste disposal sites, increases the likelihood of humans to perceive them as abject and adds to their problematic status (Jerolmack 2008).

As such designations are inherently subjective, what may be considered a 'problem animal' in one context might be seen as harmless or even beneficial in another. For example, urban foxes might be viewed as pests by some residents due to their scavenging behaviours, while others appreciate their role in controlling rodent populations (see Bonnington, Gaston, and Evans 2013). This subjectivity highlights the importance of understanding the social, cultural, and political factors shaping human-animal relationships in urban environments. The main determinant of becoming a 'problem animal', then, is the transgression of human-designated boundaries, which causes issues or conflicts for humans. The city rats at the construction site were already considered pests due to the socio-cultural history explored in the previous empirical chapter, but the additional activity of crossing the boundaries of their 'rat spaces' and exceeding the thresholds of human tolerance led to

them becoming a 'problem.' It is therefore crucial to identify the boundaries that led to the designation of those rats as 'problem animals' in order to understand how they went from tolerated to killable.

Crossing Boundaries

One important factor to consider in understanding both the perception of rats and the differentiation between 'rat spaces' and 'rat places' is the question of who is in control of the shared space. If humans are in control of the rats, then regardless of all other factors, rats are considered 'in place.' If there is a loss of control, the rats are considered 'out of place' (Philo and Wilbert 2000). Returning to the construction site, although the bun-stealing rat was already close to humans, damaging someone's food, active during the day, and posing a health risk, there was a sense of control for the construction workers and site manager as they could watch the rats a safe space afar, especially when on video. In comparison, the barely visible rat emerging at night from the bin invoked a sense of helplessness and represented a loss of control (see also Kaltenborn, Bjerke, and Nyahongo 2006 for cases of living with problem animals in the Serengeti). The question of control is particularly interesting in the case of the lab rat and pet rat, whose environment, food, water, and social contacts are all controlled by humans (see Figure 7). However, even lab and pet rats have agency regardless of the amount of control that humans exercise over them (Despret 2016). As discussed in chapter 4, lab and pet rats have clearly assigned roles that they have to live up to not be considered 'out of place.' For example, a pet rat can display its own beastliness by being aggressive and biting, resisting the role of a loving pet. As a result, the human owner might take back control by applying new measures either training the rat to be friendlier or getting rid of it. It is evident, however, that lab rats and pet rats have very limited agency to create their own 'rat places,' particularly in comparison to the city rat.

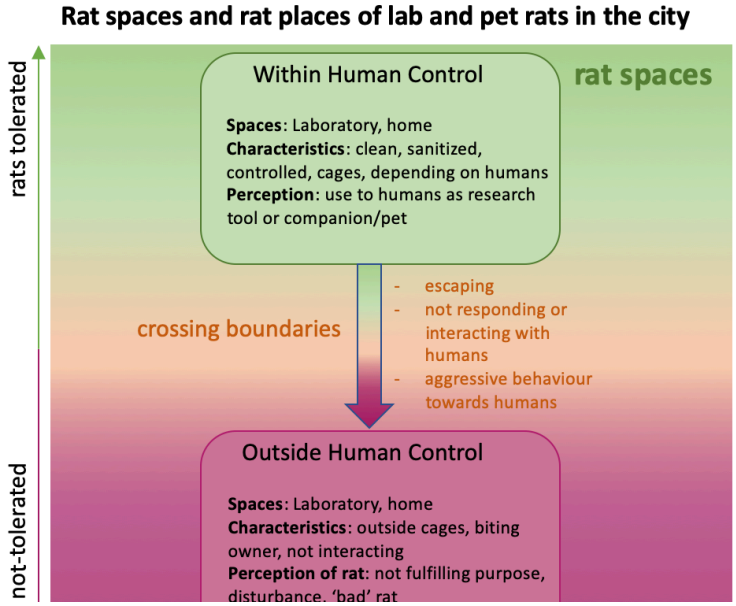


Figure 7: Tolerated 'rat spaces' and not-tolerated 'rat places' for lab and pet rats based on the finding of my field research in Zurich (source: author)

City rats are beyond human control and continuously (so far) resist all attempts at permanently excluding them from the city by using their inherent, adaptive capacities to persist and thrive in urban environments (see the discussion on resilience of pests by Arseneault and Collard 2022). The moment city rats become visible, they are immediately perceived as a threat by the human population. There is an important correlation between the notion of control and visibility, which informs humans of the rats' presence. If humans are not aware of the rats, they cannot perceive the rats as a threat. In comparison to the lab and pet rats, whose whereabouts are under the control of humans, the city rats succeed in the urban environment through their elusiveness. 'Rat spaces' for city rats, then, are often characterised by rats going unnoticed or by occupying spaces that are considered abject and therefore unsuitable for humans (see Figure 8).

The appearance of rats in public spaces, such as parks and streets, can evoke feelings of disgust and fear among city residents (see Byers, Cox, et al. 2019). These negative reactions can result in increased efforts to remove rats from visible areas and limit their presence within urban environments. Due to these socio-spatial boundaries, city rats are ousted to live in marginalised and neglected spaces such as sewer systems and are therefore associated with urban decay, poverty, and neglect (for historical roots see Atkins 2012). Their presence in certain neighbourhoods can contribute to stigmatization and reinforce negative stereotypes, leading to efforts to eradicate them from these spaces (see Biehler

2013 for relations of rats with poor neighbourhoods). As we have seen in chapter 4, sewers are the most prominent example of a city 'rat space' as rat populations remain mostly hidden in underground spaces, which are often perceived as detached from the city's social and cultural fabric. Those 'subterranean spaces' embody a 'negative' landscape, serving as a metaphor for the human unconscious and reflecting society's anxieties and aspirations (Williams 2008, 6). They are, however, not merely passive backdrops but active agents that shape human experience and contribute to the formation of identity.

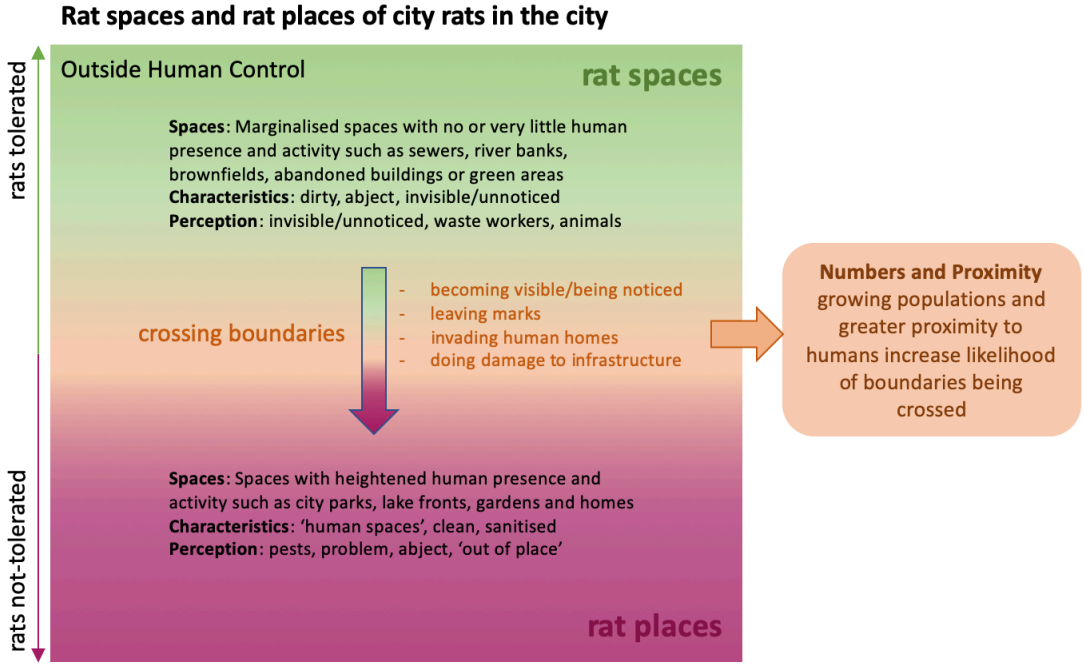


Figure 8: Tolerated 'rat spaces' and not-tolerated 'rat places' for city rats based on the finding of my field research in Zurich (source: author)

This becomes apparent when looking at how the political and cultural dimensions of abandoned and marginalized spaces have come to symbolize the intrusion of the abject into everyday life. The presence of rats in urban environments is often associated with these abject spaces and perceived as disrupting the established boundaries between the clean and the unclean and the safe and the dangerous. As a pest control manager explains, even the difference between certain neighbourhoods can influence whether rats are accepted or not (see Figure 6, p.145 for locations).

> *"So if you now have a rat, for example, at the station in Stadelhofen or on the lakeshore, yes? There you have population groups that are sensitive. But if you go to the Langstrasse district [...] the milieu is completely different. A rat is completely unremarkable there, because the people have completely different problems. (...)*

Maybe the people there grew up in such conditions and don't think it's anything special if there's a rat running around. It's kind of expected." ES

The manager points out that wealthier neighbourhoods or public spaces tend to have high expectations of cleanliness and safety, such as the Stadelhofen train station and the nearby lakefront. The Langstrasse district, on the other hand, is an area in Zurich with bars that have historically been associated with drugs, prostitution, illegality, and lower class living. As such, despite being a popular area for nightlife, the district continues to have an image of being dangerous and dirty. This image then reduces the value of the neighbourhood and its population, making it a 'trash' place with 'trash animals' (Nagy and Johnson II 2013; Biehler 2013). As such, the tolerance for rats (at least from the city's rat management perspective) varies within the city of Zurich, depending on the socio-economic background of the neighbourhood.

Whether an animal is already considered a pest on top of being a 'problem animal' impacts how other species are seen in comparison. Another pest control manager compares the damaging effects of rats and martens. Both have similar habits of invading walls and attics, but martens tend to do much more damage once established, as they are bigger and, if one is unlucky enough to have them in the attic while they birth a litter, it is forbidden to chase them out or harm them until their pups are three months old (Swiss Federal Constitution 2008). However, according to the pest manager, martens are not considered pests, while rats are:

"Yes… it is actually in the definition [of what is a pest], because the marten is not really a pest in itself if it lived where it actually belongs. But more and more living space is being taken away from it and therefore ... it comes into the villages and the city, into the attic and into the car." AA

This quote reifies the narrative of city rats as pests, pointing to strong cultural beliefs that prohibit alternative ways of seeing them. Martens, on the other hand, are framed as 'animals' that have fallen victim to humans' destruction of their natural habitat, leaving them no choice but to seek refuge in urban environments and humans' attics. This narrative gives martens sympathy and blames human negligence for the fact that they cross the boundaries between outside and inside and between wild and urban. The fact that martens are seen as 'animals' that act like pests and not as 'pests' that are also animals gives them protection under the law as well. Meanwhile, rats are seen as pests wherever they are,

because they are so strongly associated with the urban environment that no 'natural habitat' seems left for them (Feng and Himsworth 2014; Burt 2006). These strong ideas of dichotomous separation facilitate the devaluation of many urban animals (Shingne and Reese 2022) and exemplifies the dualist thinking explored in the literature chapter.

The pest control manager's points about different neighbourhoods and different species then reveal that human-wildlife conflicts are also socially constructed, highlighting the need to examine how the perception of different species influences their management in different urban contexts. As we have seen in chapter 4, the possibilities of 'rat spaces' are? very strongly limited. Due to the perception of martens as a victimised species, they receive much more understanding when they show up outside their 'marten spaces', while there is much less willingness to tolerate rats anywhere near humans. For city rats, then, moving out of their assigned 'rat space' is closely tied to appearing anywhere outside those marginalised spaces and being noticed by humans. This happens usually due to population growth or proximity to humans in densely populated areas or busy public spaces. The city rats at the construction site were in a particular position. They occupied a marginalised space that only a limited number and type of humans had access to. As construction sites are similarly labelled as dirty by those who do not work there, rats are still somewhat within their 'rat space' boundary. However, their increasing numbers and proximity to the workers suggested that a sanitary boundary had been crossed, especially since they had been invading the lunch area. The inconsistent reporting and reaction from the workers and head manager about the rat reflect how different factors interplayed with the individual positionality and sensitivity of each person in regard to the perception of the rats. In this case, it appeared that the rats were increasingly perceived as a problem.

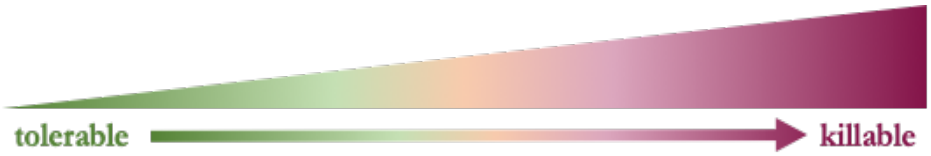
Threshold: Becoming Killable

> *"So with the rat, the threshold is reached relatively quickly, of course. [...] In a house or a building with flats, if the rats get in the cellar and you have reserves of tins or food in there and the rats urinate on it, then that is a problem. It is a real problem."*
> *PA, pest control manager*

While the previous chapter 4 showed that city rats become killable through being framed as abject, the first part of this chapter has revealed how crossing boundaries increases the

risk of rats becoming 'problem animals' and therefore their likelihood of becoming killable. Both processes reduce rats to a singular version of the rat multiple and therefore characterize them as a threat to human health and a risk to infrastructure. The friction between 'rat places' and 'human spaces' renders rats killable in the name of protecting humans but who decides when and how lethal rat control measures need to be effectively applied? Examining the relationship between rats and humans, as illustrated in the case of the construction site, reveals a rat multiplicity of tolerable and killable rats specific to the site and the actors involved. As I have shown in the literature chapter 2, sites are a product of interrelations that are always continuously 'becoming,' leading to a multiplicity of space (Massey 2022), while the actors in Zurich engaging with that space emerge through the different interactions with rats, other humans, and species within their socio-material environment (Hovorka 2017).

There are several factors that appear to influence the perception of rats in Zurich: control, visibility, number, proximity, health threat, damage, risk of escalation, protection and acceptance. Depending on these factors, rats are either perceived as tolerable and praised for their abilities and traits, or they are seen as a threat or a problem in need of management or removal. As these factors are highly context-dependent, there is no clear line indicating when rats go from tolerable to killable. In many cases, the factors are correlated as well. For example, the higher the number of rats, the more likely they are to be noticed and the higher the risk for escalation and loss of control among human stakeholders. However, depending on the location, a high number of rats can go unnoticed and never pose a risk of escalation, such as in a forest, where rat populations are often self-regulating due to the absence of food. They are also less of a threat in a forest since humans are less likely to venture there and if they do, they are more alert with regards to their own safety and hygiene. An overview of the different factors and how they contribute to the tolerance or killability of rats is found in Figure 9. This figure is intended to be applied as a tool for analysing the rat situation on the construction site to shed light on how the site manager's perception of rats transitioned from 'smart and agile' to 'dirty and disgusting'.



	tolerable rat	killable rat
Control	under human control	out of human control
Visibility	invisible/unnoticed	visible/noticed
Number	low number	high number
Proximity	far away	close
Health threat	low health threat	high health threat
Damage	no evidence of damage	evidence of damage
Risk of Escalation	low risk of escalation	high risk of escalation
Protection	physical boundary	no physical boundary
Acceptance	appropriate, 'in place'	inappropriate, 'out of place'

Figure 9 Table showing the different factors that influence the human tolerance of rats in the urban environment. These factors are not fixed parameters but are indicators of the increased likelihood of tolerating or killing rats in a specific site in Zurich (source: author)

Spatiality

The role of spatiality in the human-animal relationship in urban settings has been widely explored in recent literature, particularly in the context of how distance and proximity between urban animal species and humans produce different reactions to and management strategies for urban animals. Urban animals have long played a significant role in shaping urban environments and human-animal interactions within it. The spatial distribution of urban wildlife often results in human-wildlife conflicts, particularly when species considered as pests, such as rats and pigeons, come into close contact with human populations (see Jerolmack 2008; Holmberg 2016). The proximity of such animals to humans has led to various management strategies, often aimed at controlling their populations to minimize their perceived negative impacts.

The relationship between humans and urban animals is often shaped by the perceived threat or nuisance these animals pose. Such perceptions are shaped by cultural, historical, and socio-economic factors as we have seen as well within the perceptions of different neighbourhoods and public spaces in Zurich. The spatial aspect of this relationship is

essential, as the closer humans and rats are to each other, the higher the likelihood of conflict or interaction.

Number also plays a crucial factor in the perception of rats. An individual rat is perceived differently than a mischief or an even bigger colony of rats. This is connected to the grade of individuation explored in the literature chapter 2 and is based on the fact that when animals begin to appear together as group, they get "transformed from individuals to an undefinable 'crowd'" or swarm (Holmberg 2016, 10). Combining individual rats into a collective group results in the formation of a distinct entity characterized by its crowd attributes rather than its individual members, which subsequently devalues rats as pests and vermin. As a crowd, then, rats are more likely to become killable than they are as individuals. This is why many scholars insist on considering the 'animal multiple' and configuring animals as individuals and species simultaneously as it helps to "attune to the biopolitics of governing animals" (Hodgetts and Lorimer 2015, 291).

Returning to the construction site, the two rats stealing a bun on the video were removed from the aggregate – their performance emphasizing their individuality. There was a clear differentiation between the big rat, which was bold and agile, and the small rat, which was following and learning. This perception was aided by the fact that the rats were removed from the spectators, as we were merely seeing them on a video. The distance from the rat and the clear visibility during the day also played an important role as they added to a sense of safety and control.

A further example of how the number of rats can influence perception comes from another case at the Halwylstrasse in Zurich. This street is located in an upper-middle-class neighbourhood with small private businesses on the ground floor. The streets are typically clean and quiet with little traffic and some greenery along the sidewalk (see Figure 10). After arriving at the site with a UPAS member, we asked one of the shop owners whether she had heard anything about a rat problem, and she replied:

> *"A rat problem? No, nothing like that. I mean we saw a rat last week; it was running around the street here. But I mean, that was just one rat; it was kind of cute actually, but I don't think one can talk about a rat problem just because of that."*
> *Shop owner, Hallwylerstrasse*

Figure 10 The residential area in an upper-class neighbourhood of Zurich at Hallwylerstrasse where a small rat population has made its home in the bushes along the sidewalk. (source: author)

Despite the clean and sanitised area, the rats were not perceived as a problem, mainly due to their low numbers. The woman also individuated the rat she saw. What she did not consider, however, was the fact that seeing one rat does not mean that there is only one rat. The shrubbery planted along the sidewalk presented an ideal hiding spot for rat burrows and the rats had already dug beneath four of the adjacent bushes. According to the accompanying UPAS member, it was very likely that there were already around 12–20 rats living on this street based on the number of holes. The perceived number of rats is often solely based on the visibility of the rats, as the majority of rats remain hidden in their burrows and by evading human sighting at night.

