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Learning to live with synanthropic bats: Practices of tolerance and care in domestic space

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ABSTRACT

As bats adapt to anthropogenic environmental change they increasingly interact with humans and inhabit human infrastructure. This article addresses the challenge of learning to live with synanthropic bats. Building on ideas from multispecies studies, we explore the practices and accommodations that coproduce meaningful human-bat cohabitation in domestic space. Drawing on qualitative research conducted in the Netherlands, we find that domestic space is remade in small but significant ways in response to bats. The aim of our interviewees is to ensure minimal interference between human and bat domestic geographies: intimacy can be spatialized at the domestic scale but is best done in ways that maintain degrees of tolerance. Rather than help bats in general, much care-work centres around supporting the inter-generational reproductive work of bats. This sequential sense of ethical time certainly shifts conservation from a done to mode, and recasts home-dwellers as participants in the story of bat survival and intergenerational nourishment.

APRENDIENDO A VIVIR CON MURCIÉLAGOS SINANTRÓPICOS: PRÁCTICAS DE TOLERANCIA Y CUIDADO EN EL ESPACIO DOMÉSTICO

RESUMEN

A medida que los murciélagos se adaptan al cambio ambiental antropogénico, interactúan cada vez más con los humanos y habitan la infraestructura humana. Este artículo aborda el desafío de aprender a vivir con murciélagos sinantrópicos. En base a los estudios de multispecies, exploramos las prácticas y adaptaciones que coproducen una cohabitación significativa entre humanos y murciélagos en el espacio doméstico. Basándonos en una investigación cualitativa realizada en los Países Bajos, encontramos que el espacio doméstico se rehace en formas pequeñas pero significativas en respuesta a los murciélagos. El objetivo de nuestros entrevistados es garantizar una interferencia mínima entre las geografías domésticas de los

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humanos y los murciélagos: la intimidad se puede espacializar a escala doméstica, pero es mejor hacerlo de manera que se mantengan grados de tolerancia. En lugar de ayudar a los murciélagos en general, muchos trabajos de cuidado se centran en apoyar el trabajo reproductivo intergeneracional de los murciélagos.

APPRENDRE À VIVRE AVEC DES CHAUVES-SOURIS SYNANTHROPES : PRATIQUES DE TOLÉRANCE ET DE CARE DANS L'ESPACE DOMESTIQUE

RÉSUMÉ

Au fur et à mesure que les chauves-souris s'adaptent au changement climatique anthropique, elles se trouvent de plus en plus en interaction avec les humains et doivent vivre au sein des infrastructures de ces derniers. Cet article traite des problèmes concernant l'apprentissage de la cohabitation avec les chauves-souris synanthropes. En nous appuyant sur des idées issues de recherches multispèces, nous examinons les pratiques et les ajustements qui coproduisent une promiscuité constructive entre les chauves-souris et les humains dans l'espace domestique. À l'aide d'une étude qualitative menée aux Pays-Bas, nous constatons que face aux chauves-souris, l'espace domestique est refabriqué avec des changements modestes, mais significatifs. L'objectif des personnes que nous avons interviewées est de garantir un minimum d'interférences entre la géographie humaine et celle des chauves-souris : l'intimité peut être spatialisée à l'échelle domestique, mais elle est mieux construite par des moyens qui préservent des marges de tolérance. Au lieu d'aider les chauves-souris de manière générale, une partie importante des tâches de care se concentre sur le soutien aux travaux reproductifs entre générations des chauves-souris.

Introduction

Urban spaces continue to undergo rapid ecological transformation and in many cases are becoming biodiversity hotspots (Liu et al., 2003). Animals that were once seen as wild are adapting to urban ecosystems and human behaviour. Situated between wild and domestic, these animals, synanthropes, benefit from their proximity to humans while remaining beyond humans' immediate control (Gunawan, 2015). Tensions and conflict have ensued, so that tolerance is becoming a cross-species challenge – both for humans tolerating animal activities and animals becoming more tolerant of humans (Samia et al., 2015). There is now a large body of work on urban human-animal relations in geography: from early work such as Wolch et al.'s zoopolis (Wolch, 1996), to the more-than-human city (Gandy & Jasper, 2020), or on cities as experimental spaces with multiple ways for creatures to flourish (Hinchliffe & Whatmore, 2006), to more recent work on politics (Srinivasan, 2016) or nonhuman labour (Ernwein et al., 2021) and infrastructure (Barua, 2021). In the field of architecture, work seeks to 'negotiate the physical boundaries between human and synanthropic animal [and facilitate] hybrid relationships [in] the urban ecosystem', including in the domestic territory of the house (Gunawan, 2015: iii). In tackling biodiversity loss more emphasis is needed on coexistence and tolerance, and so

positive behaviour towards species needs to be better understood to chart more sustainable long-term cohabitation strategies (Frank, 2015).