Hidden and Perceived Threats: Affective Reactions

Despite the fact that the rats at the construction site had clearly been active for weeks before Simon's arrival and intervention, they were only perceived as a 'problem' when their numbers increased and their presence became more noticeable. Rats are usually active at night, but when they feel comfortable and need to find food for their litters, they can adapt their behaviour (Heiberg, Sluydts, and Leirs 2012). As they started to become active during the day, they became more visible and proximate to humans since both were present at the same time. Visibility plays a significant role in shaping people's perception of rats as threats. A pest control manager explains the importance of visibility for their work as well:

> *"I don't think people know that there are rats here. Unless they have seen one, they do not know. Unless you have had one in your home, you think they are really far away. But they are right there." LK*

As mentioned before, if humans are not aware of the rats, then they cannot perceive them as a threat. Additionally, as the pest control manager points out, while proximity is the main issue for rats being a threat to human health, not noticing rats does not mean that they are far away (see also Byers, Cox, et al. 2019).

Actual cases of people getting sick from rats are rare in Zurich. A member from UPAS informed me that leptospirosis cases are the most common. Infections happen around bodies of water, such as when people swim in lake waters where rats are present along the shoreline. Norway Rats are known to enjoy a dip in the water and are excellent swimmers. Their saliva, urine, and faeces mix with the water and the disease can be transmitted to humans through cuts or mucous membranes of the mouth (Koizumi et al. 2009). A pest control manager told me about a teenager who got bitten in the lip after falling asleep on the lake front after a street parade event. She was told to immediately see a doctor and make sure to have a tetanus vaccine, as tetanus is commonly carried by a variety of wild animals, as well as domesticated cats (see Crowley, Cecchetti, and McDonald 2020).

Because rats are carriers of diseases, pest control workers often must anticipate the threat that rats can pose and take action based on the potential risks that rats pose. As mentioned before regarding numbers, rats can reproduce very fast and even if their numbers are low, there is a risk of escalation. An interviewee from a pest control firm, who compared rats with martens explained:

> *"The rat already reproduces much, much faster than a marten and so you can't actually compare the rat with the marten. A rat can also transmit diseases and is therefore considered a hygiene pest. Already because of that, the health department would, uh, rather say 'kill' than 'expel'." ES*

As the rats are a hygiene pest in posing a threat to the health of humans, the tolerance of rats in close proximity to humans is very low (as shown by Clement et al. 2019 for the case of rats in Seoul). Their fast reproduction increases their potential threat, making pest control managers more likely to take lethal actions the moment rats are noticed.

The increased visibility of rats in urban environments leads not only to a higher perceived threat related to the risk of disease transmission but also to property damage associated with rats. The rats at the construction site had not done any direct physical damage to either humans or the material environment yet, but there was already a high likelihood of inflicting damage on cables and the materials needed for construction work. Destabilised piles of heavy building material or malfunctioning technical equipment can endanger the safety of workers and, beyond the value of life, can put the success of the building project at risk which is an economic risk. The perceived risk can also negatively impact the mental well-being of the humans who are forced to perform their work in the presence of rats, such as feeling devalued and uncared for by the employer (see also the case study by Byers, Cox, et al. 2019). The cultural and affective toll that rats can have on people was observed by another pest control manager who told me about the reaction of people who discover that they have rats in their home:

> *"Yes, there are people who, when they just see a rat, they become hysterical. I sometimes have the feeling that we are not only pest controllers but also a bit of a psychologist and we calm people down […]. And then sometimes you have to nurse them [the people] back a little bit and say that this will be fine in this case and we'll look at it now together and so on." PA*

Even though the job of the pest control worker is to remove the rat, the interviewee states that they must often take care of the people who are affected by rats. Having to calm someone down and letting them know that everything will be okay gives the interviewee the feeling of having to be "a bit of a psychologist", also because they have to take care of people's mental health affected by having rats in their home. For the pest control worker who deals with rats and other pests on a regular basis, the rat is a normal part of the job, while for someone who has perhaps encountered a rat for the first time, finding one in their house can induce strong feelings of unsafety and danger. Regardless of whether the rat was posing an actual threat, its perceived threat plays an important role in the perception of the rat as abject, a pest, or a problem.

The rats' hidden presence in the lunch area, for example, was already posing an unknown health threat to the construction site workers, but it was not until humans actively observed the rats in the lunch area that the health threat became visible. The knowledge of the rat's presence in the lunch area invoked various emotional responses of disgust mixed with the

fear of getting sick. Many construction workers had begun to eat their lunch inside the containers as a means of creating a physical barrier between them and the rats. Due to the rats, then, the lunch area, though physically unchanged, had transformed from being a 'clean and safe' to a 'dirty and dangerous' space (Du Plessis 2019). After making their presence known and becoming visible, the city rats' presence was questioned since their assigned 'rat space' is one largely hidden from those where human lives unfold. As such, city rats are tolerated as long as they stay out of sight, such as functioning in the sewers as invisible waste-workers instead of invading lunch areas and other human spaces (Feng and Himsworth 2014).

Individual experiences with pests can significantly impact emotional responses, as the examples above have shown. Individuals who have had negative encounters with rats, such as property damage or health issues, tend to have their opinion influenced by their strong emotional reactions of fear or disgust. On the other hand, those with neutral or positive experiences, such as observing rats in non-threatening contexts or owning them as pets, may develop more positive emotions, including curiosity or even affection. Media representations can also influence emotional responses to rats by shaping public perceptions and attitudes such as portraying rats as a problem, as nuisances and dangerous (see these newspaper articles Lawrence 2018; Guarino 2017; Belmain 2015). Fear and disgust are common emotional responses to rats in Zurich, often rooted in concerns about public health, safety, and potential property damage resulting from their association with disease and unsanitary conditions. As shown in chapter 4, city rats have been associated with the transmission of diseases such as leptospirosis, hantavirus, and the bubonic plague, leading to widespread fear and the development of rat control measures (Parsons et al. 2017). Both fear and disgust induce a sense of emergency for pest control managers to react and quickly reinstall a status of safety and cleanliness. This then increases the likelihood of applying lethal measures to eliminate the threat as the existence of the rat itself becomes abject due to the sensitisation to the combination of the abject association and embodied experience.

This again shows how cultural beliefs and values can significantly shape emotional responses to pests. Taylor and Signal for examples compare the different treatments of animals considered "pets, pests or profits", highlighting how attitudes towards animals shape the subsequent treatment of them (Taylor and Signal 2009, 129). In most cultures,

rats are associated with negative attributes and elicit strong aversive emotions, but under certain circumstances, they may be revered or considered benign. For example, the Karni Mata Temple in India is home to thousands of rats, which are considered sacred and protected by the local community (Taylor and Signal 2009). As chapter 4 has shown, city rats in Switzerland are perceived as dangerous and disgusting, leading to efforts to control their populations and minimize their presence in urban environments while pet or lab rats are perceived mostly harmless.

The affective power of the abject rat as 'dirty and dangerous' is especially influential, as apparent in the example of the rat that jumped out of the bin. In contrast to indirectly observing the rat stealing the bun through a video, the abject rat encounter was an embodied encounter accompanied by feelings of fear and disgust. As this encounter happened in the evening, the rat was not clearly visible and its sudden appearance invoked fear. The proximity of the abject rat, as well as the association with the trash from the bin, led to additional feelings of disgust. The obscurity of the nocturnal vision increased the perception of an unknown danger that turned out to be a rat. For all we know, the smart agile rat from the video and abject rat from the bin could have been the same individual, but due to the circumstances of each encounter, the rat was perceived completely differently.

The different factors introduced in Figure 9 and the accompanied emotional responses play a significant role in shaping human attitudes and behaviours towards rats, with implications for pest control and public health. It is therefore critical to identify and understand the boundaries between 'rat spaces' and 'rat places' and the way they shape responses to rats in order to develop effective and ethical pest management strategies.

Ethical Killing of Rats

> *"It is a really bad thing for a lot of people to poison an animal, a vertebrate, a mammal." LK*

Comparing relevant literature with the exploration of the different factors that make rats killable, the previous section has identified that the main 'problem' that rats pose is that they are a threat to human health and a risk to infrastructure. The protection of humans and human economic interests is the driving factor for pest control managers' decision to

apply management methods. In Zurich, applying ethically questionable methods such as killing are justified as a necessity to prevent rats from threatening human health, infrastructure and food storage. This way of thinking adopts a utilitarian perspective and prioritises anthropocentric interests over the life of rats. However, making rats killable and actually killing them raise a number of ethical concerns regarding the political and economic interests that shape the use and acceptance of killing methods.

Ways of Killing Rats

As discussed in chapter 4, in Switzerland, there are regulations in place to protect the wellbeing of animals, including pests like rats, such as the Swiss Animal Welfare Act (Tierschutzgesetz) and its associated ordinances (Tierschutzverordnung). Under these regulations, unnecessarily inflicting pain, suffering, or harm upon animals is generally prohibited, which applies to the killing of rats as well. Exceptions are made when it comes to pest control and public health concerns, in which cases the use of humane methods to kill pests are allowed. It is important to note that what is perceived as 'humane' can vary significantly between cultures and societies, and even among individuals within a single society. The idea of 'humane killing' is a controversial topic, as one could argue that killing any animal, regardless of the method, is inherently inhumane. In the case of Switzerland, humane methods for killing rats refers to techniques that aim to eliminate the animals with the least amount of suffering possible.

Enumerating the many available methods for killing rats is beyond the scope of this thesis. Rather, I focus and elaborate on the main methods I have encountered during my field research and through interviews with pest control managers. These methods include: chemical killing with rodenticide; mechanical killing with snap traps, zap traps, and shoot traps; as well as killing with CO_2.[9] Except for rodenticides, all these killing methods are designed to kill rats quickly and with minimal suffering (Capizzi, Bertolino, and Mortelliti 2014).

[9] Killing rats with CO_2 involves the use of carbon dioxide gas to induce unconsciousness and subsequent death through asphyxiation.

Table 2: Table of killing methods according to interviewed pest control managers in Zurich

Name	Technique	advantages for pest management	disadvantages for pest management
Rodenticide (anti-coagulant)	Poison	- very effective - cost-efficient - less work - works for large population	- no control over where animal dies - risk of unintended damage *for rats: animals die slowly and painfully over 2–3 days*
Snap Traps	mechanical trap that breaks rat neck	- immediate effect - dead body easily collectable *for rats: quick death*	- other rats grow suspicious - rats avoid it after one kill - needs frequent checking
Zap Traps	Electrical traps that stuns and kills rat	- immediate effect - dead body easily collectable *for rats: quick death*	- other rats grow suspicious - very expensive - difficult to install - rats avoid it after one kill - needs frequent checking
Shoot trap	Automatic trap that shoots rat and then removes body into container	- quick death - immediate effect - needs frequent checking - dead body easily collectable *for rats: quick death*	- rats grow suspicious - very expensive - difficult to install - needs frequent checking
CO_2	Filling cellar or burrow with CO_2 gas	- entire population in one try - dead bodies underground *for rats: pain free death*	- difficult to apply in most settings
Live traps	Cage that imprisons rat alive	- no dead body to collect *for rats: rat is not harmed*	- only efficient for one single rat - other rats grow suspicious - rats avoid it after one kill - needs frequent checking

Mechanical traps are considered more ethical than rodenticide because the animal is killed immediately (snap traps, shoot traps) or stunned and killed (zap traps). In the case of live traps, the question of its ethics depends on whether the animals are killed by other methods afterwards or set free in an environment deemed a good 'rat space.' The drawback of all mechanical traps, however, is that they are only successful with very small groups of one to six rats. The traps are designed to only allow for the trapping of one rat at a time, which requires multiple traps for multiple rats (Baker et al. 2012). Additionally, rats are known to be neophobic and exhibit a strong aversion to new objects or changes in their environment, which contributes to their elusive nature (Himsworth et al. 2013). Additionally, they are very intelligent and have a good memory, leading them to learn and not repeat mistakes (Burt 2006). As a result, any object placed in their environment is first met with suspicion, and it might take a while for them to approach it. Should one rat finally dare to approach the trap and be killed, the other rats will avoid similar looking objects in the future. A pest

control manager told me about his experience with snap traps in a house in the centre of Zurich he once treated:

> *"So, let's say I do it with snap traps. Then, first you wait. Then, one goes in on Monday evening, and on Tuesday I go to check and take it away and set it out. The other rats have seen that, then. They've seen that there's one stuck. Then, they don't go in again. I can put up as many as I want, but they won't fall for it. That's also a bit of a problem with rat traps. Once the other rats have seen a dead rat in the trap, they won't go in again." AA*

In extreme cases, rats are also known to move if they have lost too many family members (Heiberg, Sluydts, and Leirs 2012). While this might be good news for the house owner, the likelihood of the rats leaving one house and moving into another is quite high and therefore the 'rat problem' is not solved (Byers, Lee, et al. 2019).

If rats are in a closed room like a cellar or limited burrow system, the preferred killing method of pest control managers is CO_2. The gas leads to unconsciousness followed by death through asphyxiation. This method is considered a more humane alternative to other lethal control methods, as it leads to a relatively rapid loss of consciousness with minimal distress for the animals (Makowska and Weary 2013). However, the requirements for this method to work are rarely met. The room must be completely closed off in order for the method to be successful. In the case of burrows, other exits, especially subterranean one's connected to the canalisation, have to be closed off too. This method is also complicated because a high amount of CO_2 is needed, which can be quite expensive. However, the president of the Club for Rat Friends (CH) explains:

> *"If it is a closed room, one that you can close off completely, then CO_2 is the best death. I mean, okay, I never died from CO_2 obviously, otherwise I couldn't talk to you but, it is definitely not as bad as the poison [anti-coagulants], bleeding out internally over three days, that is brutal. But with CO_2? It is like falling asleep, like freezing to death. You get tired and then, well, you won't notice when you die. I mean it ends with death anyway, so if you have got to get rid of the rat, make it in a gentle way." JB*

As a dedicated activist for the wellbeing of rats, the interviewee cares deeply about not inflicting any harm to rats when killing cannot be prevented. Those who are actively

involved in killing rats often express a desire to kill rats or other animals without their suffering, as did the pest control managers in Zurich (Crowley, Hinchliffe, and McDonald 2018; Thornber, Rubira, and Styles 2014). The challenge here is to find a balance between costs, human protection, and animal well-being. In many cases, the latter seems to provide the least incentive for improvement when considering development and application of pest control methods (Baker et al. 2012; 2012). The treatment of problem rats is desired to be quick, effective, and cheap (Littin et al. 2004). It is probably for this reason that the most common way to kill rats is with biocide products containing toxic substances, as these are cheap and efficient compared to other methods. This makes biocides the best choice in regards to human interest. When considering animal welfare however, they are the most ethically contested, both in regards to animal welfare as well as concern for the environment (Rylnikov, Robinson, and Bajoni 2008; Hunold and Mazuchowski 2020).

Biocides used to kill rodents, such as rats and mice, are called rodenticides. The toxicity of rodenticides is based on several different active ingredients, most commonly anticoagulants. Anticoagulants are blood clotting inhibitors, which are very toxic to humans and animals. Furthermore, they are poorly degradable substances, which leads to their accumulation in living organisms and the environment (Rylnikov, Robinson, and Bajoni 2008). In Switzerland, the use of anticoagulants is strictly controlled by import and distribution departments due to the high risk of contamination for non-targeted species, especially those that prey on rats and mice. The most common secondary poisoned animals include hawks, owls, and foxes, as well as daring cats and dogs. Rather than expressing concern for this unethical method of killing rats, opponents of rodenticides argue that anticoagulants threaten valuable wildlife such as owls, foxes and other bird species (Hunold and Mazuchowski 2020). There is also a high risk of children and non-target species being harmed by accidentally ingesting rodenticide baits.

Certain rodenticides, particularly those with high concentration of the active anti-coagulant substance, may only be used by individuals who have undergone appropriate training and obtained a relevant certification or license, such as professional pest control operators or farmers who have received specific training in the safe use of rodenticides. Part of this training includes using tamper-resistant bait stations to minimize the risk of non-target animals or children encountering' the poison, as well as monitoring bait consumption and removing any uneaten bait after the treatment is complete. Users must also ensure the

proper disposal of rodenticides and any contaminated materials in accordance with local waste regulations (Bundesamt für Umwelt 2023). Publicly available rodenticides hold a much lower concentration of the anticoagulant than the products available to professional pest control managers. To use products with higher concentration, a license has to be obtained, usually by completing training as a pest control manager. However, there are options for farmers to receive a license for a limited use of a specific substance. Additional to those methods, which are only used by professionals who have the necessary license and training to ensure that the use is both humane and effective, there are other methods which are strictly forbidden. Glue traps for example are considered inhumane and are therefore illegal in Switzerland. Glue traps, as the same suggests, are designed for rats to be caught in the glue. Unless checked regularly, the animal then dies of due to dehydration or self-inflicted injury in a desperate attempt to break free. This prolonged suffering is why it is generally viewed as an unacceptable form of pest control. Glue traps are still common, especially in the United States (see Mason and Littin 2003).

Killing rats with rodenticide is often the preferred choice to other methods, as a pest control manager explains:

> *"Customers sometimes prefer the poison because they don't have to see the rats as they do with the live trap or the snap trap. Baiting is also cheaper because it requires less work; you don't have to check the traps all the time. And the traps are also dangerous, so if you put your hand in there as a human being, your fingers are at least broken; with children it can also be worse." AA*

Distributing poisonous bait is economically more attractive than other methods as it yields results without much intervention. Additionally, distance from death plays a role when it comes to killing. Rats killed with mechanical traps are killed directly, while rats who ingest rodenticide die slowly over the course of two to three days. This removes the inhibitor of 'killing an animal' because no one is there to see them die or suffer whereas with mechanical traps, the death must be witnessed through the dead body (Mazhary 2021). This is also reflected by another pest control manager who admits that she would not be able to kill a rat, if she had to do it directly.

> *"Yes, I think it has a lot to do with this indirect way of killing the animal. I mean, you are not there when the animal eats the bait and also not when it dies. For me personally using poison bait is not necessarily more comfortable than snap traps. I*

would prefer snap traps. It is, I think, the kindest. I mean of course killing them directly yourself, that would also be but uhm … it would be more difficult. I heard from other pest control workers that they once stepped on a rat or hit it with a shovel, killing it, and the problem is solved. It is definitely quicker but it takes quite some inhibition to overcome." LK

According to the interviewee, not having to witness the animal's death facilitates the application of biocide. However, a quick death with a snap trap is considered kinder than a slow death with poisonous bait. She also considers killing a rat directly, as it would be both a quick death for the rat as well as a quick solution of the problem. This is closely related to the concept of the 'abject' where the removal of the rat is a representation of the process of cleansing the house and creating order and safety again (Kristeva 1982). However, she points out that there are "quite some inhibitions" to overcome to kill a rat directly. By not being directly involved in the death of the rat, humans avoid a direct engagement with the act of killing, which allows them to remain at a comfortable distance from the abject as well (Seegert 2014). So not only do rats become killable, they are also subject to be killed in a way, that creates the least harm, discomfort and economic loss to humans.

To conclude then, anti-coagulants are not the preferred method to kill rats but they are the most used. Pest control managers end up choosing anticoagulants as they are effective and easily applied, even though they are the least acceptable according to ethical principles. However, as human safety and economic factors weigh in on the choice of methods, anti-coagulants are in many situations the only option to guarantee both protection and successful extermination.

Negotiations of killing rats

One of the primary ethical concerns in pest control management is the moral consideration of rats as sentient beings capable of experiencing pain and suffering (Asdal, Druglitrø, and Hinchliffe 2016). Sentient beings have inherent value and deserve moral consideration, a category that should include rats as well (Kirk 2016). As some of the reflections of other interviewees have already shown, pest control managers in Zurich have no desire to inflict unnecessary pain on rats. A pest control manager who used to have rats as pets explained:

> *"Yes, it's basically, for most of the colleagues, it's always a little bit emotional. Basically, even with a wild rat, a sewer rat, whether you have pet rats or not, when you look at it, it's a beautiful animal. I still think it's a beautiful rodent. And when you know you're spreading poison somewhere, not just on a pile of course, but in a bait or you're setting up a snap trap or something. And then I know, I'm killing this animal now. It's always a bit emotional." AA*

Despite the fact that the interviewee does not necessarily have to see the dead rat, he is aware that he is killing them, and it makes him "a little bit emotional". He can see the rat as an animal, a "beautiful rodent", and not just as a problem or a pest. For him, the differentiation between the lab rat, the pet rat, and the sewer rat does not matter when it comes to killing. However, his job requires him to use lethal methods to manage rats because the protection of human health (and often human interests more broadly) comes before the life of the rat.

The ethics of killing rats, particularly from the perspective of pest control managers, is a topic that intertwines moral dilemmas, ecological considerations, and the socio-economic implications of wildlife management. Crowley et al. (2018) examine the motivations and methods employed in the lethal management of grey squirrels in the UK, which serves as a relevant case study for understanding the ethics of killing rats (Crowley, Hinchliffe, and McDonald 2018). Their paper identifies different 'modes of killing': reparative/sacrificial, stewardship, and categorical. In the reparative/sacrificial mode, killing is seen as a moral duty to correct anthropogenic ecological disruptions, often accompanied by feelings of discomfort and regret (Crowley, Hinchliffe, and McDonald 2018). This perspective is also relevant to rat control in urban settings, where pest managers might view their actions as necessary for maintaining ecological balance or public health, despite potential personal discomfort.

My data reveals, that most pest control managers indeed apply a utilitarian perspective to pest control management that focuses on the overall welfare of both humans and animals (Višak and Garner 2016). From this viewpoint, killing rats is considered ethically justifiable if it significantly reduces the spread of diseases and benefits human welfare. This utilitarian approach, which values the benefits of environmental components against the costs of intervention, can be applied to rat control in agricultural or urban settings where economic and health interests are paramount. However, critics argue that this approach may neglect

the suffering experienced by the animals targeted and promote the indiscriminate killing of rats (Faria and Paez 2015). This becomes apparent in the case of another pest control manager, who pointed out what it means to be affected by rats in one's own house:

> *"Yes, I think it is also always a question of uhm … like who is affected. If someone has 43 rats in the cellar, that person is probably much more likely ready to uhm do whatever it takes to get rid of them, whether that means poisoning or killing, so yeah." LK*

The interviewee describes the moral dilemma of weighing an animal's life against your own safety and comfort. While it is easy to claim not wanting to harm animals, it becomes much more complicated when the animals are living in one's walls and posing a health threat to oneself and one's family. Emotional responses of fear and disgust might also play a role in wanting to "get rid" of the rats by any means, regardless of ethical considerations.

However, the precautionary principle suggests that non-lethal alternatives should be explored before resorting to lethal methods in pest control management (Faria and Paez 2015). This principle encourages the consideration of humane and non-lethal alternatives, such as reproductive control and habitat modification, as more ethically acceptable methods for managing rat populations (Littin et al. 2004). In practice, however, the resources to explore alternative ways of killing are limited by the need to solve a rat infestation quickly, to protect humans, and with certainty, to not harm one's own business success. However, Zurich's pest control managers agree that they only kill rats if it is necessary and that they prefer to avoid it if alternative options exist, which they often do not. This is often due to the low tolerance threshold for rats, as an interviewee in a previous quote already admitted, since one rat alone is enough to urinate and contaminate a food source for example and then pass leptospirosis to a human. For this reason, killing is often inevitable as soon as rats get too close to humans, as a member of UPAS clarifies:

> *"There are places in Zurich, or basically anywhere in Zurich along the waters, you could catch a rat. But we only start to fight rats when we are under the impression that uhm, the risk that a human is in danger, the health risk, is heightened. Only then we start acting on decimating the rat population or to see that it does not grow further." LK*

Killing rats then, is seen as a means of controlling their populations and protecting human interests, such as preventing the spread of disease or protecting property. It is a reaction

to a threat and not aimed at trying to exterminate all rats, at least not for pest control managers in Zurich.

There is a growing acceptance of urban animals, even unwanted pests, as part of the urban environment, which is noticeable in the way UPAS manages the rat populations city-wide. Understanding that rats become killable through an interplay of socio-cultural and context-dependent factors reveals, that there is room for co-existence and that killing is a negotiation between human safety and rat lives. This leaves room for alternative approaches. This chapter has shown, by exploring the perception of rats as pest, as abject, as 'problems', that humans have a very low tolerance for rat presence which leads very quickly to the adoption of lethal methods. The only way to prevent rat death and suffering is to keep them away from humans. Instead of trying to move the threshold then, it is important to note that killing is not necessarily the only option for managing rat populations or addressing the challenges posed by these animals. These new approaches to animal management and conservation can help promote coexistence and mitigate the negative impacts associated with rats in urban settings. Whether or not to kill a killable rat then becomes inevitably relevant when thinking about multispecies justice and the role of humans in human-rat conflicts, as is the subject of chapter 6.

‘Becoming with’ rats

> *“Well, I mean, we are not gonna get rid of rats in the city. We are the reason they love it here, and they will always and forever be a part of us. That’s a fact we just have to live with.” PA*

This final empirical chapter explores how material components and human behaviour in Zurich shape rat populations and behaviours, and also how rats, in turn, shape human behaviour and the material world. Using the concept of ‘becoming with’ (Haraway 2008), the chapter brings together rat ecology, field observations and interviews to shed light on the hidden realities of rat lives in the multispecies city of Zurich and asks and asks, how do we make space for rats? ‘Becoming-with’ focuses on the interconnectivity of humans and other-than-humans and sees each being and object as a contributor to making each other. However, as has been discussed in regards to the concept of ‘animal spaces, beastly places’, there is an important material aspect in regards to the setting in which and through which rats and humans become with each other. Materialities play a significant role in shaping human and rat behaviours and interactions with each other and with other species. Instead of focusing on how rats are perceived and placed (chapter 4) or how human-rat conflict develops with lethal consequences for rats (chapter 5), this chapter centres around how rats and humans are becoming together through some specific materialities in Zurich. Furthermore, acknowledging the mutual co-becoming between rats and humans shifts the focus away from anthropocentrism to a more relational perspective, which further allows to explore rats in Zurich through the ‘multispecies city’ concept (Dooren and Rose 2012). Therefore, rather than asking how rats affect humans, this chapter explores how humans affect rats through the intentional and unintentional planning of the city and their behaviour (see also Salomon Cavin 2022). Rather than a straightforward analysis of what benefits and disadvantages the flourishing of city rat populations, it shows that the interaction between rats, humans, and their environments is subject to the nuanced interplay between different factors, leading to sometimes unexpected outcomes.

First, this chapter highlights the role of the materialities of the city of Zurich within the process of ‘becoming with’ (Haraway 2008). From the design of green spaces and buildings to the flow of water and waste, the material world is both the locus where human-rat interactions are set in, as well as a medium through which rats shape and are shaped by

their environment. Analysing the three main needs of the rat population to thrive – water, shelter, and food –I highlight the impacts of green spaces, the built environment and the sewage system in Zurich on rats. Second, the chapter sheds light on the role of everyday human behaviour in regard to rats through the analysis of practices of littering and waste management. Anthropogenic food waste is a key factor in unintentionally promoting the distribution and growth of city rat populations. However, these practices are not just limited to the relation between rats and humans but also draw in other species and materials connected with them. Third, the chapter analyses the 'becoming with' rats in Zurich through the lens of 'multispecies justice' and heads Haraway's call for more 'response-ability' for other species as well as for humans themselves. As such, this section reveals the challenges of a multispecies-co-existence in the city. Going beyond the mere intellectual exercise of acknowledging rat agency, my data reveals a need to address the pressing practical issues of living with 'problem animals' like rats. By analysing, understanding, and reapplying the knowledge acquired in the previous chapters, I highlight the possibilities of 'becoming with rats' in Zurich through more informed actions from both citizens as well as pest control managers alike.

Materialities of Ratropolis

Rats are highly adaptable creatures capable of thriving in a wide range of environments, as their only requirements to do so are access to water, shelter, and food (see Figure 1). As a synurbic species, rats find everything they need in urban environments, where all these resources are readily available. As outlined in the introduction, the basic needs of rats in urban environments are met by exploiting the resources and spaces provided by human activities and infrastructure. As the rats in Zurich adapt to the ever-growing urban landscape, understanding how their behaviour and ecology are influenced by the materialities of the built environments and the ways humans design and maintain these materialities, offers a lot of insights into the different modes of co-existence between humans and rats. The findings of my field research show that not every location that has access to water, shelter, and food inevitably turns into a 'rat place'. Instead, 'rat places' in Zurich emerge within a situated interaction of humans, rats, and materialities, revealing an intricate process of 'becoming with' in the urban environment.

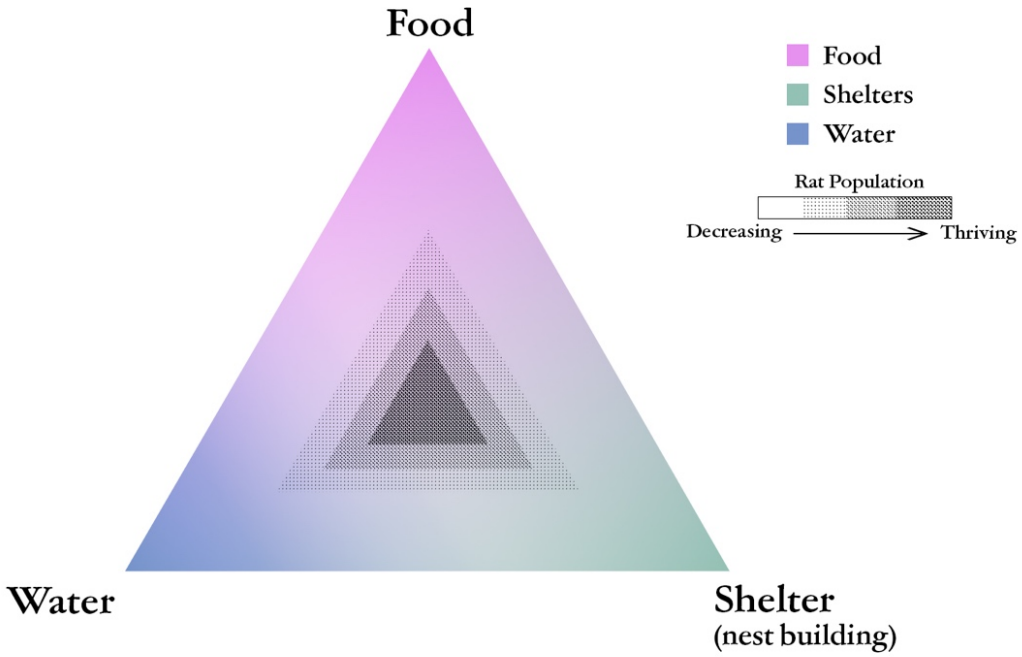


Figure 11: The triangle shows the three basic needs of rats: food, water and shelter. At the centre of the triangle where all three resources overlap, rat populations thrive. Moving away from the centre, there is an increasing lack of at least one of

As a reminder, the concept of 'becoming with', as posited by Haraway, refers to the interconnected, reciprocal relationships among different species and entities (Haraway 2008). It emphasises co-evolution, co-existence, and mutual shaping of humans and other-than-humans lives and futures. It is a call to acknowledge and respect the agency of all lifeforms in the shared world, moving beyond anthropocentric perspectives. It is not a one-sided process where humans dictate the terms, but rather a mutual, dynamic process involving all parties in shaping each other's existence. This process is not limited to humans and other-than-human species but also includes various materialities with which they are connected. Materialities play a significant role in shaping human and rat behaviours and interactions with each other and with other species. Following the definition of Jane Bennet's "Vibrant Matters", materialities are not divided into passive matter and active humans/animals, but instead, all matter, even the seemingly inanimate, has a form of agency and vibrancy (Bennett 2009). These various materialities not only provide a backdrop for the lives of rats but are also intertwined with them, affecting and being affected by rat behaviours.

The study of materialities in animal geographies represents a relatively recent turn. As urban environments are increasingly recognised as shared, multispecies spaces, attention has turned to the material relations between humans and other-than-human animals within these spaces. Rats and other urban animals interact with the materiality of cities in many ways by appropriating spaces, shaping and being shaped by urban infrastructure (see Yeo and Neo 2010 for the case of monkeys in Singapore). As I have shown in chapter 4, there are materials like rat cages and lab walls which limit the freedom of movement of lab rats or pet rats, containing them. Furthermore, humans control the materialities of food and water given to them, influencing their growth and health.

For simplicity, I differentiate between more static and more dynamic materialities. This simplification between fixed and dynamic materialities is not an attempt to enforce a rigid dualism, but rather a means of engaging with the complex material realities of the urban ecosystem in a way, which still allows to put the 'becoming with' between rats and humans to the forefront. This does not aim to deny or play down the 'agency of matter' but to prioritise the concepts and focus which are central to this chapter. Static materialities are more enduring, long-lived components of the urban environment, such as buildings, streets, sewage systems, and fountains. These elements constitute a significant part of the rat's physical habitat and create the urban landscape within which rats navigate and dwell. Dynamic materialities refer to the elements that are constantly moving and transit within the urban environment, such as waste, food, and water. These elements, often resulting from human activities, are also more likely to transform quicker, such as food being eaten, and thus significantly influence rat behaviour, population dynamics, and geographical distribution. It is important to note that there are no fixed categorisations by any means, as the case of green spaces shows, for example. The creation of green spaces like parks requires static materials in the sense of their geographical location and basic structure. However, they also incorporate moving components in the form of plant growth, animal populations, and the cyclical changes brought on by seasons, human use, and maintenance activities.

Rat ecology and water

Water is identified as a key materiality affecting rat populations, playing a role in determining the geographical distribution, abundance, and behaviour of rats in urban settings. As discussed in the introduction chapter, the city of Zurich is widely recognised

for its water resources, including Lake Zurich, the Limmat and Sihl rivers, and its numerous public fountains. The availability and accessibility of water play an important role in the distribution, abundance, behaviour, and well-being of rat populations (Gardner-Santana et al. 2009). Rats are physiologically dependent on water for survival, consuming up to 10% of their body weight in water daily, with lactating females requiring even higher amounts (Guo et al. 2023). As rats are good swimmers, natural water sources such as lakes, rivers, and collected rainwater bodies are preferred habitats and are plentifully available in Zurich. In urban environments, rats often rely on anthropogenic water sources as well, such as fountains, sewage systems, and other water transmission systems (Byers et al. 2019).

Both the flow of water, as well as the containment of water in fountains, are subject to the pathways built or strengthened by humans to control it. Measures to control water include fortifying river banks and implementing safety measures to prevent overflow. Similarly, the city has a well-developed and maintained system of water drainage to direct rainwater into the subterranean storm sewers. The wide access and availability to public water sources such as lakes, rivers and fountains is primarily addressed to human needs, both aesthetically and culturally, many urban animals make use of them as well, which underscores how rats, humans and other species are interconnected through the presence of water.

Fountains are an interesting example of human-designed public water sources. The water is drinkable, easily accessible and frequently used by birds for bathing purposes and hydration as well. Fountains can also be used as water sources by rats, depending on their design and their location. Especially those fountains with low-level access or smaller basins designed for dogs to drink from, are ideal for rats as well. Especially fountains located in parks and close to green spaces where rats can find burrowing grounds might become a primary water source, as the rat case in Hallwylerstrasse has shown (see also chapter 5). The fountain in question had a low basin and was located on a square surrounded by greenery, which offered safe passage for the rats to access the fountain (see Figure 2). The fountain's design also makes it a popular public pool for children to play in. Restricting access to the fountain for rats would also mean restricting access for children, which would take away an important cultural meeting point for parents and daycare centres during summer. While sharing the fountain with birds, squirrels, and smaller lizards does not pose a threat to the children's health, sharing it with rats certainly does due to the risks of disease

transmission. When the rat case at Hallwylerstrasse occurred, UPAS had to take immediate measures to ensure, that the water was not contaminated and that residents would be informed.