Our article analyses the challenge of learning to live with synanthropic bats. We ask simply: how do people learn to live with synanthropic bats, and what can this tell us about caring for the nonhuman at home? In her recent *Progress in Human Geography* report, Gibbs noted that there remains surprisingly little research in geography on animals in the home (Gibbs, 2020, p. 771). This despite Donna Haraway noting as long ago as 2006 that the domestic had long 'been despised, really, as a scene of interesting action' (Haraway, 2006, no page number). Our paper focuses on the practices that make multispecies domestic space. We explore how human inhabitants recognize bat agency and how they deal with their presence, and how practices of care make domestic space relatively open rather than closed to nonhuman life. We draw on ideas developed in more-than-human and animal geography, as well as contemporary debates in multispecies studies, about the modes of ethics that cross species lines.

Recent work in geography and multispecies studies draws heavily on feminist readings of care. These readings parse care into affective, practical, and wider political dimensions and observe that these dimensions do not always align well (Gibbs, 2021; Puig de la Bellcasa, 2018). Our paper concerns ethical accommodation and care for unloved (Rose, 2011) or awkward creatures (Ginn et al., 2014). Bats fit in this category, because they are nocturnal animals which often go unnoticed and they appear physically strange to many people (Kingston, 2016). Studies have shown that synanthropic bats are unwanted by most humans regardless of context: despite the critical role bats play in the ecosystem and the benefits that they provide to human society, bats are still seen as scary, dangerous, dirty and therefore they are not usually welcome (Musila et al., 2018; Prokop & Tunnicliffe, 2008; Prokop et al., 2009; Voigt et al., 2016). The affective experience of dwelling with bats therefore does not map in any easy way on to the practical dimensions of expressing care for them. Our analysis shows that the extent of care practiced is not strictly correlated to care for specific animal lives and bodies. Rather, we will show in the later sections of the paper that taking action to care for bats turns on the question of inter-generational reproduction – helping bats to breed (van Dooren, 2014).

Bats often use human buildings as nurseries and with high fidelity to place they like to return year after year; human homes become important bat breeding sites and over time bats become familiar with domestic space as they reproduce and raise their pups. It is this long-term performance of synanthropic behaviour that the humans we study learn to care for in their homes. Learning to live with bats in domestic space then becomes more than a practical question of helping them (or not) and begins to articulate an ethical concern to foster life as it passes through generation to generation of bats. Such care enables bat species to maintain liveable places through successive generations, to let animals enmesh human dwellings within their own webs of sociality (Garlick, 2019). This is especially poignant in domestic space. The home is a site of social reproduction for humans. But it is also a site for more-than-human reproduction. Clearly, human house dwellers have the power to shape what bats can do and to provide multispecies spaces that can nourish inter-generational reproductive labour.

This article is based on a broader project on human-bat relationships in the Netherlands. Elsewhere, we explored practices of citizen bat conservation in the city through the lens of becoming-with animal (Caiza-Villegas et al., 2022). Here we focus on people who adapt to living with bats in their domestic dwellings in the Netherlands. The rest of this paper explores the responses of humans who encounter bats in their domestic space, asking why they do what they do, and what wider lessons can be drawn for bat conservation and multispecies studies. Before introducing the case study and the discussion of empirical data, we outline the challenges of synanthropic bats co-existing with humans and the idea of caring for other species' inter-generational labour.

Synanthropic bats: conflict and co-existence with humans

Bats are a large, diverse, and globally distributed group of mammals of the order Chiroptera, comprising 21 families and around 1,400 identified species (Wilson & Mittermeier, 2019).

Bats have evolved to be long-lived and slow breeding, and have an important ecological function as pollinators and seed dispersers. They are also the main predators of night-flying insects, naturally controlling pests in farm areas. Bats create cognitive maps of their environments; they navigate spaces through memory and sense, and they retain and transfer knowledge among their peers (Toledo et al., 2020). Bats in other words have their own geographies and these geographies overlap human spatial orders. Indeed, bats have shared buildings since humans first built primitive shelters (Voigt et al., 2016). Thanks to increased urbanization, at present at least 19 species of bats are known to roost in buildings (Jung & Threlfall, 2016) in temperate zones as well as the neotropics, especially in areas which also include vegetation, riverine habitats and parklands (in North America, see Dixon, 2012; in the neotropics, see Jung & Kalko, 2010; García-Morales et al., 2013). Human infrastructure is used variously as breeding maternities, for sleeping or hibernation quarters, and as resting or foraging sites (De Boer et al., 2018; Voigt et al., 2016).