Figure 12: The fountain at the square at Hallwylerstrasse had easy access and was well located for rats to access. During the day in summer, it is a popular spot for day care and parents to take their kids to play in the water. (source: author)

The case at Hallwylerstrasse then revealed an interesting relation between designing and organising public spaces for aesthetic and cultural purposes serving human interest, such as the design of the fountain and the implementation of green spaces around it. During summer months, the availability of food sources through anthropogenic trash appeared to be enough to sustain the small rat population which had settled there. As discussed in chapter 5, the origin of the rat population was not entirely solved, but UPAS member Simon suspected that the rats had ventured there from the river banks of the Sihl, roughly 180m away. Studies have shown that rats usually roam on a radius of 100m away from their nests in search of food, however, they can wander further when in search of new nesting grounds (Byers et al. 2019). The interplay between static and dynamic materialities is visible in the interaction between rats and water sources in the urban environment. Rats adapt to the built environments of the city, which include static materialities like the structure of fountains or sewer systems. At the same time, the dynamic aspect of water, in the form of its flow and accessibility, shapes rat behaviour. In this particular case, the combination of green spaces, which responded well to rat's need for shelter, the closeness to both fountain and river, and the particular availability of trash as a food source during

summer, have apparently created a good enough place for this rat population to settle. As the case of the Hallwylerstrasse fountain illustrates, spaces designed for human use and aesthetics can become 'rat places' due to the presence of water, food, and shelter.

In Zurich, areas with dense vegetation along the rivers are often inhabited by rat populations (see Figure 13). This is also reflected in the majority of rat sightings in Zurich, which occur close to natural water sources like the rivers and the lakeshore, as these spaces also offer biological food sources like insects and specific plants, and burrowing grounds in the soil at the river banks. However, both the lake and river banks in question are usually characterised by steep slope with overgrown vegetation, both of which are not popular among humans as it restricts access to the water for swimming purposes. As a result, the rats settling in these areas do not interfere with or come into close contact with humans, allowing them to remain invisible and unlikely to pose a threat to the residents. Additionally, these green spaces also offer refuge to birds, insects and other species.

Figure 13: An example of an overgrown slope at the lake shore which provides rats with easy access to water and burrowing grounds for rat populations. The dense vegetation and steep slope discourage humans from accessing the lake through this area, offering safe shelter for the rats and many other species. (source: author)

Unless there are options for shelter and food around, water sources alone are not enough to attract rat populations to settle (Byers et al. 2019). While water is a necessity for rat populations, not every water source is exploited by rats, especially not in the case of cities

like Zurich, where water is easily accessible. For this reason, it is difficult to limit rats' access to water sources in Zurich, as there are simply too many sources. According to UPAS, it is also not necessary, as long as rats do not contaminate humans' sources of drinking water. Rats' relationship with water has ecological and health implications for urban areas, as we have seen in the case of transmittable diseases (Himsworth et al. 2013). Rats are known carriers of various pathogens, which can contaminate water sources through their urine (Koizumi et al. 2009). Increased water availability can then facilitate the transmission of these pathogens, posing a risk to human health.

This is one of the main concerns of UPAS. As chapter 5 discussed, rats become killable very quickly when they pose a health threat due to contamination of shared food or water sources. Once Leptospirosis is in a water source, anyone drinking from it can be infected, including rats and other species. As an interviewee from the pest control services explained:

> *"Any pet can get it too by drinking from these dirty little water puddles. A dog or a cat, I mean, isn't that why we don't let dogs drink from stagnant smelly water? You just gotta be careful." RM*

While water sources attract rat populations, they also pose health risks due to potential contamination with pathogens carried by rats. In this sense, water plays a dual role, serving as a source of life and potential danger.

Rat ecology and built environment

> *"And then you have older houses with more fragile sewage systems, and then the rats just get into the buildings." AA, pest control manager*

Urban landscapes, in both their design and their maintenance, greatly influence the prevalence of rats in the urban environment as rats use the existing infrastructure of buildings and streets to find shelter and navigate around the city. Buildings, especially older ones, often provide plenty of hiding places and access to food, especially if they are residences or contain food-related businesses. Rat populations in Zurich often occur in areas with old and impaired infrastructure and sanitation (see Figure 14), where they use the permeability or porosity of these weakened physical structures to gain access to houses,

which provide them with warmth, especially in winter. However, while rats might make their way into houses in search of food, the lack of water is often the reason they do not stay. Inside buildings, water is more difficult to access as it is contained in pipes connected to the sewage system.

The sewage system serves its initial purpose for humans as a means of cleansing the city from abject materialities like waste and keeping it out of sight (see Kaika 2005). While being designed and maintained with the goal of providing a sanitary environment for people, sewage systems accidentally offer an ideal habitat for rats due to the availability of water, food from waste and nesting opportunities in unused dry pipes. Sewer systems can be classified into two main types: closed systems and open or partially open systems. Closed sewers are often entirely underground and sealed off from the surface, meaning that the entire subterranean structure is well contained within pipes and sewer shafts of different sizes, and access is sealed through physical barriers such as metal manholes. Open or partially open systems, as the name suggests, consist of canals, ditches, or culverts that are exposed to the environment (De Feo et al. 2014).

The closed sewage system in Zurich was built in the 1870s and is based on the Parisian model and is known to be home to rats as well, like most sewage systems are. Sewer rats adapted to this human-made environment, modifying their behaviour to exploit the resources it offers. Little is known about the number, distribution or habits of sewer rats in general (see Heiberg, Sluydts, and Leirs 2012; Parsons et al. 2017; Guo et al. 2023) and even less so in Zurich. Research suggests, however, that rat-borne pathogens are higher in rats that live in or have access to sewers; these rats are, therefore, more likely to transmit diseases to humans and other animals (Krøjgaard et al. 2009; Guo et al. 2023). Keeping wastewater strictly separate in sewage systems has been shown to reduce the spreading of diseases, as humans and other-than-human species are less likely to come into contact with them (see Krøjgaard et al. 2009 for the case of Leptospirosis). In cities with less developed sewage systems, which are open or partially open sewer systems, rats often nest in the sewers and venture in and out as they please in the search for additional food sources (see Guo et al. 2023). Due to this, open sewer systems can increase the risk of pathogen transmission, as rats can easily contaminate surface waters with their urine and faeces, posing threats to human and animal health (as shown by Santos et al. 2017 in regards to urban slum infrastructures).

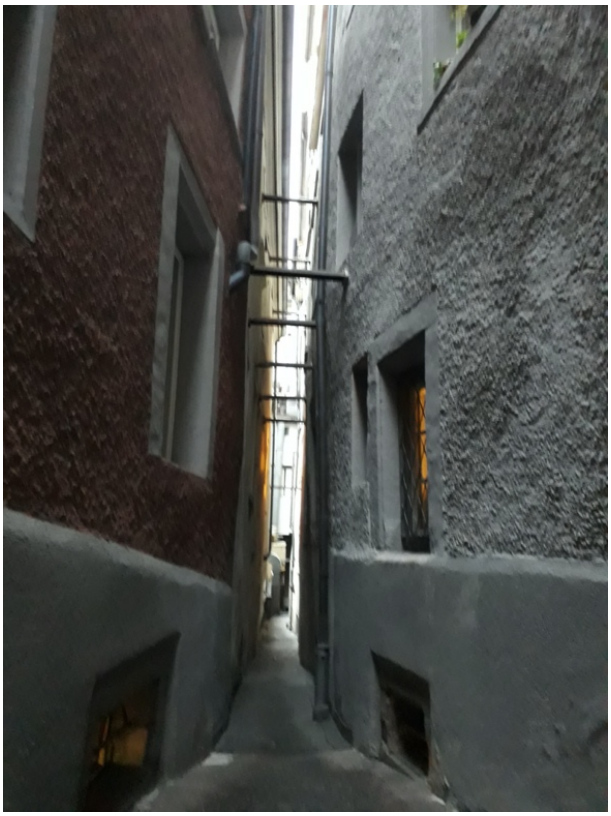


Figure 14: A narrow alley in the Old Town of Zurich. The buildings are several hundreds of years old and require to be stabilised by horizontal bars. Renovation is difficult and often very costly due to challenges of lack of space, uneven terrain and weak foundations of the underground. (source: author)

Closed sewer systems, like the one in Zurich, are designed to contain abject and potentially dangerous matter from mixing with humans to protect them, especially in relation to diseases. The management of sewers thus plays an important role in keeping city rats from becoming 'problem animals' and transmitting diseases. However, closed sewer systems are difficult to implement, as they require intensive renovation of older open sewer systems as well as the construction of subterranean infrastructure (Gulyani, Bassett, and Talukdar 2014). As sewage systems are in constant use, they require a lot of maintenance work to function properly, especially when they are older, as is the case in many parts of Zurich Centre (see Figure 15). As rats are known for their burrowing behaviour, strong teeth and habitual gnawing to maintain their teeth, their activities of nest building and homing often lead to significant infrastructural damage in urban areas (Firth et al. 2014). For this reason, the materials used for constructing buildings, laying pipes, or even enclosing waste can influence the presence of rats. For example, the use of certain plastics in pipework might facilitate rat incursions, while others might deter them (see Barzman et al. 2015).

Figure 15: The old town of Zurich has buildings that are several hundred years old. The sewage system is also old and suffers from pipe breaks and leakages. As buildings are renovated, the sewage pipes are upgraded too. (source: author)

If there are cracks in pipes, rats can expand them into holes and dig their way out to the surface. Leaky or burst sewage pipes are often indicators of rat activity. For this reason, whenever there are rat cases in the city far away from natural water sources like lakes or rivers, UPAS and pest control managers first suspect leaks in the sewage system. A UPAS member explains:

> *"For example, at the main bus station over there, we used to have a lot of problems. I went there 4–5 times a year and had to drop 6 kg of poison grains. And then, after four years, we finally found the reason. There was a leak in the sewage system in the building next to it. We closed it, and since then, nothing." Simon*

The main bus station in question was located right next to the Hauptbahnhof, the main train station of Zurich, and close to the Sihl River. Despite regular management with poison, the rats kept coming back, and it was unclear where they came from. The main

attractive feature of this spot for rats, was the amount of trash, which was kept in easily accessible and often overflowing bins, which served clearly as a food source. Otherwise, however, the area was loud and busy, offered only a small strip of greenery next to the street, and there were barely any burrow entrances found in comparison to the number of rats. For UPAS, it was also a mystery how rats kept on finding this specific location since the area was not well connected to green areas where other rats were living. As such, it seemed unlikely that the area would prove so popular to be found and inhabited by new rat populations so frequently. All these indicators pointed to a connection to the sewers. Indeed, once the connection to the sewers was discovered and sealed, the rats did not come back, despite having a water source and some food sources. Without the protected shelter of the sewer, the main bus station no longer provided them with all their basic needs and was, therefore, not a suitable place to settle.

Apart from green spaces, most surfaces in urban environments, as well as the foundation of most recent buildings, are covered with concrete, so even if there is a leak in the sewage system, rats have no way to break through. However, especially in the Old Town of Zurich, many buildings still have natural floors in the cellar through which rats can dig their way into the house. A UPAS member explains:

> *"Another issue are natural floors in cellars, where rats can just dig their way up from the canalisation, if it is defective. But there, rats are actually useful, because they show us where wastewater is trickling into the ground." GB*

The sewage system's 'leakiness' or weaknesses then allow rats to venture into other parts of the city, leading to interactions and co-existence that might be undesirable from the human perspective. These pathways created by the rats represent their active role in shaping the urban environment and offer indicators for broken sewage pipes. The human response to these rat incursions is often to seal the leaks and reinforce the barriers, an act of maintenance aimed at keeping the two spheres separate. However, the persistence of the rats and the inevitable imperfections in the infrastructure means that there is always potential for new 'rat places' to emerge. This creates a dynamic situation in which the two species, although primarily inhabiting separate spheres, continually shape and become with each other. For instance, the design of the built environment does not solely influence rat habitats but is at the same time informed by rat behaviour. In the process of 'rat-proofing' buildings, alterations in materials and construction methods have taken place.

Everyday rat-aptation

Building on the previous discussion, this section focuses on the dynamic materialities of potential food sources which flow through the urban built environment and the role of everyday human practices which influence them. The dynamic materialities of the city - distributed and altered by human behaviour - are fundamental elements in the 'becoming with' rats in Zurich. One of the main dynamic materialities influenced by human behaviour is the distribution and abundance of food waste and trash. Humans generate vast amounts of waste as a by-product of consumption-oriented lifestyles, which result in overfilled public bins, improper waste disposal, and littering. These practices not only create aesthetic and sanitary issues for humans but also result in unintended consequences for urban ecology. By establishing an abundant and accessible food supply, they draw in various other species and materials, further amplifying the concept of 'becoming with' in a multispecies city. In exploring these intricate dynamics, this section illuminates the challenges of multispecies co-existence within our cities, the trade-offs and negotiations that occur daily, and how they shape and are shaped by the shared urban environment. By focusing on these 'everyday' practices and their wide-reaching implications,

Man's trash is rat's treasure

> *"The messier and dirtier it gets, the more cultural consequences there are. I mean, so much food is thrown away, and I don't know what else, and that's a laid table, a buffet, for the rats! And yes, then it's just practical to have so much food in front of your nose, a nice place to build a nest and then it just multiplies." LK*

The abundance of anthropogenic food sources in urban environments affects the behaviour and population dynamics of urban animals, including rats, scavengers, and other species. Many synanthropic species depend heavily on human leftovers to survive, making them indirectly dependable on humanity's wasteful lifestyle and trashy behaviour (Holmberg 2016). The unintended provision of food in the form of food waste and poorly managed garbage in urban areas contributes greatly to the flourishing of rat populations in cities (see Nagy and Johnson II 2013; Doherty 2019). In the case of Zurich, since water

and shelter are abundant, food becomes the main limiting or supporting factor. Food can come from various sources, the most notable being waste, littering, and bird feeding.

Zurich is known for its commitment to sustainability and green living and boasts an abundance of public spaces filled with diverse greener (Meyer 2022). Zurich's numerous parks and public gardens are interspersed throughout the city and are home to a variety of trees, flowering shrubs, flower beds, and seasonal annuals. Parks and green spaces are frequented during the summer months, especially along the lake shore, where people like to picnic, drink, and barbecue together. Despite the many opportunities to dispose of trash in public bins, littering is quite common in the summer, especially when the public trash cans are overfilled, and visitors do not want to take home their waste. With the lake as a natural water source and the park as an ideal ground for burrowing, the rats take advantage of the free food and reproduce. The president of the Club der Rattenfreund (CH) explains how the availability or scarcity of food at the lake influence rats' reproduction:

> *"In summer, along the lake, there you can always find a lot of rats. Because there, well as I said, if you leave food lying around, throw away bread and fries and whatnot, the more there will come. It is an attraction. And if we could just stop that, then there would be fewer rats, they couldn't live. If the table is set, a mother can raise her litter of 12–20 pubs easily. […]. If the food is scarce, a mother can recognise that, she sees that she has no chance to raise all of them and then she will decimate her own litter down to the number that she knows "I can raise those". Sometimes, it goes down to zero. Then she doesn't have babies anymore, but instead a full belly." JB*

Rats are very adaptive animals and respond quickly to their environment. If there is an abundance of food, then rats will reproduce quickly and plentifully. Once the litter has arrived, the availability of food will determine whether all the pups can be raised or not. If there is not enough food around once the pups are born, then the mother rat will decimate her own litter down to the number of pups she can support. With a short gestation period of only 21 to 23 days and a period of only five to six weeks to reach maturity, the number of rats can multiply easily over the course of just two months as long as there is enough food. It is, therefore, essential to recognise how human behaviour and attitudes towards trash disposal benefit rat populations. A member of UPAS summarises how the 'problem rats' at the lake could be addressed quite easily by making visitors aware of the consequences of their actions:

"First of all, people have to be sensitised that they should not throw all their trash away like that. Like when they go for a walk at the lake and eat a sandwich, and then just throw the rest into the bushes. And bird feeding should be forbidden." GB

In addition to littering, people who feed other animals, especially birds, also provide food for the rats. Lake Zurich attracts many visitors, among whom are many families and tourists who like to feed the ducks, swans, and seagulls, especially during the summer months. The city's residential bird lovers, on the other hand, are dedicated to feeding all kinds of bird species, including pigeons and sparrows, all year around and are very active in winter to save the birds from presumed starvation. While some see bird feeding as a way to connect with nature (see Cox and Gaston 2016), others see it as problematic, as both the type and amount of food are often not suitable for the bird populations (see Wilcoxen et al. 2015). Simon from UPAS told me about a lady who saw herself as an avid lover of birds, especially pigeons, and who would go around the city and hand out 20 to 25 kg of bread per day.

"Per day! And with 25 kg, you really feed the entire city. Not only the birds but also mice and rats. The overfeeding of bird food is a huge problem. That attracts all kind of animals, most prominently, the rat." Simon

The well-intended act of providing food for birds can actually lead to the overfeeding of birds and the unintended feeding of rats (see Figure 16). Furthermore, as Simon explained, these people do not work together but are usually individually motivated in their quests. As a result, several people are feeding the same birds, each person offering amounts of bird food and bread to sustain them for a week, which consequently results in gross overfeeding.

Figure 16: Leftover food on the lakeshore with ducks and a crane in the background, uninterested in consuming any more bread. Between the rocks, there are many entrances to rat burrows. (source: author)

Another example is shown in Figure 17, a woman who goes to the lake several times a week, visiting the same few spots with a variety of different bird foods: bread, seeds, corn, and even meat for the seagulls. The birds flocked to her, happily eating until they were full, most of the time leaving only bread behind. Unbeknownst to her, the rats burrowing between the stones along the lakeshore were welcoming her food offers just as much as the bird, leaving no crumb behind.

Figure 17: Bird feeder at Lake Zurich. According to Simon, the woman feeds the ducks, seagulls, and swans almost every day. The leftover food is left on the shore (see Figure 16). (source: author)

Overall, the rats in Zurich reflect similar findings of rat ecology, which can be observed on a global scale, demonstrating their adaptability to thrive in urban environments in response to the availability of water, food, and shelter (Feng and Himsworth 2014). Unlike other cities, however, Zurich stands out in regards to its urban infrastructure, notably the closed sewage systems, which significantly influence rat populations by diverting them to alternative sources of water and shelter. While water is critical for rat survival, its abundance in Zurich through natural and anthropogenic sources does not solely dictate rat settlement, as rats need safe places for nesting and burrowing as well as food. For this reason, trash management is crucial as improperly disposed trash provides abundant food for rats, promoting population growth. Conclusively, human behaviour, specifically littering and animal feeding, inadvertently support rat proliferation.