Some species of bat (and other animals) that share living spaces with humans are termed synanthropic – members of a species that can exist and thrive near humans and that have developed complex ecological relationships (Voigt et al., 2016). By learning to live near humans, synanthropic bats have demonstrated exceptional ecological and behavioural plasticity (the ability to adapt to different environmental conditions) (Jung & Kalko, 2010; Jung & Threlfall, 2016; Nunes et al., 2017; Uhrin et al., 2010). The advantages of human-made infrastructure for synanthropic bats include faster reproduction, energy-saving and decreased predation. Some species are more flexible than others. For example, the most common synanthropic bat in the Netherlands (our area of study), the common pipistrelle (*Pipistrellus pipistrellus*), can be found in natural areas but is much more abundant in inhabited areas. The serotine bat (*Eptesicus serotinus*) is found often in human dwellings but is less resilient than the common pipistrelle to roost modification, and they do not return to their roost following a structural intervention. Meanwhile, pond bat colonies (*Myotis dasycneme*) use buildings almost exclusively as maternity roosts in the summer (Haarsma et al., 2019), which makes this species extremely vulnerable to structural changes due to human action, and their numbers are declining rapidly. Of the twenty-one bat species in the Netherlands, these three species – common pipistrelle, the

serotine bat and the pond bat – commonly use houses and buildings as a roost. Other less common species like brown long-eared bat (*Plecotus auritus*) prefer darker open spaces like barns and cellars (Voigt et al., 2016).

Due to negative perceptions and misinformation (Brittingham & Williams, 2000; Gareca & Aguirre, 2007; Thomas & Jung, 2019), bats face illicit eradication or being removed by structural modification of their roosting places. In areas where bats present a high roost fidelity, such as in Australia, conflict with house owners is common; smell, noise, and public concern about disease are reason enough to remove or disperse bat colonies entirely (Currey et al., 2018). Rose (2010), explained how the systematic killing of flying foxes in Australia by electrocution, starvation, maternity destruction, impalement, or shooting has become an extreme way of eradication. Similarly, revulsion to bats has led humans to exterminate entire bat colonies, for example in Costa Rica (Reid, 2016). These killings are justified as necessary to protect agriculture or property, or against the risk of zoonotic disease.

Many bat species are now considered to be declining or are threatened. O'Shea et al. (2016) estimate that human activity, including intentional killing, causes 54% of annual bat deaths. Even though intentional killings have decreased since 2000, bat decline occurs through habitat loss or fragmentation as well as insect decline (IUCN, 2022). Mass deaths still occur because of threats such as wind turbine collisions and white-nose syndrome (a fungus that kills bats during hibernation) in North America, for example. Future threats include climate change induced weather changes like storms, floods and droughts. While in general bats are vulnerable to human activity, the close association of synanthropic species with humans entails further risk. Human infrastructure can trap bats, house pets become new predators, they can be exposed to chemicals and pathogens, while on the other hand humans can face pathogen and parasite exposure, noise, odour and infrastructure damage (Voigt et al., 2016). The ecological proximities of humans and bats create opportunities and threats for both.

It is important to note that when it comes to human-bat conflict, geographic areas are not directly comparable due to varying political and cultural frameworks. Attitudes to bats, including tolerance and the willingness to protect them or kill them, vary widely. Different legal frameworks are also in place assigning them protected status or not (Kingston, 2016). In addition, various bat species are visible in different ways making them more or less tolerable. While a species' likeability can increase levels of tolerance this is hardly the case where bats are associated with infectious diseases or are present in large sizes and numbers (Kingston, 2016). Tolerance in human-animal contact can be regulated through incentives, be that legal enforcement (Frank, 2015), monetary inducements (e.g. payments for the presence of certain animals on land, Naughton-Treves et al., 2003) or social (e.g. a German award program for house owners that protect bat colonies *Fledermäuse Willkommen!* (Bats Welcome!), NABU, n.d.; Voigt et al., 2016).

European Union law protects bats, and in the Netherlands the Dutch Nature Conservation Act 2017 (2022) requires processes of mitigation and compensation for bats if they are removed from buildings earmarked for construction, renovation, or demolition. Mitigation usually takes the form of providing replacement roosts for displaced colonies. There is, however, concern about how effective roosts replacements are. Studies of compensatory maternity roosts in Scotland and Germany indicate that they are not as successful as expected, with only 17% of artificial shelters used again as maternities

(Mackintosh, 2016; Zahn & Hammer, 2017). In the Netherlands, bats have a strong association with human infrastructure and citizens play an important role in bat conservation (Caiza-Villegas et al., 2022; Haarsma & Tuitert, 2009). In general, though, conservation initiatives have done comparatively little to promote residents' tolerance of bats in their homes – this is an opportunity for conservation and the wider question of learning to live with synanthropes to which this paper seeks to contribute.

Domestic critters: caring for inter-generational work

It is impossible to move through a home without being close to animals. Snails slime, cockroaches scuttle, birds flit, spiders weave – bats fly around the threshold of our sensory perception. Beyond the realm of tangible encounter countless unnoticed microorganisms live and die. Rats and mice scuttle. Species such as flying foxes (Rose and van Dooren 2011) or pigeons (Bjerke & Østdahl, 2004) reflect how unwanted animals who dwell in proximity with humans are drawn into complex and conflicting relations. Slugs, for example, domestic monsters, are not welcome into home gardens in Britain, but somehow gardeners and slugs are sticky together by stories, curiosity, and disgust (Ginn, 2014). According to Power (2009), the presence of brush tail possums is considered offensive in general, but somehow this mammal also triggers feelings of homeliness due to its native status. This contrasts with the unhomely dissonance creating by the fear and loathing of a bedbug infestation (Hollin & Giraud, 2021). Humans and animals come together in a variety of complex biopolitical orderings, which exceed domestic space: gestures of welcome and hospitality vie with regimes of exclusion, extermination and control, amid nested practices and spaces of accepted life, valued life, and unwanted life.

The responses we are focusing on enact relations of care. Care is a longstanding concern of animal geography, but the subdiscipline has been careful to emphasize that although very different, care is not the opposite of killing – the two are usually enacted within the same biopolitical regime. When it comes to conservation, for example, scholars have examined the paradoxes of biopolitical interventions that prioritize the welfare of species above the welfare of individuals, showing how killing and caring overlap (Daniels & Mather, 2017; Margulies, 2019). In food production, Bear and Holloway (2019) have shown how 'divergent conduct' can mean care is extended to individual animals (dairy cows, in their case) even within wider systems of instrumentalized treatment or slaughter. While animal geographies and multispecies studies have explored the way certain animals are made killable, the ethical response is not to decry killing itself (Haraway, 2006).

This article aligns to previous work that has stressed the difficulties of navigating between exterminism and care with creatures who are not entirely welcome, the ones that are 'less visible, less beautiful and less part of our cultural life' (Rose and van Dooren, 2011, p. 2). The questions of meeting awkward creatures, as Ginn et al. (2014, p. 116) explain, 'Opens up space for friction, conflict, and misrecognition'. Candea's (2010) concept of inter-patience suggests a middle ground between intersubjectivity and the absence of relation in these spaces; inter-patience refers to the action or allowing things to happen without the need to be together. During his fieldwork researching meerkats, practicing 'mutual habituation' allowed researchers to be in the field close to the meerkats while avoiding contact or intervention. Candea experiences this mutual habituation in another way. He argues that habituation does not imply invisibility; instead, it is a process

in which the researchers come to engage with the meerkats beyond intersubjectivity and interaction. As a result, Candea (2010) questions the normative distinctions between engagement and detachment, usually applied to describe human-nonhuman relations. The point is that engagement and relation involve misunderstanding, gaps and learning to speak and hear in imperfect ways across different worlds (Despret, 2012). Spatial arrangements are important: human dwellings are not impenetrable; they have cavities, fissures, and gaps of which animals can take advantage. Homes are permeable spaces that allow human and animal lives to overlap. For example, some ceilings and cavities are good places for bats to live, and bats will use small gaps to reach spaces under roof tiles and double walls. Such contact zones are places where humans and nonhumans intersect and weave histories together: animals story their places through scent, memory, migration and return.

In this paper, we examine the tension between inter-corporeal interactions and longer-run temporalities of nonhuman reproduction. Care goes beyond bodily entanglement to encompass a wider ethical time space. Bats forage and fly for insects, but their ecologies take advantage of human dwellings. In Deborah Bird Rose's (2012) influential account of ethical time, she writes how energy flows across species lines and systems and how 'nourishment' occurs in synchronous time, that is, the ongoing present. As we shall see, human inhabitants take actions that express care in the present, actions that if not precisely providing nourishment are at least intended not to impede the capacities of bats to find nourishment elsewhere (that is to say, tolerating them). It is clearly the case that, when it comes to bats inhabiting human dwellings, 'lives are nourished by others, not only members of one's own group, but by others as well' (Rose, 2012, p. 130). But Rose also writes of another axis of ethical time which is just as important as cross-species care in the present, 'the sequential processes of generational time' (2012, p. 131). Any group of beings can be seen as an outcome of, as inheriting, their forebears' reproduction – reproduction understood here not just a physical reproduction, but as passing down wisdom, attachments to place, genetic diversity and ways of behaviour. In our case, this means the ongoing plasticity required of both individual bats and their colonies to stay adapted to living with humans. Processes of birth, life and death pass through generations creating a sequence where living beings are indebted to their ancestors, and to those others who sustained them in past slices of 'synchronous' time (Rose, 2012). In this paper we seek to broaden the ethical time-space of animal geography, connecting care between bodies in the present to the question of inter-generational reproduction and helping maintain bats' adaptive response to humans: to the performance of being synanthropic.

Methodology

This study draws on site-based, qualitative research with humans who share houses with bats. Angelica conducted both sedentary and go-along interviews people who regularly encounter bats in their home dwellings. Go-along interviews subscribe to a phenomenological approach with its focus on 'expressed feelings and emotional responses to everyday situations' and 'foregrounds ways in which individuals themselves recognize and express the impact of experiences on their lives' (Lager et al., 2021, p. 1082). Essentially, the researcher joins in the research participants' patterns of movement to gain

access to experiences as they occur in place, including the small and mundane details of everyday life that play a role in one's sense of place. It 'moves back and forth between the subjective experience and the world in which experience is lived out' (Williams, 1996, p. 8). An important benefit of this method is its potential to change power relations common to traditional approaches, as research participants play a more active role (since researcher and participant move side-by-side). The study contrasts research based upon survey analysis, which usually measures attitudes and beliefs of residents towards bats based on pre-established variables (Bjerke & Østdahl, 2004; Fagan et al., 2018; Siemer et al., 2020). Such studies give good overviews but lack the capacity to analyse the meaning or texture of everyday life.