In chapter 5, I discussed the reluctance and emotional turmoil of the pest control managers who have to kill rats. Many pest control managers reported that they did not wish to kill rats, but that they killed rats out of necessity when the rats became a problem. As a reminder, rats are more likely to become a problem when they settle in places where they are close to humans, can damage infrastructure or material, or can contaminate water or food sources, all of which are more likely to happen when the number of rats increases. A pest control manager expressed her anger about having to kill many rats after having to deal with a rat infestation at a small public plaza with benches and greenery. This park was frequently used during lunch breaks and in the evening. Visitors would eat their food and discard leftovers in bushes, providing ample food sources for rats and birds alike. The pest control manager described the consequences that she had to face:

> *"Especially with the rat, I get really angry when I have to kill big rat populations, I really do not enjoy that. I mean … one could just pay attention before there are so many, no? Then no one would have to kill so many rats." LK*

The interviewee was very angry at the situation, as she realised, that there were so many rats, that their presence must have been noticed sooner. When she asked around, people reported having seen rats in the area for weeks, but no one had reported the sightings. By the time the pest control firm was contacted, the population had already grown to an estimated 30–40 rats. As a result, a large amount of poisonous bait and pellets had to be deployed around the plaza and directly inside the rat burrows. As discussed in chapter 5, killing rats with anti-coagulant biocide causes the rats to bleed out over the course of two

to three days and is known to be very painful. Furthermore, the deaths of rats cause great distress to other members of the population, and pups still dependent on their mothers often die of starvation (Raj 2008). When asked what measures could have been put in place to prevent situations like this from happening, the interviewee replied:

> *"Like trash cans, or checking the surrounding, whether there are playgrounds or people who are picnicking. Like are those recreation areas where people are sitting and leaving potential food lying around for rats? Can we put bins which are inaccessible for rats? We once even made posters to tell people not to leave food. Like those could be measures. […]. So we have done a lot of work trying to figure out where do the rats come from, but once they are there, you need to keep them from reproducing." LK*

People working in rat management know what measures could be taken, but the implementation is often difficult. The measures the interviewee describes above all serve the purpose of preventing rats from becoming a problem by limiting the number of rats that can be supported by anthropogenic food sources:

> *"Most is happening overfeeding. If rats have food available, then they can reproduce. So, at places where there is little food, then low rat populations can surely be tolerated. Which is exactly what we do." LK*

Rats seek food rather than human contact. The more rats there are, the bolder they become in their search for food for survival, as the original source might not support the size of the population. These material realities, whether they are urban landscapes, food resources, waste disposal systems, or even technology, influence interspecies relationships in different ways.

The research agenda of multispecies co-existence is closely tied to the demands of 'multispecies justice' regarding a moral incentive and ethical responsibility towards other-than-human beings (Celermajer et al. 2020). Its focus lies on studying how the relationships and interactions between humans and other-than-human entities, including animals, plants, and even inanimate objects and ecosystems, affect each other, with the aim to find more informed ways of co-existence between different species (see McCance and Baydack 2018 for urban areas; and White and Gunderman 2021 for the interesting case of insects). Efforts to promote co-existence between humans and wildlife in urban areas focus on fostering understanding of and appreciation for the roles that different species play in

urban ecosystems as well as addressing the underlying social and cultural factors that contribute to conflicts (see Frank and Glikman 2019). The literature on multispecies co-existence in urban environments, particularly concerning rats, demonstrates a growing interest in re-evaluating the relationships between humans and other-than-human species through the lens of multispecies justice, as we have seen in the previous section. By exploring alternative perspectives on rat-human interactions and seeking solutions that balance the needs of all species, scholars contribute to a more inclusive and sustainable vision for urban environments (Shingne 2022; Celermajer et al. 2020). As such, multispecies co-existence tends to be future-oriented, seeking solutions for a world where humans and other-than-humans can thrive together by exploring how laws, regulations, and policies can promote or hinder making space for all species. In this section then, the focus is on reviewing where multispecies justice approaches are at work in Zurich and where there is potential to delve deeper.

Rat-Informed Multispecies Justice

> *"And it's just the cultural consequences: it's humanity's own fault if the rats get out of hand." JB, president of the 'Club of Rat Friends' in Zurich*

The previous two sections have outlined the role of materialities and human behaviour within the process of 'becoming with' rats in Zurich. In this section, I head Haraway's call for more 'response-ability' for other species as well as for humans themselves and explore the 'becoming with' rats in Zurich through the lens of a multispecies justice. A multispecies justice perspective emphasises the interconnectedness of human and other-than-human lives and the need to consider the well-being of all species in decision-making processes (Celermajer et al. 2020). The traditional anthropocentric approach to decision-making tends to overlook the agency of non-verbal entities such as rats, thus creating a pressing need for mechanisms to 'speak for the rat' in these processes. For researchers, giving a voice to rats involves incorporating an understanding of rat needs, behaviours, and impacts into decisions that directly or indirectly influence their lives and habitats. This process then requires to study of rat ecology, thus informing policies and practices that cater to the well-being of rats and acknowledge their ecological roles. Further advocating for rat well-being, animal rights advocates raise awareness about ethical treatment, emphasising the rights and welfare of rats in human societies (see Evans 2010 for the case of Switzerland). Pest

management professionals also play an essential role as well, as they gradually shift from strategies of extermination to humane, integrated approaches which take into account the biology and behaviour of rats (see Baker et al. 2022). The role of urban planners and policymakers is similarly important as the design of infrastructures and policies greatly influence rat habitats and behaviours, thereby increasing or reducing human-rat conflict (see Johnson et al. 2016).

It is important, however, to acknowledge that these advocates cannot flawlessly represent a rat's perspective, as their interpretations are bound by human understanding. Despite these limitations, the inclusive nature of their advocacy aligns well with the principles of cosmopolitics, as it allows for a variety of voices to contribute to the discourse (Stengers 1997). The notion of rat 'participation' in decision-making involves reflexively and responsively incorporating the behaviours, needs, and impacts of rats in the decisions humans make. This approach necessitates a shift from traditional anthropocentric decision-making towards a more-than-human approach that recognises the agency of rats, and considers how they both influence and are affected by their environment (Shingne 2022). It is, however, important to note that acknowledging rat agency is an intellectual exercise that can shift perspectives but does not inherently resolve the practical issues surrounding multispecies justice. It is a recognition that rats, like humans, are active participants in their environments, capable of making choices and having an impact on their own lives and the urban ecosystem. However, mere acknowledgement without an in-depth understanding of rats' ecological and ethological characteristics fails to offer tangible solutions for their cohabitation with humans in urban settings.

For example, rat agency may be acknowledged when rats are seen navigating human-created obstacles in their quest for food. However, understanding their ecological role means recognising that rats are opportunistic feeders, which informs us why certain waste management practices are ineffective in deterring rats and may even invite them into closer contact with humans. Acknowledging rat agency does little to address the practicality of their eradication when they become a problem to humans. For this reason, it is important to understand rat ecology and ethology, examining how rats interact with their environment, their behavioural patterns, social structures, and survival strategies. This knowledge provides a foundation for informed decision-making in urban planning and management, allowing for actions that consider the well-being of both rats and humans.

This ecological perspective highlights the potential consequences of leaving rat populations unchecked in urban environments as well (see Feng and Himsworth 2014; Heiberg, Sluydts, and Leirs 2012). It also underscores the importance of understanding their reproductive rates and habitat preferences as it allows for the development of humane and effective population control measures that align with multispecies justice.

Furthermore, the practical understanding of rat agency through ecological and ethological knowledge allows for a re-evaluation of what justice means in the context of human-rat relations. It challenges the anthropocentric approach that often results in the marginalisation and mistreatment of rats and promotes a more inclusive consideration of other-than-human interests. This is not about simply recognising that rats have agency, but about incorporating that agency into urban systems in a way that acknowledges their intrinsic value and their right to coexist. As humans facilitate the establishment of 'rat places' in Zurich, they also contribute to the creation of human-rat conflict. As we have seen in chapter 5, killing rats is considered a necessity when rats get too close to humans or when the threat of rat populations growing rapidly or invading human spaces becomes too great. Humans as a species, then, hold power and advantages over other-than-human species, which leads to lethal consequences for pests considered unwanted and abject. Focusing on the process of 'becoming with rats' in urban environments allows to examine the causes of conflicts and the sources of potential solutions, while taking into account the relational practises and behaviours in which humans contribute to making rats 'problem animals'.

Focusing on the rat's ecology and ethology also helps to address anthropomorphic (mis)interpretation of their behaviour. During a conversation with two different UPAS members, I was confronted with two different narratives on the lives of sewer rats. Surprisingly, little is known about the life of sewer rats globally (see Heiberg, Sluydts, and Leirs 2012; Feng and Himsworth 2014; Guo et al. 2023) and even less so in Zurich. As was explored in chapter 5, sewers are part of the subterranean imaginaries, which are strongly connected with ideas of the abject. As such, anything living in such abject places invokes questions about, how and why anything would thrive in a place like this. The first UPAS member I talked to mused about this as well:

> *Well, in the sewers, rats can be tolerated, I think. I mean there are rats who spend their entire life in that pipe system and … well if they have enough food, then that is not a problem and they can live there. But yes, isn't it a crazy story? That rats can completely spend their entire life in darkness? LL, 23.5.2019*

The narrative of rats living in darkness and spending their entire life in the sewers is like a 'crazy story' to the UPAS member. It is difficult to imagine, that anyone would want to live like that. But who is 'anyone'? There is a danger to anthropomorphism here where one assumes that just because a human would not want to live like that, neither would any other being. Returning to the point of rat agency expressed through their ecological and ethological actions, it becomes apparent that a shift is needed towards adopting a more-than-human position when analysing this situation, as the second UPAS had already recognised:

> *"But in principle, a rat that lives in a sewer is not necessarily unhappier than one that lives somewhere outside. It is simply exposed to other dangers. But if you have a well-maintained sewer system, then there are fewer problems. So I don't see any problem why they can't be there." GB, 23.5.2019*

Most city rats are seen as pests no matter where they are, but going beyond reducing rats to pests and seeing them through a more-than-human way actually reveals how little we know about what would make a rat 'happy'. When rats have their needs fulfilled, they reproduce, regardless of anyone being able to judge whether they are happy or not. Therefore, thriving sewer rat populations at least confirm that their lives in the sewers offer them everything they need. The phrase 'But if you have a well-maintained sewer system, then there are fewer problems' is interesting as well because it does not specify *who* has fewer problems. The interviewee could point to the fact that humans might have fewer problems with rats, since the rats are separated from humans and, therefore, not posing a threat. However, it could also suggest that sewer rats have fewer problems because they are left in peace by humans for the same reason. Due to the lack of knowledge about sewer rats in Zurich, I can only muse about what 'different dangers' sewer rats are exposed to in comparison to other rat population. For example, heavy rainfall can lead to a flooding of the pipes, causing some rats to be caught in the current, causing them to drown. Meanwhile, rat populations at the lakefront risk being poisoned and bleeding out internally.

Applying this gentle shift from more traditional anthropocentric decision-making to a more-than-human perspective, gives more space to recognise how rat agency expresses itself. A multispecies justice approach then needs to be informed by understanding the ecological and ethological characteristics of rats, about which too little is known at this point.

Multispecies Justice within Pest Control

Attempting a more ethical and humane co-existence of other-than-human species demands an adjustment of pest control and management practices. As chapter 5 discussed, killing, especially with rodenticide, is often the preferred method for pest management due to its efficiency and economic advantage in comparison to other methods. However, there are several alternative approaches to killing rats that can be used to manage rat populations and address the challenges posed by these animals. One approach is the use of humane methods of control, such as humane traps or repellents, which allow rats to be captured and released without harm. Another approach is the use of habitat modification and exclusion techniques, such as sealing off potential entry points and removing sources of food and shelter, to reduce an area's attractiveness to rats (see Hunold and Mazuchowski 2020). These tools and methods are all part of so-called integrated pest management (IPM) approaches, which combine multiple methods to address pest problems in a sustainable and environmentally friendly way (Tobin and Fall 2009). IPM methods require the development of novel approaches or technologies to mitigate negative interactions between rats and humans while preserving the right of other species to be present and co-exist in urban environments. In other words, the general approach to 'problem animals' has to be rethought not only in the name of multispecies justice but also through a reconsideration of what a just multispecies city would look like.

However, alternatives to killing rats are currently underexplored due to a variety of factors, including perceptions of ineffectiveness, a lack of awareness, and economic and political considerations (see Raj 2008). The implementation of habitat modification poses a challenge, as it often requires the cooperation of city administration, waste workers, building owners, and the wider population to achieve results. Furthermore, from an economic perspective, alternative approaches to killing are often less effective and more time-consuming than killing and are therefore not deemed worthy of effort or resources

(see Višak and Garner 2016). Subsequently, the possibilities for controlling rat populations are limited by economic and political factors (see Kornherr and Pütz 2022). While the use of humane killing methods and integrated pest management approaches often require a greater investment in research and training, once established, there are many benefits from a multispecies justice point of view.

In Switzerland, the department for the environment has specifically adopted an IPM approach to the management of animal infestations (see Figure 18). This serves as a guideline for all pest control firms operating in Switzerland and is also part of the course material to obtain a licence to work as a pest control manager. As Figure 18 shows, the pyramid of IPM is heavily focused on preventive measures followed by early detection. As applied to rats, the aim is to prevent them from becoming a problem and manage them so that the need for killing does not arise. For rats, then, IPM approaches are a key factor in establishing a multispecies co-existence, which is informed by the ecology of these animals in the urban environment. The tools of IPM are physical embodiments of a new ethical perspective on rat control that focuses on reduced-harm and promoting co-existence rather than extermination. They are an extension of human agency and intention, materialising the growing recognition of rats as fellow companions with whom we share our urban environments. Whether it is a trap or repellent, the tools become a bridge that facilitates a more respectful mode of co-becoming between humans and rats.

However, as discussed in the previous sections, the implementation and promotion of IPM approaches are challenging and require a well-rounded approach in order to be successful in preventing or even reducing the need to kill rats. In the case of Zurich, a well-maintained closed sewage system and building infrastructure provide a strong foundation for preventive measures (as found in Figure 18), as they help limit rats' access to buildings and lower the chances of the subterranean sewer rat population mingling with humans.

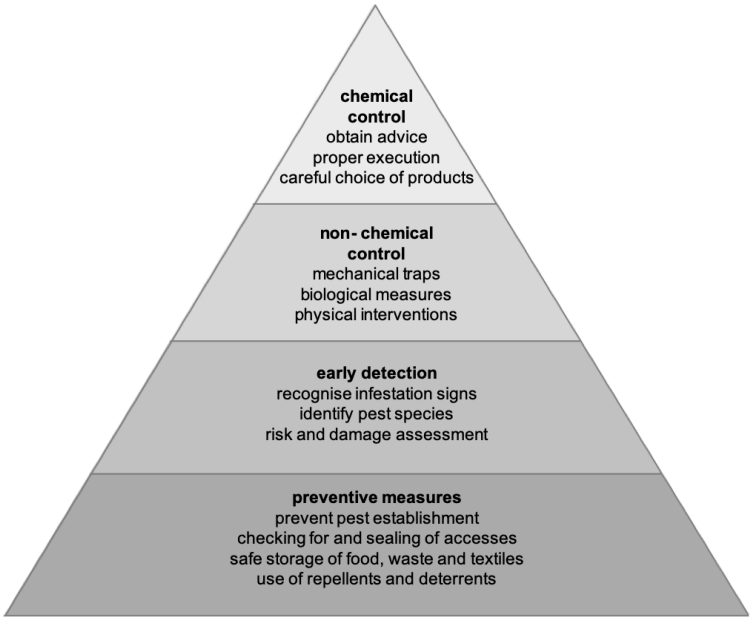


Figure 18: In integrated pest control, the co-existence with rats is managed with a combination of preventive measures, early detection of rat presence, non-chemical control methods, and chemical control methods (Bundesamt für Umwelt 2023).

While prevention and early detection are important to prevent rats from becoming a problem, IPM approaches are also applicable when a rat population has already gotten out of control. In order to demonstrate how this looks in practice, I revisit the rat case at the construction site discussed in chapter 5, where a particular set of circumstances has led to an unusually large rat population by Zurich standards.

Simon from UPAS, who inspected the construction site, concluded that a combination of methods, namely snap traps, biocide, and habitat modification, was the best approach. The snap traps around the lunch area could keep the rats away, but the traps would not be enough to kill or drive away all the rats since they had already built nests and were tending to their litter. In order to increase the success of baiting with biocide products, some adaptations had to be made, especially regarding the food sources that the rats were using. When the construction site was established, trash bags were installed all over the area. The trash bags were installed in plastic bins with holes (see Figure 19). These bins were easily accessible for the rats and presented an easy food source. When trying to make baits more attractive to rats, it was important to implement a habitat modification and remove any alternative food sources to stop the population from growing and increase the existing population's likelihood of eating the baits.

Figure 19: The trash bins at the construction site were made of plastic and had holes. The lids had to be opened by hand and were sometimes left open or blown open by the wind. (source: author)

From these examples, it becomes evident that the materialities embodied in IPM technologies and tools play a critical role in shaping the 'becoming with' of humans and rats in the city. They not only mediate the interactions between these two species but also embody broader shifts in human attitudes towards other-than-human beings. Therefore, as multispecies justice scholars strive towards more ethical and sustainable urban ecologies, it is crucial to continue to innovate and experiment with these materialities, developing novel tools and approaches that support a more just co-existence with other-than-humans. However, this is not a straightforward path but more of a negotiation, because multispecies co-existence with rats, holds many challenges.

Challenges of a Multispecies City

While the concept of the 'multispecies city' is valuable in reorienting perspectives towards greater inclusivity, it does not inherently result in 'multispecies justice' for all, particularly for animals such as rats. One significant critique of the 'multispecies justice' concept is that

it can be overly idealistic and not fully consider the power imbalances inherent in human-animal relations. The romanticised vision of co-becoming may overlook the harsh realities of urban ecosystems, where economic, political, and social interests predominantly shape human attitudes and policies towards other-than-human species. As I have shown in chapter 5 especially, the pragmatic concerns of property damage, disease control, and aesthetic values add to the systematic exclusion or eradication of rats. Another point of critique is the tendency to anthropomorphise animal experiences, projecting human-centric notions of justice and coexistence onto other-than-human species without fully understanding or respecting their intrinsic needs and behaviours. This can result in misguided conservation efforts that may actually harm the animals they intend to protect, as the examples of animal feeding patterns in Zurich have shown. Moreover, the complexity and unpredictability of interspecies interactions can lead to unintended consequences that undermine the goal of multispecies justice. For example, efforts to integrate rats into urban environments may inadvertently lead to increased conflict with humans, as the animals' natural behaviours clash with human activities and expectations. In such scenarios, the rhetoric of interconnectivity fails to account for the very real conflicts that arise between species with differing needs and interests. The concept also often assumes a level of agency and voice for other-than-human animals that may not be realistically attainable in current political and legal structures. While the idea of representation for other-than-human species in decision-making processes is philosophically appealing, in practice, it faces significant challenges. Therefore, in this last section, I focus on the challenges of the multispecies city of Zurich.