Angelica conducted 17 site visits and interviewed 28 people (13 women and 15 men; 20 homeowners, eight renters) in the provinces of Groningen, Drenthe and Overijssel. All participants were Dutch, and the majority highly educated. Most were employed, with three participants being retired. The age range was broad, from 14 to 74 years old. Sixteen participants were in rural areas, eight in urban areas and three considered their houses to be suburban. Participants were approached in different ways. Some participants responded to a social media advertisement titled 'Do you have bats in your house?'. Other participants responded to announcements posted on community websites and other participants were contacted through the Groningen and Drenthe Bats Groups.

Interviews took place in participants' homes during the evening in Spring and Summer and during the afternoon in Autumn and Winter. Visits involved two components. First, semi-structured interviews were conducted, lasting between 40 minutes and one-and-a-half hours. These focused on participants' perceptions and experiences of bats in their homes, including reflection on the importance of their property's physical borders. Second, Angelica conducted walking tours in and around the respondents' houses, photographing places where participants spotted bats. During this activity, bat-detectors were used to collect data on species composition and behaviour. This activity took from 30 minutes to one hour. All interviews were recorded, transcribed, and coded. Angelica took notes and recorded the sounds of bats to identify species, the number of the individuals (where possible), and the function of the place (maternities, eating grounds, hibernation, summer shelter) – these were shared with the participants.

While Frank is a cultural geographer, Angelica and Bettina are biologists-turned-cultural geographers with Angelica being research active still in the field of biology. In fact, Angelica has been a bat biologist, primarily carrying out fieldwork and data analysis in the neotropics. As a social scientist, she later explored perceptions and attitudes towards bats by bat advocates. During the research for this paper, Angelica was able to draw on both research identities, particularly during the go-along interviews. Using bat detectors and their knowledge about bats, Angelica became an interpreter by transforming low-frequency bat sounds into familiar human sounds. Hertz frequency became bat names, and a combination of whistles were assigned specific bat behaviours such as foraging or social calls. This activity involving the respondents, bats and the researcher creates a dynamic space in which small details appear, and participants' sense of bats takes a more concrete form.

Accommodating bats: what to do?

The questions posed when bats live in human dwellings begin simply: will they be accommodated, and if so, how? Above, we described human-bat relationships as often deemed undesirable, and humans have shown they are willing and capable of eradicating them in large numbers. And yet, this does not occur in our case. Indeed, bats are allowed in private homes and their ongoing existence is supported, or even encouraged. While there are not masses of bats and nor are they huge in size, they still invade the safe and clean space of the domestic human home. As we now show, there are a range of responses, all set against wider ecological rhythms of bat life. However, what unifies the interviewees in this study is their welcoming rather than hostile reception of bats. Having bats fly around the garden or living with them led most participants to appreciate their presence. Several felt that bats belonged there, and expressed joy at having bats around because it is something special. Most participants found bats to be strange, mysterious, curious, interesting but also fragile and even cute. All this means that we are examining not the full range of responses, but the forms of welcome extended by bat friendly people. Illicit killing or hostile exclusion of bats does occur, as we showed above, but lies beyond the bounds of this study. In the following three subsections we unfold a typology of welcoming practices performed by residents: those who do not much, those who do a little, and those who do a lot. These types of response produce spatial orders that can sustain multispecies dwelling. These categories do not map on to wildlife conservation techniques or approaches; they do not reflect codified norms in treating bats in human dwellings. Rather, the typology emerges from our research data, and so represents residents' own practical expertise and how they construct care for bats.

Doing not much

The first set of actions are oriented more towards general provisioning and watching, rather than direct support or intervention. Sitting outside and enjoying the bats flying while foraging or passing by is a practice that some residents describe as enjoyable. Backyards and connected gardens in the neighbourhood are often used by bats as feeders or flying ways. Sometimes the house owners have small groups of 5 to 15 bats that visit their gardens, mostly in summer. Bats manoeuvring is undoubtedly an impressive spectacle. Residents reflected on these moments and described bats as fast and speedy. This experience gave residents a new appreciation for them. For example, Jan (37) comments about his experience with bats in his garden during the go-along interview:

I am very sure they are on the roof somewhere, but I am not sure if it is on our side of the roof or the roof of the neighbour. Because they are speedy, I can't tell where they are coming from, but they are always hunting here [his garden] and going in there [behind his fence]. I just grab a chair, sit in the garden, and enjoy the show. (Jan, bat feeding area, Common Pipistrelle)¹

Gardens are important source of food, water and occasionally shelter for bats. In the following quote from Wouter, who has one of the biggest colonies of more than 100 bats living in his house, he expresses pride in his eco-friendly garden. During the sedentary interview, he said:

Having bats is also a sign of a healthy environment. So that is what we are creating. We both [he and his partner] agreed to not use any poison in the garden nor in the water. So there will be plenty of insects to eat . . . I think we live together with them. They are here at night, they come out when is getting dark, and they rest in the morning. (Wouter, maternity colony (roof) and feeding area (garden), Common Pipistrelle and Serotine Bat) The last sentence is one.