A central question is how to balance the rights and welfare of different species, particularly when their interests are at odds. For instance, consider the cohabitation of humans and rats in urban environments, rats can pose substantial health risks to humans and can cause significant damage to infrastructure. However, they are also sentient beings with their own interests, deserving of consideration and respect. While the focus with rats and humans is on preventing conflicts and health risks by promoting IPM approaches, multispecies justice does not mean that humans have to compromise their safety for the lives of other-than-human-beings. However, as I have shown in the previous chapters, urban animals like rats have historically been marginalised and degraded due to their association with disease and damage to property (see Biehler 2013). This is important to remember because this deeply embedded perception of city rats as dangerous and abject heavily influences

human responses to conflict situations, especially regarding the affective and emotional reactions of citizens who encounter rats in their homes (see chapter 5). However, adopting a multispecies justice lens allows us to re-evaluate the preconceived notions of anthropocentric value systems and consider the ways in which human actions and decisions impact rats and the places they inhabit. An increased understanding of the ecological dynamics of rat populations in relation to the materialities of Zurich and human behaviour then, also proves to be very useful for further implementation of multiple justice in IPM practices.

As earlier sections have shown, there is a direct connection between the maintenance and planning of urban infrastructure and city rat populations. As Simon from UPAS explains, the renovation of public places and improvement of the old sewer system have impacted the incidence of rat infestations:

> *"The city has renovated many public places in the last years and while doing that, they also renewed the sewage system as well and since then, we have had no problems in those places anymore. These interventions really calmed down the rat situation since the '90s when I started. I mean, they didn't do it for that, it was never the main goal, they just wanted to make things prettier, but as a consequence it happened."*
> *Simon*

Simon points out that the city did not act out of awareness of rat risks. The aim was to make the city more attractive to humans and create aesthetically pleasing spaces. Additionally, the renovations were often accompanied by renewing the sewage system and sealing building foundations and other accesses with hard materials such as stone plates or concrete. It appears that spaces designed to be pretty and inviting to humans are not necessarily inviting to rats. These kinds of intended or unintended habitat modifications and exclusion techniques exemplify the influence of infrastructural materialities on the 'becoming with' process. By sealing off potential entry points into buildings or removing food and shelter sources, these techniques modify the urban fabric, turning the city itself into a pest control tool. This underlines the active role of material urban infrastructures in shaping multispecies interactions and shows, that the operationalisation of 'multispecies justice' within urban settings also confronts structural obstacles (Sage et al. 2014). It also reflects an understanding that successful IPM requires not only the management of rat populations but also the management of human behaviours and the urban environment

that enables rat infestations. By renovating and improving public spaces for humans, the 'rat places' within these public places have been erased. The existing frameworks of governance, urban planning, and legal systems are not designed to accommodate the complex requirements of a genuinely multispecies city. For instance, regulations that protect certain species often do so at the expense of others, failing to consider the intricate web of ecological relationships that sustain urban biodiversity (see Sage et al. 2014; Shingne 2022). When asked where the rats went, Simon assumed that they either retreated into the sewers when construction started or moved to a different location where their presence could be tolerated.

While the city did not plan to help UPAS with their pest control tasks, the cooperation of different stakeholders on a city-wide level is an important factor in successfully applying IPM measures. As rats are very mobile, chasing them away from one place likely leads to their establishment in another. According to a study on rats from Vancouver, entire rat populations are likely to move when disturbed by construction noise or intensive trapping practices (Byers et al. 2019). For this reason, Simon points out the importance of coordinated measures:

> *"Why would you fight rats in a fancy neighbourhood and right next to it you have the Langstrasse where no one cares about rats? Or you fight them in the garden but you do not check if the canalisation is damaged; you put poison everywhere but not check the source. That is Sisyphus work. (…) You need a place that coordinates this." Simon*

Many pest control firms are privately hired by homeowners to get rid of rats in their houses or apartments. As is their job, these firms will kill the rats, and maybe they will check for unsealed accesses to identify where the rats entered the house. However, if the source of the rat infestation is not addressed, another rat infestation is likely to occur close by. For this reason, it is important to approach rat infestations thoroughly and take into account the rats' ecology. Rather than fighting rat infestations in individual households, UPAS collects information on rat sightings and cases on a city-wide level and is then able to anticipate the risk of rat infestations in certain places. This helps prevent rat-human conflict before it arises, as the head of UPAS explains:

> *"Thanks to our strategy of taking care of all the main public areas where we know that rats appear regularly, now we can intervene early and prevent that populations*

> *get bigger. Our baiting usage is also very low due to that. We used to plant 150 kg of baits per year and now we use 10–15 kg (…). And it is all due to a consistent approach of finding and fixing the root causes such as repairing sewage leaks and things." LK*

By covering the entire city with regular and consistent checks for any signs of pests, rat populations can be detected early on. The members of UPAS can address the root causes of rat infestations and prevent the need to kill rats. As such, the rat populations are kept from becoming a threat to humans and can continue to co-exist. Frequent control checks by UPAS members are also conducted along the lake, especially along the popular Seefeld area (see Figure 6, p.145). For most of the year, the rat populations along the lakefront co-exist without any conflict despite their proximity to humans. As Figure 20 shows, the rat burrows are easy to spot along the lakeshore slopes, but unless someone goes looking for them, they go unnoticed. However, as discussed in the discussion about trash above, the area is prone to rat outbreaks during the summer months, when anthropogenic food sources increase. In preparation for the summer, the check-ups become more frequent, and rodenticide baiting and pellet distribution begin as early as May in an attempt to prevent the rat populations from growing out of control.

Having understood anthropogenic food sources and improper waste disposal as key factors in the growth of the rat population along the lakefront, UPAS has tried many tactics to encourage the population to change their behaviour. Public awareness campaigns can educate residents on the importance of proper waste management and disposal to minimise rat infestations (see Biehler 2013); however, motivating people to actually read and follow the instructions is another challenge. As Simon points out:

> *"When I look at the hustle and bustle of the people in the city, they don't have time to read a pamphlet. They only react when they stumble over a rat, not before." Simon*

Figure 20: A man walks his dog along the lakeshore. In the grass slope towards the lake, rats have built an extensive net of tunnels, unnoticed by most passers-by.(source: author)

UPAS has made several attempts to appeal to the population of Zurich with posters and pamphlets, trying to sensitise people to the effects and consequences of their actions on the other-than-human species that share their urban environment, but these attempts have had little success. An initiative to inform people about the connection between extensive bird feeding and growing rat populations and instructions to stop feeding birds led to an intense response from angry bird lovers. The result was torn posters and angry letters from people expressing their anger at UPAS and accusing them of being animal haters. A UPAS member was very upset about the reaction and the narrow-mindedness of some people:

> *"Easy for them to say we hate animals. They are not the ones having to kill them. But then we are called when the rats move into their house. And then? How much do you wanna live with them [the rats)] then?" LL*

The struggles with implementing more effective bird feeding or littering management policies reflect the limitations of material interventions in reshaping deeply ingrained human behaviours. Despite public awareness campaigns, the city still struggles with waste disposal issues that contribute to rat infestations. This underscores that 'becoming with' is

not a one-way street, but a mutual process that requires changes not only in the lives of rats but also in human lifestyles.

However, overall, UPAS has succeeded in building a network of people who are attentive to and observant of their environment and who report sightings of various urban animals back to UPAS. Simon explains that having a good network of 'spies' who are always on the lookout for signs of rats is incredibly helpful and efficient:

> *"I do not have time to go to go around the entire city all the time. And also, it would be such a waste of time if I did, without any reason. […) And like that, I have spies all over the city who keep their eyes open for me and when they see something, then I go there and investigate." Simon*

By cultivating and maintaining relationships with city gardeners, restaurant owners, lakefront goers, waste workers, dog owners, and many more can help cover the entire city with watchful eyes. Simon explains, that he often sends out emails and makes phone calls to check up on them, and remind them to report anything. As such, the use of technological materialities, also plays an important role. There have been attempts to popularise the use of a phone application through which the people of Zurich could report rat sightings, as has been done in Paris (see Willsher 2018), but as rats are far less visible in Zurich than in Paris, UPAS rarely receives information through it. However, digital tools like phone applications for reporting rat sightings present a new frontier of technological materialities. These digital materialities not only enable new modes of rat surveillance but also democratise the pest management process, turning every city-dweller into a potential participant in IPM. In this way, the digital tool becomes a node in a city-wide network of surveillance, a material embodiment of raising awareness of the other-than-humans that share the city with humans.

Unfortunately, despite raising awareness, extermination is still often seen as the main necessary response to rats. This raises questions about the possibility of fostering multispecies co-existence beyond the realm of biopolitics (see also Srinivasan 2013; Lemke 2016). Exploring alternative approaches that prioritise empathy, care, and the recognition of animal agency open up new possibilities for co-existence (see Gruen 2009 in regards to empathetic engagement). However, these approaches need to be carefully considered in the context of the risks and challenges associated with the presence of rats in urban

environments, as well as the broader implications for our relationship with other animals in the Anthropocene (see Srinivasan 2015; Gibbs 2020). As another UPAS member elaborated:

> *"Somehow, they always come back. I think it would be an eternal fight if we tried to exterminate rats. But you know, it is also not the goal. We just want to make sure that rats, when there are people, do not come into contact with them. We just want to prevent contact." GB*

Rather than a complete elimination of rats from the city, the goal of UPAS is to manage rats in such a way that both rats and humans are without constant friction. This suggests a shift in the boundaries of typical 'rat spaces' like the sewers to include more 'rat places' that might not have been considered acceptable before, such as the lakeshore or train track slopes. However, by creating more just urban ecosystems in which 'rat places' can be tolerated, the needs and rights of humans must inevitably be considered as well. This is especially relevant since, so far, no city has achieved a complete eradication of any of its unloved synurbic species, neither rats nor others (see Shingne and Reese 2022). Not only are rats here to stay, but they are also deeply intertwined with human life such that targeting them or singling them out is impossible. As the example of bird-feeding has shown, the intention of feeding bird species can influence rats. Reciprocally, taking actions to prevent rat populations from flourishing can also influence other species. Applying multispecies justice is also not limited to only two species, namely rats and humans, but calls for a balanced approach that acknowledges the rights and interests of *all* beings. This pursuit involves a dynamic and iterative process of negotiation. This negotiation draws heavily upon deep ecological knowledge and acknowledges the rights and interests of other species in order to identify and weigh new information, unforeseen changes, and differing needs against each other. This further reveals, how well-intentioned actions may lead to unintended consequences given the complexity of interspecies interactions. Thus, the road to multispecies justice is less a predetermined path and more a journey of continuous exploration, adaptation, and learning. This also becomes apparent in the example of composting in Zurich, as an interviewee explains:

> *"If you have a compost pile, then that is a source for many animals including the rat. You can close the compost and make it inaccessible for rats, but then you also close it for all the other species, like insects, blindworms, birds, hedgehog. It is all connected. You can't just get rid of the rat alone." JB*

Composting in Zurich is common among homeowners who have a garden and create their own compost pile in their backyards. The compost piles are usually made of vegetable and fruit leftovers from the kitchen and green waste from the garden itself. Composting is a popular way to attract useful insects and invertebrates to promote a healthy garden. However, regardless of human intentions for the compost pile, it also attracts species like rats. Trying to provide food for some other-than-human species but not for the rats is thus impossible. This interconnectivity is also a challenge when targeting rats with rodenticide, as it is difficult to ensure that non-targeted species do not accidentally ingest it. Keeping this in mind, multispecies justice is not only a question of ethical responsibility but also a necessity as the urban environment involves the co-becoming of all species, including those considered pests.

In this sense, the challenge of interconnectivity is not a curse but rather a blessing to be worked with. As many studies have shown, understanding the ecological processes and urban design principles that influence rat populations can inform more humane and effective strategies for managing urban wildlife (see Gardner-Santana et al. 2009; Feng and Himsworth 2014; Byers et al. 2019; Guo et al. 2023). Instead of trying to separate rats from the city, understanding the ways they are 'becoming with' their environment opens new possibilities for thinking about multispecies justice. Aiming for a just relationship with urban animals requires an understanding of the ecological, social, and cultural factors that shape these multispecies relationships in the city, as well as considering the diverse perspectives of urban residents and other stakeholders (see also Wolch, Byrne, and Newell 2014; Yeo and Neo 2010). To achieve this, interdisciplinary approaches, such as this thesis, integrate knowledge from fields such as ecology, geography, sociology, and animal welfare to understand how to make space for all urban inhabitants in a multispecies city.

Conclusion

> *"The ideal will be to open up spaces wherein they can indeed exist and ignore us for most of the time, and which they can occupy and convert into their own beastly places, as many animals are continually seeking to do (even in the bustling city)." (Philo and Wilbert 2000, 24)*

Since I started my journey of writing this thesis, I have experienced a notable shift in my perception of the urban landscape. When I stroll down tree-lined boulevards, sit in park cafes, or simply enjoy myself by the riverbank, I find myself perceiving the city with rats on my mind. Observing an unattended trash bin adjacent to a tree, I envision it as an accessible opportunity for rats to scavenge the remnants of someone's unfinished lunch. Shrubberies, left untended along the periphery of a fast-food restaurant's parking lot, morph in my eyes into ideal nesting grounds with readily available nutrition. An active construction site near the river, coexisting with a food truck park, seems to bristle with the potential for rat activity. It is as though a fresh set of interpretative filters has been layered upon my usual urban view, a transformative shift that has made the previously invisible aspects of rat life remarkably apparent.

I began this thesis with the question, "How can we rethink the rat-human relationship in a multispecies city?" and I realised that 'rethinking' can happen on many different levels. This is also necessary, as this thesis has shown that a multispecies co-existence in the city represents profound conceptual and practical challenges. Especially in regards to a more-than-human justice, multispecies co-existence demands a radical reimagining of our relationship with the more-than-human world, one which moves beyond hierarchical binaries of human and other-than-humans, and instead replaces anthropocentric attitudes with a more sensitive, equitable understanding of shared realities. The crux of this challenge lies in the negotiation of diverse and often conflicting rights, interests, and vulnerabilities across species lines. As such, I respond to this question by retracing the main steps of this thesis.

Main contributions

In this thesis, I focused first, on the conceptual rethinking of embedding humans, rats and cities into one theoretical framework, second, on the methodological rethinking of how to study rats from a more-than-human perspective, and third, on the empirical rethinking of how rats are made and killed, but ultimately how rats and humans are 'becoming with' each other.

Looking back to the introduction, the first aim of this thesis is to add to the understanding of the world as co-becoming through the relations of humans and other-than-human beings and develop a theoretical and conceptual framework that allows for an inclusive study of rats and other urban animals. By integrating theoretical discussions and concepts from Animal Geographies into UPE, I established a conceptual framework that serves as a starting point for the study of urban animals. Using a UPE perspective has enabled the studying of the relations between materialities and rats within the city. While not directly adopting either an Actor-Network or assemblage approach, the thesis has made use of the research from many scholars who have explored these concepts in depth and benefitted from the knowledge they produced (Gandy 2003; Heynen, Kaika, and Swyngedouw 2006). Similarly, while imaginaries and discourses were not the centres of my research, many aspects of the 'rat multiple' (Deleuze and Guattari 1987), as well as the association with the 'abject' (Kristeva 1982) or 'problem animals' (Peterson 2019) are closely related to the studying of these concepts. By employing the UPE perspective, this thesis expands the knowledge about the flows of trash and waste in relation to rats and enables to study the influence of the materialities of the cities on rats. Instead of merely considering the human-centric dimension of the city, the application of UPE here allows for an inclusion of other-than-human entities in the political processes and power dynamics of the urban ecosystem. Urban spaces, as the research posits, are not exclusively human, but co-constituted spaces where humans and animals alike negotiate their existences. Applying UPE to the rat-human relationship in Zurich, the study underlines the political nature of interspecies interactions. It unveils the hidden structures of power and exclusion inherent in the cityscape, affecting both human and other-than-human inhabitants.

However, it is especially the expansion of the UPE framework with concepts from Animal Geographies, that marks the main theoretical contribution of this thesis. First, Animal

Geographies allow to ontological shift in the focus on those animals, who do not contribute to the Marxist agenda which dominates much of UPE literature (Gandy 2022). By underscoring the significance of considering other-than-human animals in geographic inquiries, Animal Geographies opens up the frame of UPE to include urban animals outside of anthropocentric limitations. This perspective enriches the UPE field by advocating for a shift in focus from an anthropocentric view to a more-than-human urban perspective. Second, Animal Geographies advocate for more-than-human perspectives to reconfigure the ontological and epistemological reach of the mostly 'human' geography and thereby challenge anthropocentric thinking (Gibbs 2019). Scholars are promoting a relational approach to ethics and politics, emphasising the interconnectedness and shared vulnerabilities of humans and other species (Urbanik 2012; Buller 2017). Third, Animal Geographies stress the importance of recognising the agency of other-than-human species, their behaviours, and their effects on urban spaces and environments (Carter and Charles 2013). This is essential in order to acknowledge and understand how animals shape and are shaped by urban spaces. This allows to explore not only how humans are affected by animals but also how animals are affected by humans.

As such, Animal Geographies offers a crucial reframing of animals as co-constitutive parts of urban environments, moving beyond the traditional view of animals as passive entities or nuisances in urban spaces. This also opens up the possibility to think of animals as political actors who influence urban design, policy-making, and social behaviours (see also Srinivasan 2016). Overall, this expansion enables to examine the interactions and relationships between humans and other-than-human animals, including conflicts, cohabitation, and the socio-political implications of these relationships. Therefore, by incorporating Animal Geographies into a UPE framework, a more comprehensive understanding of rats is offered, which considers the mutual influences between rats, humans, other-than-humans and the material world and helps address anthropocentric biases. In practice, the case study of Zurich then is explored as a multispecies city where different species coexist and continually become with each other. My conceptual framework recognises rats as integral parts of urban ecology and calls for their consideration in urban planning and policy. Additionally, by focusing on the lived experiences of city rats, the research challenges traditional narratives of the city as a human-dominated space, thus adding depth and dimension to both fields.

In regards to studying the rat-human relationship, the integration of Animal Geographies into UPE offers a more comprehensive perspective in the study of the multispecies city by providing a lens through which to explore how rats and humans cohabit and co-create urban spaces. UPE's critical analysis of socio-political processes provides the necessary framework to interrogate the structural forces that govern urban life. Meanwhile, Animal Geographies' focus on the spatial and ethical dimensions of interspecies relations enriches this framework, ensuring that the experiences and agencies of other-than-human species are not overlooked but are integral to the analysis. Animal Geographies can address the limitations of UPE by ensuring that ecological considerations within urban political discussions are not anthropocentric but more-than-human in nature. This advances a more-than-human perspective that acknowledges cities as dynamic, living entities inhabited by a multitude of species. It invites a re-evaluation of what constitutes an urban ecosystem, prompting researchers and policymakers to consider the complex web of interactions that define urban life. UPE's critical analysis of socio-political processes provides the necessary framework to interrogate the structural forces that govern urban life. Meanwhile, Animal Geographies' focus on the spatial and ethical dimensions of interspecies relations enriches this framework, ensuring that the experiences and agencies of other-than-human species are not overlooked but are integral to the analysis. Together, these fields challenge the prevailing anthropocentric urban planning and governance, advocating for policies and practices that foster the multispecies flourishing of all kinds of species (see White & Gunderman, 2021). They call for a reimagining of urban spaces as shared habitats where the wellbeing of all species is considered, where multispecies justice is pursued, and where the integrity of ecological networks is maintained. In doing so, they contribute to the development of urban environments that are sustainable, equitable, and resilient, reflecting the intricate balance of the more-than-human world.

Another aim of this thesis was to provide an alternative and innovative methodology for studying multispecies entanglements and navigate the pitfalls of anthropocentric approaches in order to put more-than-human methods into practice. This was essential in order to overcome the challenges of the traditional epistemologies mentioned just before in the theoretical framework. In conventional anthropocentric research methodologies, animals are often relegated to passive objects of study, rather than active subjects with agency (Buller 2014). Multispecies ethnography radically revises this perspective by taking seriously the lives, actions, and experiences of non-human animals. In my study,

multispecies ethnography has been implemented through a variety of methods. In many ways, my final research design echoes the principles of multispecies ethnography as outlined by Kirksey and Helmreich (2010), who advocate for recognising the interconnectedness of all urban inhabitants, human and other-than-human alike (Kirksey and Helmreich 2010). Direct observations and field notes offer an immersive understanding of rat behaviours, interactions, and adaptations in the urban environment. Through this method, the agency and individuality of rats are recognised and brought to the forefront of research, avoiding reductive classifications that paint rats as mere 'pests' or 'vermin'. Interviews with a range of stakeholders (including residents, pest control workers, and urban planners) also form a significant part of my methodological toolkit. By engaging multiple perspectives, these interviews enable a deeper exploration of the complex and contradictory human attitudes, practices, and experiences related to rats (Locke and Muenster 2018). Additionally, multispecies ethnography helps unearth the historical and cultural aspects of rat-human relations, tracing the shifts and continuities in attitudes and management strategies over time. This approach also reveals how rat populations have been influenced by human actions and urban transformations.

The more-than-human approach in my research design allowed me to challenge traditional binaries that separate humans and nature, paving the way for a more inclusive understanding not only of rats, but the urban environment as well. The use of ethnographic observation, individual and group interviews, and the focus on inclusivity through "additive empiricism" provide a wide-ranging understanding of rat-human relationships in the urban space (Smith 2019; Latour 2016, ix). This methodology, with its holistic approach, equipped me with the potential to uncover interspecies interactions that traditional methods may overlook. As Steele et al. (2019) emphasise, the more-than-human perspective not only brings into focus the interconnectedness of humans and animals but also sheds light on how this interconnectedness shapes the shared environment (Steele, Wiesel, and Maller 2019). This study, through the application of multispecies ethnography and by focusing on city rats specifically, reshapes the comprehension of the urban environment, introducing a new understanding of urban life and the complex multispecies relationships within.

Finally, the last aim of this thesis was to analyse the 'becoming with' of rats, humans and other-than-human beings and explore the ramifications thereof. This then represents the

key findings of my empirical research. In my first empirical chapter, 4, I explored how rats are made, both conceptually and materially, through their relationship and interactions with humans. My examination began by drawing attention to the legal frameworks that govern the treatment of animals in Switzerland, particularly focusing on the differing approaches toward animals classified as pets, pests or lab animals. The analysis then extends beyond the legal context to explore the 'rat multiple', which emerges from the examination of the lab rat, the pet rat and the city rat. This concept essentially refers to the various ways in which rats are perceived, treated, and constructed based on their context and their relationship with humans. Different environments and human-rat interactions create a unique context that shapes rat lives, leading to the creation of distinct 'versions' of rats. The 'rat multiple' then represents the first key finding: the categorisation and subsequent treatment of rats are intrinsically intertwined with societal norms and values and emerge through the relationship with humans and their material environment.

Following this revelation, I then delve into the 'rat spaces', the human-conceived idea of spaces where rats belong and ideally should be contained to. Here, the exploration unravels three major domains: the 'lab rat space', the 'pet rat space', and the 'city rat space'. Each of these 'spaces' presents a unique set of features, laws, and practices that govern human-rat interactions. In the 'lab rat space', rats are seen as scientific instruments, crucial to human progress in various fields. The regulation for the work with lab animals is very strict, and both the rat's environment and body are under constant surveillance and control (Neville et al. 2022). The 'pet rat space' showcases a different dynamic, wherein rats are viewed as companions providing emotional fulfilment to their human caretakers (Hou and Protopopova 2022). The laws here aim to secure the welfare of the pet rats, yet the limitation of oversight may lead to negligence. The 'city rat space', contrarily, highlights a more antagonistic relationship where rats are seen as pests, dangerous and undesirable (Brookshire 2022). As a result, city rats are subjected to pest control measures that aim to control or eradicate them. Additionally, due to associations with dirt and waste, city rats are caught up in the process of 'abjection' and consequently are branded as 'abject' themselves and framed as 'trash animals' (Kristeva 1982; Nagy and Johnson II 2013). This then led to another key finding: different 'rat spaces' shape and are shaped by distinct versions of the 'rat multiple', leading to different ideas of control from a human perspective.

However, it is evident that these 'rat spaces' fail to encapsulate the full range of rat behaviours and experiences as they are strongly limited by the anthropocentric gaze. The ways in which rats transgress the boundaries of their assigned spaces not only exemplify their agency but also highlight the inherent limitations of anthropocentric frameworks in defining animal lives (Donaldson and Kymlicka 2016). This chapter then argues that the 'making' of rats in human society is a complex process shaped by legal considerations, power dynamics, and the multiplicity of 'rat spaces' shaped by the historical and cultural perception of rats. The diverse representations and treatments of rats across these spaces underscore the significance of context and the variability of the human-rat relationships. The findings illuminate the broader anthropocentric narratives and structures that both define and constrain these interactions, ultimately painting a compelling portrait of rats as they are 'made' through their relationships with humans. This critical reflection provides a robust foundation for setting the stage for an exploration of 'rat places' in chapter 5.

In chapter 5, I explored the sub-question of how, when, and where rats transition from tolerable critters to killable 'problem animals' and explored the cultural attitudes towards rats, the rationale behind their extermination, ethical considerations of lethal management, and finally, the methods applied to kill them. In order to understand how this transformation occurs, this chapter builds again on the concept of 'rat spaces' and 'rat places', which play an important role in the dynamics of this shift (Philo and Wilbert 2000). 'Rat spaces' are those where rats are tolerated, and conversely, 'rat places' represent those areas where rats become 'problem animals', posing perceived threats to human health, infrastructure, and food storage (Peterson 2019). Thus, the threshold from tolerable to killable is transgressed when rats cross the boundaries of their assigned 'rat spaces' to create their own beastly 'rat places'.

An example that vividly illustrates this transition is the comparison of the rats at the construction site in Zurich. When a pair of rats was observed stealing someone's lunch bread on a video, the reaction of the construction manager was a delight and even admiration for the rat's agility and intelligence. On a different day in the evening, the construction manager had an encounter with an 'abject rat' that jumped out of the bin. Here, the rat's sudden appearance, associated with an environment marked by filth, invoked feelings of fear and disgust (Seegert 2014). The rat, formerly an unseen creature tolerated within its 'rat space', was now perceived as an intruder upon creating its own 'rat

place' and thus crossing the threshold into becoming a 'problem animal'. This third key finding then shows that the transformation from 'rat spaces' to 'rat places' is profoundly influenced by cultural beliefs and values, as well as situational factors (McKiernan and Instone 2016). Furthermore, these factors shape the affective experiences of humans encountering rats, often leading to increased efforts to control their populations and minimise their presence in urban environments (Capizzi, Bertolino, and Mortelliti 2014).

Moving on to the rationale for extermination, my research identified that rats become killable when they are deemed a threat to human health and infrastructure. The justification for killing rats often emerges from a utilitarian perspective where lethal action against rats is justified if it serves to significantly reduce disease spread and benefit human interest. However, this perspective is critiqued for potentially overlooking the suffering of rats and encouraging their indiscriminate killing. As such, my research shows, that the process of making rats killable, goes hand in hand with categorising them as 'problem animals' that have breached the tolerable threshold by invading 'rat places'. This justification answers the 'when' aspect of my research question, highlighting the conditions under which rats are deemed killable.

Further ethical challenges ensue when I move from the 'ways of killing rats' to the 'how' of my research question, investigating the different killing methods. The practices of killing rats are fraught with moral dilemmas, balancing between anthropocentric interests and the value of animal life. The chapter details the various methods employed to kill rats, from chemical to mechanical methods, as well as applying CO_2 into burrows or cellars. I emphasise that regulations, such as the Swiss Animal Welfare Act, dictate that these methods should cause minimal suffering, however, here, my research underscores the tension between the legal imperative to protect animal welfare and the socio-cultural necessity to eliminate perceived pests. The choice of methods is also influenced by political and economic interests, such as wanting to have quick results to protect against infrastructure damage and keep the costs for pest control treatment low (see also Kornherr and Pütz 2022).

Finally, the chapter focuses on the ethical considerations of killing rats in pest control management, particularly noting the emotional struggle experienced by pest control managers who see rats as sentient beings capable of suffering. While the protection of

human health and economic interests necessitates lethal management methods, pest control managers still feel the moral weight of their actions. While non-lethal alternatives exist, practical constraints often limit the exploration of such alternatives (see Baker and Macdonald 2017; Witmer 2018). Pest control managers in Zurich, however, agree that they only kill rats when necessary and prefer to avoid doing so as long as there are viable alternatives. But, due to the low tolerance threshold of humans for rats, killing often becomes an unavoidable option when rats get too close to humans. Recognising that rats become killable due to an interplay of socio-cultural and context-dependent factors, this chapter closes by stressing the possibility of managing rat populations without necessarily resorting to killing, thus proposing a more multispecies justice-based approach to human-rat conflicts.

In chapter 6, I explored the concept of 'becoming with' rats in Zurich. In contrast to the earlier chapters, which focused on human perceptions of rats (chapter 4) and the emergence of human-rat conflict (chapter 5), this chapter investigated the question of how to make space for rats in the multispecies city and proposed several insightful findings. The exploration of mutual co-becoming between rats and the materialities of the city, marks another step away from anthropocentrism, leading the discourse towards a more balanced, relational perspective. This shift also effectively highlights the interconnectedness of rats and humans within shared urban spaces, necessitating consideration of ethical and moral responsibilities towards other species, a central tenet of multispecies justice (Celermajer et al. 2020). It further proposed fostering understanding and appreciation for the roles that rats play in urban ecosystems, thereby challenging conventional human-centric perspectives and advocating for a more holistic multispecies perspective (Frank and Glikman 2019; Shingne 2022). The emphasis of this chapter is on the subtle and sometimes unanticipated outcomes that result from the interactions between rats, materialities and human behaviour, showcasing the need for a more-than-human perspective.

A key finding of this chapter is that human-designed infrastructures and human actions and behaviours influence rat populations in Zurich by providing them with their basic essentials for survival: water, food, and shelter (see Parsons et al. 2017). While access to water and shelter are important factors regarding the distribution of rat populations, my research revealed that the most limiting factor for the growth and size of rat populations

in Zurich is food. Specifically, the abundant anthropogenic food sources, coupled with plentiful water and shelter, inadvertently support the reproductive success of rats. Therefore, human behaviours such as littering and feeding birds lead to leftover food sources, which unintentionally benefit rat populations. Thus, controlling waste disposal and discouraging such practices could significantly impact rat numbers, given their adaptability and reliance on these food sources. Another key finding is the success of Integrated Pest Management (IPM) in Zurich, building a critical component of establishing rat-informed multispecies co-existence. IPM's efficacy was demonstrated in Zurich, where a well-maintained urban infrastructure, including a closed sewage system and building structures, helped limit the rats' access to shelter, water and food, and further contributed to reducing human-rat contact (Barzman et al. 2015). This finding is crucial as it suggests that infrastructure maintenance and urban planning have a high potential for managing city rat populations. Overall, this chapter shows, that by engaging and learning about rat ecology, humans can adapt to rats by modifying the materialities of the city both for the safety and protection of humans as well as rats. Building on these key findings, as well as the conceptual and methodological framework outlined in this section, I return to my research question then.

"How can we rethink the rat-human relationship in a multispecies city?"

The first step towards rethinking the rat-human relationship involves critically questioning and deconstructing the anthropocentric biases that have traditionally informed the understanding and treatment of rats. Anthropocentrism, which places humans at the centre of the moral universe, often fails to recognise other-than-human entities as active agents that possess their own forms of agency, social organisation, and subjective experiences. Furthermore, challenging anthropocentric biases is essential due to the impact that human perceptions have on the lives of rats, as has become apparent through the exploration of 'rat spaces' and the lethal consequences rats have to face for creating their own 'rat places'. Additionally, anthropocentric systems of value also subject rats to the concept of 'species relations of power' (Hovorka 2019). In comparison with other species, the 'pest' discourse of city rats is so strong, that even other species are devalued by being compared to them, such as with 'rats with wings' for pigeons (Jerolmack 2008). This demonstrates how the designation of rats as pets, lab rats or pests, and the power dynamics that ensue from this classification, are largely shaped by anthropocentric (in-)considerations. Similarly, the

'making' of rats in human society is a process shaped by legal considerations, power dynamics, and the multiplicity of 'rat spaces' shaped by the historical and cultural perception of rats. The diverse representations and treatments of rats across these spaces underscore the significance of context and the variability of anthropocentric biases on human-rat relationships. Therefore, by moving away from anthropocentrism towards a multispecies approach, we can begin to perceive rats as beings with their own desires, needs, and intentions, and understand their integral role in urban ecosystems (Despret 2016).

One effective way to decentring the human within anthropocentric thinking, is to embrace rat agency. On a conceptual basis, I advocate for the acknowledgement of rat agency through the concepts of 'becoming with', as proposed by Haraway, which effectively expands the lens through which the relationship between humans and other-than-human beings can be studied (Haraway 2008). By focusing on interconnected and reciprocal relationships, this concept allows to understand rats in their own right, acknowledging their capacity to influence and shape their relations with humans. Emphasising the mutual shaping of humans and other-than-human lives and futures allows to recognise rats as key participants in the co-evolution and co-existence of multispecies cities. Additionally, considering materialities within the 'becoming with' framework further highlights how rats interact with and shape their physical environment and are, in turn, shaped by the materialities of the city. Taking into account not only rat agency but also the role of materialities, offers another important tool to enrich the concept of 'becoming with' (Haraway 2008), by highlighting the continuous mutual shaping of relations and spaces between humans, other-than-humans, and their material environment.

Understanding the interconnectivity of all beings through the concept of 'becoming with', a deeper ecological and ethological understanding of rats is essential to gain insights for a rethinking of the rat-human relationship. From an ecological standpoint, rats are a part of urban ecosystems, contributing to the overall biodiversity of these environments. Understanding rats from this perspective can help us appreciate their role in these ecosystems, highlight the importance of co-existence, and guide efforts towards creating more inclusive and sustainable urban habitats. This is also relevant in regard to pest control practices, which are often driven by a simplistic view of rats as harmful pests that need to be eliminated (see Brookshire 2022). As the key findings of my research have shown,

integrated and ecologically sensitive pest management strategies can benefit both rats and humans. Instead of focusing on extermination, it could involve strategies that focus on rat-informed strategies for cohabitation and shared urban spaces.

The common perception of rats as pests is deeply ingrained in many human societies. This narrative not only devalues rat lives but also often justifies lethal methods of rat control prematurely. Questioning these narratives allows us to challenge the assumptions that underpin them and explore alternative ways of understanding and relating to rats. This may involve recognising the contradictions inherent in the human-rat relationship - for instance, the paradox of viewing them as pests while creating environments that promote their proliferation—and advocating for more compassionate approaches to rat control. As such, rethinking the rat-human relationship necessitates a deeper ethical engagement with these creatures. This means recognising rats as sentient beings that possess inherent worth and are deserving of moral consideration (see Asdal, Druglitrø, and Hinchliffe 2016). It involves moving towards a more empathetic stance that values co-existence over extermination, and that seeks to mitigate harm and promote wellbeing for all urban inhabitants - human and other-than-human alike (Donaldson and Kymlicka 2016). As such, it calls for a radical reframing of urban policy, design, and management, which requires an understanding of rats as subjects with lives, desires, and agency, rather than as mere objects to be managed. By recognising the shared vulnerabilities of humans and other species, and questioning the efficacy and ethics of traditional extermination methods, we can move toward a multispecies city that accommodates the needs and existence of all its inhabitants, including those species deemed problematic. This approach requires a radical shift in perspective, from seeing rats solely as pests to be exterminated, to understanding them as participants in the urban ecosystem with their own roles and rights. It suggests that policies and practices should be informed by a deeper ecological consciousness that respects the interdependence of all urban life forms.