It is increasingly recognized that gardens play an important role in providing food for wild animals in urban areas, and some participants were aware of this (Van Helden et al., 2020). Eco-friendly gardens provide bats with a wide range of insects such as mosquitos, moths and beetles. Most interviewees recognized the role of bats as insect controllers, which they saw as beneficial. From this set of practices, involving passive watching and provisioning, we see how caring for bats does not always demand a lot of effort or time. As we stated in the quotes above, caring for bats is also a matter of recognition, and the research process itself contributed to respondents' being able to do this better. Gardens are places of intersection where the physical and behavioural qualities of bats that normally are rejected are instead transformed into features that humans appreciate and admire.

Doing a little

In this case our participants are aware of the presence of bats in their dwellings but have no direct contact with them. They focus on small practices, mainly additions or deviations from domestic routines and chores. These practices were about not engaging bats directly, but rather creating distance and minimizing contact time. For example, opening doors or windows so bats can leave the building, or collecting bat droppings to avoid damage to work equipment. Swarming behaviour means that small groups of males, or single males during mating season, as well as young bats, are often trapped in human-infrastructure. For example, Bonnie (34), who lives in an apartment building close to the city centre, during the go-along interview, remembered that every year bats were trapped in the staircase:

When we got bats in the hall, we always let the door open. Because Klarissa [a bat group volunteer] said that. So at night, we left the door open, and we waited until the bats went out . . . Here in the entrance, there was one bat sleeping here. Sometimes we just leave this door open because they can leave. (Bonnie, hibernation roosts (building roof), Common Pipistrelle) Same here, the last sentences should be in one line.

Another reported practice was cleaning bat droppings. Sometimes bat droppings are mistaken for mouse droppings but unlike mice, as one of the interviewers mentioned, bat droppings stick to the windows and walls. When bats return to their roosts after foraging all night, they congregate in the entrance and fly in small circles until they can get inside. During this period, bats poop and the droppings stick to walls, windows and doors. Tineke during the sedentary interview commented that during summer she noticed little black droppings near where the bats live: 'Every day I clean up, I clean the windows and the wall during the whole time they [bats] are here. I don't have any problems with them'. Tineke has a maternity roost of Common pipistrelle in the roof of her house. The maternity period lasts 6–9 weeks; it can take another 4–5 weeks for the pups to eat by themselves and be ready to leave. Tineke is therefore cleaning up after bats for three months but during their breeding season, not year-round. Again, we see here how care, in the guise of non-



Figure 1. To prevent bat droppings damaging his work equipment Andre has hung plastic bags around his barn. (Photo by A. Caiza-Villegas)

interference and even tolerating mess (see Frank, 2015), attaches not to specific bat bodies, but to a time-space of reproduction (see Rose, 2012). Tineke is tolerating their presence and minimizing the disruption they cause during a specific period in which bats are breeding. Tineke states she has no problem with cleaning up after the bats, even though ultimately, she states, 'I like them [bats], but out of my house'.

Other interviewees deal differently with bat droppings, which can accumulate underneath the roost. For example, Andre (63) has a barn, in which he keeps his work equipment. Andre tells us as we enter the barn during the go-along interview (Figure 1): 'In the barn, where I store all my work material, they [bats] poop a lot so I hung plastic bags around to avoid that the droppings destroy my stuff [equipment and materials]'. The volume of droppings observed during the visit suggested the presence of a medium-to-large bat colony, and indeed, we identified a maternity roost of the Brown Long-eared bat). Fresh bat droppings are neutral to slightly acidic, however when they dry, droppings become twice as acidic and can corrode some metals. The open plastic bags that Andre placed in the barn collect a large amount of the droppings and protect his equipment. These results provide important insight into how our participants adapt to the presence of bats. In the case of Tineke and Andre, the presence of and labour involved related to bat poop could potentially open up, what Ginn et al. (2014) noted as a space for friction, conflict and misrecognition. Instead they meet bats with tolerance, adjusting their behaviours and are 'willing to accept damage caused by wildlife up to a threshold' (Frank, 2015, p. 740). Simple actions like cleaning, hanging plastic bags or leaving doors and windows open, are enough to accommodate bats' geographies; there is no imperative for our participants to impose human-centred spatial discipline or to engage the bats any more closely. The residents are performing marginal, if occasionally lifesaving, supportive work in maintaining the generational labour of colony survival. For this group of people, there is no inter-subjective recognition, no attempt to build a common world across species difference (Candea, 2010). And

yet their small actions, expressing tolerance and hospitality, make a significant difference in nourishing bat colonies.

Doing a lot

Maternity colonies are formed by lactating females and their pups, with some groups returning loyally to the same place every year. This is one of the two most vulnerable times for bats in their yearly life cycle (the other is hibernation). Residents who have maternity colonies in their houses understand how vulnerable bats and their young are in this period, and they expressed their concern – especially for babies. Such care for some included bodily interaction from carrying to feeding. Daphne (42) has a maternity colony that lives in the top of her chimney. During our sedentary interview, she told us that young bats often fall through the chimney and land in her living room. She keeps the chimney open in the room to have easy access to help the bats:

We bought the house in 2005 in August and we moved here in December 2005 and I think probably in July 2006 the first bats came into our living room because they live at the top of the chimney. In 2006 one small [young bat] fell down and we caught them and let it go. It flew outside. This happens almost every year. (Daphne, maternity roost (chimney), Common Pipistrelle, eating grounds, in her garden, serotine Bat) Last sentences in in one line.

Adult females are very sensitive during this season and there is a high probability that they will abandon their young if they are disturbed. However, unlike adults, young bats are very curious and like to explore, often finding ways out of the colony. When that happens, bats become trapped inside houses or buildings. This is a life-threatening situation for the bat, and they usually need human assistance to get out. Daphne understands this. When their central heating system was installed, their chimney had to be removed and replaced, but she said, 'No, it is not possible because there are bats. When you replace [parts of the house] you have to be nice for the bats and make sure that they come back' (Daphne). Daphne's sense of care extends not only to the bats' tangible presence, but also to their past work in producing new generations and to the future work of maintaining the life of their colony. This is more important as identifying individual bats as a receptor for care is usually impossible since they are so hard to distinguish. Practices that help bats reproduce distend ethics beyond the immediate present, or synchronous time, and into sequential, or historical time (Rose, 2013).

Hellen (69) has a bat maternity colony in her attic; on one occasion she had seven young bats inside her house. Hellen called the Bat Work Group in Groningen and asked for help. The bat volunteers discovered that the bat colony was in her attic and immediately advised her how to handle the bats and help them back to their colony (Figure 2). Angelica accompanied her to the attic where Hellen explained how she dealt with the bats:

Here, be careful and look there, we have a towel there so I can send the babies back. We put the towel there and I can see how the baby grabs it with the fingers and claims. (Hellen, maternity roost (attic), Common Pipistrelle) Last sentece in one line.



Figure 2. Helen demonstrates how she uses a rolled-up towel to help young bats climb back to their maternity roost. (Photo by A. Caiza-Villegas)

There is a prevailing sense of uncertainty in how interviewees discussed dealing with babies they found. They try their best, creating artificial, temporary shelter out of boxes and bags but usually they don't know what happens to the young pups when they are left outside the house or brought to a shelter. Here we see humans expressing care for bats in an indeterminate way. Helen, for example, returned home to find a small bat lying on her floor and 'I saw he was dead . . . then I thought he was not dead; perhaps he was sleeping'. She placed him outside on a tree, and he disappeared – eaten or flown away, it was impossible to know. Daphne, similarly, when young bats get lost puts them in a 'kind of nest' in her garden and hopes 'the mother picks them out'. But she doesn't know: the outcome of their practices of care are uncertain, but they do them anyway.

Swarming and hibernating are also crucial stages for bats. Swarming behaviour is linked to finding a place for suitable hibernation. Sometimes young bats with little experience end up inside houses or buildings by accident. For example, Tom (25), a former biology student, tells us what he learned and did when he found thirteen bats inside the staircase of his building apartment: I learned that they [bats] need to be released when it is 14 degrees [C°] to fly properly. Also they need to eat first. I also learned that you can give them coffee milk mixed with water to give them some energy. I have a bat drinking from a small spoon for two and three times. Tom, hibernation roost (building roof), Common pipistrelle (Figure 3)²



Figure 3. Tom helping a dehydrated bat trapped in the staircase of his apartment building. He is giving the bat a mix of water and milk so he can release it outside. (Photo courtesy of Tom Lamain, Groningen)

Mutual habituation without contact or intervention is no longer an option. But for our participants caring for young bats has not been an easy task. Despite all the physical accommodation that our participants provided to the bats, there are other skills, such as correct handling, that they need to master. Residents need to learn how to deal with distressed bats, skills they are prompted to develop as maternity colonies return to the same house year after year. The point here is that bat and human geographies are overlapping. Inhabitants are learning that it is possible to cohabit the same building, but that bats – especially curious or inexperienced young pups – will find their way into places they don't need to be. Residents engage these animals through bodily interaction, though not very often. Such interaction is fraught – it is risky to both bat and human. While domestic space is accommodating, the idea here is to maintain spatial distance to minimize the need for physical intimacy. There may be only a few metres of geometric space between residents and bats, but the wider geographies (of foraging, flying, breeding) depart from this space almost entirely. Accommodating bats means making overlapping but non-interfering circuits for the different species. Frank (2015, p. 740) stated that 'even when species cause conflicts' – in our case through frequent and potentially corrosive bat droppings, or through causing the sacrifice of interior design plans – 'people

can be tolerant towards wildlife if species are perceived as beneficial to the personal, spiritual, cultural, economic, social or political well-being of society' (see also Frank, 2015, p. 740). It is clear from the above, that our respondents place more value in bats than them simply being protected by legislation.