However, there are also cases where co-existence is extremely difficult and demands a very careful approach. Brighenti and Pavoni's research on the rewilding project of bears into the Alpine range provides an insightful examination of the concepts of domesticity, wildness, and urban space, exploring how these intersect and impact both human and animal lives. The story of Daniza, a wild brown bear introduced into the Brenta Natural Park in Northern Italy in the early 2000s, is emblematic of the complexities arising from

reintroducing wild animals into areas proximate to human habitation (Brighenti & Pavoni, 2018). Her unfortunate death, caused by a human intervention deemed necessary for public safety, ignited a public debate on animal rights, conservation, and public safety. The authors argue that urban spaces and wild animals are not in opposition but are instead deeply interconnected, influencing and reshaping each other. The classification of animals (pets, pests, wildlife, etc.) and their subsequent treatment in urban settings are contingent upon these fluctuating boundaries. The case of Daniza illustrates the inherent contradictions and moral dilemmas in managing wildlife in urbanised landscapes. Comparing this situation to that of rats in Zurich, another urban wildlife management issue, reveals parallels in the challenges faced in balancing human safety, animal rights, and ecological considerations. Like the bears in the Alps, urban rats are often viewed through the lens of biosecurity, seen as pests that need to be controlled to maintain public health and safety. However, this approach often overlooks the ecological roles these animals play and the complex socio-ecological interactions that define urban ecosystems. This thesis' empirical data has also made clear that living with 'problem species' like rats or bears is not always aligned with the ideals of 'multispecies justice' (see Clement, 2003). While the concept of multispecies justice advocates for the fair and ethical treatment of all species, the primary concern for human safety sometimes necessitates interventions that may not align with these principles. In urban settings, where human-animal interactions are frequent and complex, managing wildlife often involves difficult decisions that prioritise human welfare, sometimes at the expense of animal lives or natural behaviours. This underscores the need for a balanced approach that considers the rights and welfare of both humans and animals, acknowledges the interconnectedness of urban and wild spaces, and strives for solutions that minimise harm to all parties involved. The challenge lies in finding a balance between protecting human health and considering the wellbeing and ecological significance of species like rats. This may involve integrated pest management strategies that focus on cohabitation and harm reduction, rather than extermination.

In summary, rethinking the rat-human relationship within a multispecies city, my research primarily emphasises the deconstruction of anthropocentric biases that traditionally dictate the understanding and treatment of rats. It is essential to recognise and acknowledge rats as active participants and co-creators of multispecies cities. Inspired by Haraway's concept of 'becoming with', my work highlights the importance of acknowledging reciprocal and interconnected relationships between humans and rats, inclusive of the material realities

that shape their co-existence. From an ecological perspective, understanding rats as integral components of urban biodiversity can shift away from extermination-based pest management towards more rat-informed strategies. A significant aspect of my work lies in challenging ingrained negative narratives about rats and advocating for their reframing as co-inhabitants of our urban spaces. Such a process necessitates a deeper ethical engagement, where rats are recognised as sentient beings deserving moral consideration, fostering a shared empathy and wellbeing among all urban dwellers. Ultimately, my research advocates for a paradigm shift in urban policy, design, and management, viewing rats not as mere objects but as subjects with their own lives, desires, and agency. This holistic view of our multispecies cities underlines the concept of shared existence and the necessity for a co-evolutionary philosophy that respects all forms of urban life.

Limitations and Empirical Contribution

While this study provides substantial advancements in the understanding of rat-human relationships in the urban environment of Zurich, it is important to acknowledge its limitations. As is the case with all academic work, the conclusions drawn and the contributions made are influenced by various factors, including methodological choices, theoretical frameworks employed, and practical constraints encountered during the research process.

A central methodological feature of this study is the application of multispecies ethnography. Although this method is potent in elucidating intricate interspecies relationships, it is not without its limitations. As Madden notes, the application of ethnography to other-than-human actors is fundamentally anthropocentric, as it assumes a human observer and a non-human observed (Madden 2014). This dichotomy, while practically unavoidable, may have shaped the interpretation of rat behaviour and influenced the conclusions drawn from observations. The inherent challenge of interpreting other-than-human experiences through a human lens must be recognised as a constraint on the depth of understanding achieved. The fieldwork encountered several practical constraints that limited the range and depth of the research. Given the elusive nature of city rats, gathering first-hand data was a challenging endeavour. Additionally, the potential for observer bias in interpreting the observed rat behaviours should be acknowledged. Even though the research tried to minimise bias through method

triangulation, it could not be entirely eliminated. The research conclusions should, therefore, be considered in light of these limitations.

Furthermore, the scope of this study is geographically limited to the city of Zurich, which is a specific cultural and environmental context. While this research provides a detailed case study, it may not be directly applicable to other urban contexts with different socio-ecological characteristics. The political, cultural, and ecological specificities of Zurich influenced the nature of rat-human relationships and the interpretation of these interactions. Generalising these findings to other urban environments should be done with caution. Comparative studies examining rat-human relationships in different urban contexts could provide valuable insights into how these relationships are shaped by cultural, social, and ecological factors. This ties back to the fact, that my research is limited by not having had the chance to conduct further research and compare my findings with other cities. As the specific socio-ecological contexts of the city have a great impact on rats, it would have been beneficial to delve deeper into exploring the factors which influence the growth and distribution of rat populations in other cities.

Despite these limitations, this thesis provides a novel contribution to the understanding of rat-human relationships in an urban setting, bridging the disciplines of UPE and Animal Geographies. It serves as a stepping stone for further explorations into the intricate web of interspecies relations within our cities. Recognising these limitations does not negate the value of this research, but instead prompts a thoughtful reflection on our research processes and assumptions, fostering an avenue for continual growth and improvement in our scholarly pursuits.

Zurich, often revered as one of the cleanest cities globally, offers a distinctive landscape to understand the cohabitation of humans and rats in an urban setting. The urban ecology of Zurich, defined by well-maintained infrastructure, cleanliness, and a closed sewer system, provides a unique habitat for rats and a significant case study for understanding their relationship with humans. In most cities, rats are commonly associated with decay, disrepair, and dirtiness. However, Zurich challenges this perception, given its reputation for cleanliness and high living standards. Exploring the rat-human relationship in Zurich through a UPE lens and incorporating insights from Animal Geographies provides a theoretical framework that contextualises these experiences. UPE helps reveal the socio-

ecological processes that give rise to and maintain urban environments, thereby understanding how rats are 'made' in their relationship with humans (Heynen, Kaika, and Swyngedouw 2006). Moreover, this approach can uncover the power dynamics in urban settings that drive the interaction between rats and humans. Meanwhile, animal geography explores animals as active participants shaping urban spaces and not merely as passive entities in a human-dominated world (Buller 2014).

The multispecies ethnography employed in this study has proved particularly illuminating in studying the rat-human dynamics in Zurich. By viewing rats as co-citizens and considering their agency, this research could identify rat-human interactions outside the typical narratives of infestation and pest control. This approach offers new insights into urban life, including the different ways that humans perceive, interact with, and respond to the presence of rats. Moreover, Zurich's well-developed waste management system and its effort to transform from a 'sanitary city' to a 'sustainable city' give an insight into how urban practices can influence rat populations. Such practices not only shape rat habitats and food sources but also human perceptions and responses towards these animals. In conclusion, Zurich's unique urban ecology, combined with a theoretically rich approach and innovative methodologies, offers an unparalleled perspective on the rat-human relationship. It showcases how urban environments, far from being exclusive realms of humans, are dynamically shared with and shaped by other species. This study thus broadens the understanding of urban cohabitation beyond the human-centric view and contributes to the growing body of knowledge in UPE and Animal Geographies.

Recommendation for future work

Building on the rich body of work presented in this thesis, there are several directions that future research might consider in the exploration of rat-human relationships in the context of a multispecies city. First, there remains a gap in the understanding of how human attitudes toward rats shape and are shaped by rat behaviour. An in-depth examination of human attitudes and perceptions, as well as how these might shift under different circumstances or interventions, could provide valuable insights. Public health campaigns often frame rats as vectors of disease and as a threat to human wellbeing, while environmental education initiatives might cultivate more positive or temperate views. A longitudinal study tracking shifts in human attitudes toward rats in response to different

types of interventions would provide valuable data for policy and practice. Second, while this thesis has provided an overview of the behaviours exhibited by rats in urban environments, in-depth ethological studies would help elucidate how these behaviours are influenced by interactions with humans, human behaviour, dynamic materialities and the built environment. There are some mentionable studies which have contributed to the understanding of rat ecology and ethology for this thesis, such as the work on rat movement in Vancouver (Byers et al. 2019), on sewer rat ecology (Heiberg, Sluydts, and Leirs 2012; Channon et al. 2013; Guo et al. 2023) and studies drawing on pet and lab rat behaviour (Neville et al. 2022; Modlinska and Pisula 2020). However, there is much more room for expanding the knowledge and understanding of city rats. For example, a comparative ethological study of city rats from different cities that examines behaviours in regard to closed or open sewage systems would greatly contribute to the understanding of rat ecology. This is also essential since rats do not exist in isolation and are not bound by city limits. As they are part of ecosystems that include other species, humans, and non-living elements, further research could explore the role and impact of rats within these complex entanglements, which are not limited to the rat-human relationship.

Third, the thesis has touched on the topic of pest management and the implementation of integrated approaches to pest control. However, further research could adopt a genuinely interdisciplinary approach to this issue, drawing on fields such as ecology, sociology, psychology, and urban planning. As my research in Zurich has shown, a well-coordinated collaboration of different stakeholders and civilians can greatly affect the success of IPM in practice. Pest management is inherently an interdisciplinary problem, and developing solutions that are ecologically sound, socially acceptable, and effective also requires collaborative research that transcends disciplinary boundaries. Fourth, exploring how urban planning and policy interventions could shape rat-human relationships is another important direction for future research. As my research has shown, the role of materialities of the city, both built environment as well as materialities that flow through the city, are all intrinsically intertwined with rat realities. The introduction of green spaces, rat-resistant urban designs, and humane pest management policies could shift the ways in which rats and humans interact within the city. A study that evaluates the impacts of such interventions on rat populations and human perceptions could provide critical insights for urban planning and policy, which in turn would tie back to IPM approaches.

Finally, to include a perspective for future research, which was almost part of this thesis, there is the option for a conceptual and methodological experiment closely related to this research, which is the consideration of a rat's right to the city. The concept of the "right to the city" was first introduced by French sociologist and philosopher Henri Lefebvre (Lefebvre 1967). Lefebvre argued that all inhabitants of a city have a right not just to the city's resources and services, but also to participate in the managing of the city itself. A notion initially coined in the context of human urban inhabitants, the 'right to the city' has often been employed to stress the entitlement of every city dweller to not just physically occupy, but also to shape the urban environment. Building upon the foundations of 'becoming with' and 'multispecies justice', there is also an argument to be made for a 'more-than-human' right to the city for rats (see Shingne 2022).

While this might seem unconventional, the idea of granting rats a 'right to the city' fundamentally aligns with the principles of multispecies justice. It acknowledges that rats, like humans, are active agents in the city, and their presence and activities contribute to the urban fabric in significant ways. Furthermore, it challenges the anthropocentric conception of cities as primarily for humans and instead posits cities as multispecies habitats. From a 'multispecies justice' lens, urban animals have a 'more-than-human' right to the city, which demands the acknowledgement of their ecological, economic, and cultural roles in the urban fabric. Recognising a rat's right to the city, therefore, necessitates a reframing of urban planning and management practices, urging us to incorporate considerations for other-than-human species into our strategies and policies. This shift towards more inclusive urban planning could serve to balance the needs of all city inhabitants, human and other-than-human alike, in turn fostering urban ecosystems which are more informed about the ecology and ethology of other urban animals. However, acknowledging a 'more-than-human' right to the city for rats also raises important questions about how to balance rat populations and activities with human health and infrastructure needs. It invites a reframing of rat management towards more humane and ecological approaches that respect their roles and needs while still addressing the potential conflicts and risks associated with their urban presence. Investigating rats in the light of a "more-than-human right to the city" enforces a multispecies revaluation of urban spaces as well as rat management (Shingne 2022). These are just a few potential directions for future research. They highlight the interdisciplinary and dynamic nature of the rat-human relationship in a multispecies city. Further exploration of these topics could contribute to a more reflective

understanding of the rat-human but also the rat-city relationship, inform more inclusive and equitable urban planning and policy, and promote the wellbeing of both human and other-than-human city dwellers.

Final thoughts

During this thesis, many of the findings which emerged contributed to my understanding of the human-rat relationship. From the onset, I strived to discover and untangle the cultural and historical threads that weave into the fabric of the 'rat multiple', the 'rat spaces' and the 'rat places' which I encountered along the way. I discovered an emerging sense of empathy and respect for rats as fellow city dwellers, challenging the traditional narrative engrained in me as well, that categorically positions rats as pests. Such an evolving understanding, which locates rats within the same urban ecosystem as humans, presents a distinct shift from anthropocentric perspectives to more inclusive, even holistic ones, in my case.

In the journey of this thesis, I have rethought the rat-human relationship within a multispecies city, anchoring it in empirical evidence and guided by a sense of ethical response-ability for my research subjects. One of the key foundations of this work has been the recognition of rats as active agents in urban life, not merely passive objects. They not only navigate, respond or adapt to the shared urban environment, but they also contribute to shaping it, contributing to the process of 'becoming with' a multispecies city. Rethinking this relationship demanded a disruption of the anthropocentric perspectives that limit the understanding of other-than-human beings. Looking at rats in Zurich city through a multispecies lens, allowed me to glimpse into the complexity of the rat-human interaction. The emerging mosaic of shared spaces, experiences, and relations, revealed a vibrant dynamic between rats, people and infrastructures in Zurich.

In terms of the human perspective, my research indicated a range of responses, from fear and revulsion to admiration and empathy, towards rats. I found that these reactions are tied not only to personal beliefs and experiences but also to broader societal narratives about rats, the natural environment, and the 'appropriate' relationships between humans and other species. In terms of rats, my research showed rats in a broader relation with the inhabitants and infrastructures of Zurich, painting a more-than-human picture of rats, and

highlighting their realities and experiences. This thesis has also urged a reconsideration of ethical practices, making a case for extending multispecies justice to rats. It invites to not merely to live alongside rats, but to live with them, in recognition of our shared urban experience. These findings offer valuable insights into the nature of human-animal relations in urban spaces, and make a humble but noteworthy contribution to the understanding and multispecies co-existence with rats in Zurich.

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Annexe

Explanation of Swiss Animal Welfare Laws

As a manifestation of representational and value-oriented processes of the human-rat relationship, the laws and ordinances strongly influence the anthropocentric ordering of rat-human relations. They define which animals are to be protected or killed, how they are to be managed and under what circumstances these rules apply. These legally defined instructions regulate how animals are to be treated by humans in different circumstances, often based on the benefit or value of an animal to humans.

In Switzerland there are four main types of documents that have legally binding definitions, application notes and regulations which apply to humans when dealing with rats. As these laws and ordinances apply to humans and not to rats, the analysis of those documents brings to light a reflection of the above discussed issues from power dynamics, categorisations and anthropocentric perspectives. Within a legal frame, animals are still more seen as 'objects' rather than 'subjects' and are usually addressed through a 'firmly anthropocentric and anthropomorphic perspective' (Taylor, 2011, p. 252). Therefore, even though most of these documents aim to find just ways to manage, treat, protect and live with animals, not all animals fit the requirements of receiving the same ethical care and consideration.

To understand the different documents, a quick introduction to the structure of the Swiss legal system is necessary. The core on which all these documents are based, is the Swiss Federal Constitution. The Federal Constitution (*Bundesverfassung*) forms the basic legal order of the Swiss Confederation and regulates the relationship between the Confederation and the cantons, the structure and competences of the federal authorities, and the fundamental rights and duties of citizens. In the hierarchy of norms, federal laws (*Bundesgesetze*) stand between the Constitution and ordinances (*Verordnungen*). They concretise the Constitution and are in turn concretised by ordinances, which are issued by the competent authority on the basis of a law. Ordinances are often used to clarify actions to be taken in specific circumstances when laws contradict each other. For example, if one person's freedom of expression is confronted with another person's right to human dignity.

This conflict can be effectively observed by taking a closer look at the different levels of the legal concretisation regarding rats in Switzerland.

Table: List of Swiss legal documents that apply to rats depending on different contexts.

Article Number	Legal hierarchy	Title of Document and Abbreviation	Date of enactment
SR 451	Law (Bundesgesetz)	"Federal Act on the Protection of Nature and Cultural Heritage" *Bundesgesetz Natur- und Heimatschutz (NHG)* *Loi fédérale sur la protection de la nature et du paysage*	01.07.1966
SR 455	Law (Tierschutzgesetz)	" Animal Welfare Act (AniWA) " *Tierschutzgesetz (TSchG)* *Loi fédérale sur la protection des animaux (LPA)*	16.12.2005
SR 455.1	ordinance	"Animal Welfare Ordinance" *Tierschutzverordnung (TSchV)* *Ordonnance sur la protection des animaux (OPAn)*	23.04.2008
SR 814.812.32	ordinance EDI	"Specialist permit for general pest control" *Fachbewilligung für die allgemeine Schädlingsbekämpfung (VFB-S)* *Ordonnance du DFI relative au permis pour l'emploi des pesticides en général (OPer-P)*	28.06.2005

The species *Rattus norvegicus* belong to the sub-phylum vertebrates, which includes all mammals, birds, reptiles, amphibians, and fish. Within the family of *mammalia*, Norway rats belong to the order of *rodentia*. These taxonomic classifications are important in order to know, which laws apply to which species.

The Swiss Animal Welfare Act (Schweizer Tierschutzgesetz TSchG) for example, applies to all vertebrates and states at its core that "no one shall unjustifiably cause pain, suffering or harm to an animal, put it in fear or otherwise disrespect its dignity" (SR 455, Art. 4). The term "dignity" in regards to animals found its way into the Swiss Federal Constitution in 1999, following a total revision of the latter, and was aimed at referring to the dignity of any living being in regards to the Genetic Engineering Act (Friedli 2009). The constitutional principle of animal dignity was later implemented in the Animal Welfare Act (TSchG) and concretised in the Animal Welfare Ordinance (TSchV) is defined as followed:

> *"Dignity: dignity means the inherent worth of the animal that must be respected when dealing with it. If any strain imposed on the animal cannot be justified by overriding interests, this constitutes a disregard for the animal's dignity. Strain is deemed to be present in particular if pain, suffering or harm is inflicted on the animal, if it is exposed to anxiety or humiliation, if there is major interference with its appearance or its abilities or if it is excessively instrumentalised;" SR 455, Art 3*

This section applies to all kinds of pets, pet rats included. If we apply it to lab rats or city rats however, the dignity of those individuals are weighed against the "overriding interests" of human safety and healing human suffering. The weighing of interests between animal welfare and human wellbeing is subject to anthropocentric values even if ethical considerations are taken into account. As such, lab rats serve a purpose of supporting science and they are "excessively instrumentalised" being used for experiments aimed at serving the greater good of humanity. City rats on the other hand, face the challenges of being seen as nuisances as they are posing a threat to human health and can damage infrastructure and material. They are often seen as pests and framed as 'problem animals' (Peterson 2019), which reduces their value in the eyes of humans and facilitates the justification of using lethal management methods against them.