Conclusion

Bats are adapting to widespread anthropogenic ecological change. This brings them into close contact with humans. In our study, we have examined the ways in which domestic space is remade by the arrival and accommodation of bats, where human and bat geographies overlap but interfere with each other only minimally. Most participants felt privileged to have bats in their properties. Open spaces like gardens lead to a more relaxed interaction, while intimate spaces inside the house promote more demanding interactions with bats, active participation and careful removal. Overall, the impetus for bat care expressed across our participants was that intimacy could be spatialized at the domestic scale but was best done in ways that maintained degrees of detachment and tolerance within the domestic arena. Tolerance is key: even though bats are seldom in direct contact with our participants, the majority are willing to adapt their places and domestic routines during bat breeding season. There are of course limits to accommodation and tolerance. Residents frequently remarked on bats crossing the line. Bats are tolerated in the in-between spaces in the house, but if they regularly use the interior, they become a problem. In such cases even our participants will have bats removed to another area. But this is a last resort, not something residents want to do: they therefore adapt their homes to make this less likely, to facilitate bats quickly returning to their areas. For bats generally do not react well to relocation or disturbance: studies show that bats that are translocated or denied access to old lairs disappear from the area (Voigt et al., 2016).

Most broadly, our analysis speaks to the question: how can humans accommodate other species? The practical stakes here are that the smallest unit of conservation for many synanthropic bats is likely the human dwelling, and that accommodating bats will matter in the long term as they increasingly rely on anthropogenic habitats and roosts. One clear point for conservation is that the extent of doing or practicing care is not correlated to the degree of bat flourishing that the act fosters in the long-term. Leaving a window open, or not blocking access, gently moving a bat outside – these do not require major ethical commitments or lifestyle changes. Rather, they are small acts of care that have wider ripple effects in nourishing bat populations. Where living together with bats involves practices that are not always entirely comfortable, our participants are willing to accept the challenges and overcome differences, because they all recognized bats as 'vulnerable beings whose vulnerability is often tied to their place(s) in human society' (Srinivasan, 2016, p. 76). We are not suggesting that any of the three categories of response outlined above (doing a lot, a little, not much) are ethically superior. We are not suggesting a hierarchy in which doing a lot is active, while at the other end just watching bats is passive; we are not setting up a divide between work and worry (cf. Puig de la Bellacasa, 2018). Rather, we're suggesting that the small practices create domestic space need to be seen in a requisite ecological scale of long-run anthropogenic change and bat colony reproduction. A point for animal geographies, then, is to attend to specific modes of care that are not rooted in affection and connection, but in the spaces between.

Looking to the multiple inhabitations of domestic space draws attention to the way that relations of care go beyond intersubjectivity and beyond interaction. Recalling Deborah Bird

Rose's (2012, p. 131) affirmation of the knots of life, in which "lives are nourished by others, not only members of one's own group, but by others as well", through gifts from forebears. One point for animal geographies is that ethics encompasses not just (or even at all) the body, nor just the tangible set of relationalities joining home-dwellers with bats – ethics also occurs through multi-generational, sequential time. This means that distinctions between small acts of provisioning or intercorporeal acts of very targeted care recede into the background of the larger story of species and colony reproduction. The unit of concern, and of conservation, is less the individual bat that is let out the window, or the baby bat fed and watered, but rather the longer story of intergenerational bat reproduction, of the breath of life passing through generations of the colony. The domestic becomes a site of multispecies reproduction. It becomes a site where synanthropic creatures are made and remade, with humans playing a key role in creating ecologies tolerant of bats. The point here is that synanthropism is made and remade through these interactions: it takes tolerance from both humans and bats to be synanthropic.

We might see learning to live with other creatures at home as a question of storying domestic space through cross-species affinity. Parsing the differences between modes of care and attention here is thus less about judging effective from ineffective or less effective care, and much more concerned with the creation of a general disposition of accommodation: a nurturing of bat reproductive labour by home dwellers. This is instructive in considering the quandary of adapting ourselves and our homes and infrastructure to accommodating nonhumans. This sequential sense of ethical time certainly shifts conservation from a done to mode, and recasts home-dwellers as participants in the story of bat survival and intergenerational nourishment. Put simply: doing a lot is not ethically superior to doing not much. Though of course both are superior to the practices of hostility and violence which lie beyond this paper, in houses and other spaces unseen. The precise care actions and their impacts on bat welfare are perhaps less important than the cocreation of a sense of community and the grounds – or the air – for getting on with life. Will the bats return each year? The residents look out for them, prepare to accommodate their roosting maternities. Each year, continuing the multispecies story, residents open their space up in limited and specific ways that circumscribe the limits of hospitality. Each year they await the bats.

Notes

1. The quotes from this research state the name of the respondent, how bats use their domestic space, and bat species.
2. The protection of bats in NL is strict regarding the manipulation and possessions of bats. People cannot keep or manipulate bats with not their respective permits. However, in case of bats which are in distress, citizens can intervene and help the bat.

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