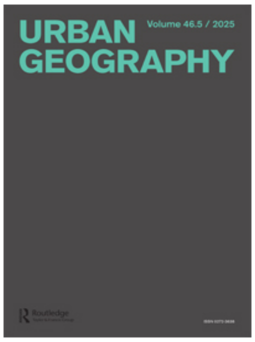

Urban Geography

ISSN: 0272-3638 (Print) 1938-2847 (Online) Journal homepage: www.tandfonline.com/journals/rurb20

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To cite this article: Lukas Adolphi & Gerhard Rainer (25 May 2025): The more-than-living city: sewage treatment, geontopower and the urban metabolism of Non/Life, Urban Geography, DOI: 10.1080/02723638.2025.2505461

To link to this article: https://doi.org/10.1080/02723638.2025.2505461

Published online: 25 May 2025.

URBAN GEOGRAPHY
https://doi.org/10.1080/02723638.2025.2505461

Routledge
Taylor & Francis Group

The more-than-living city: sewage treatment, geontopower and the urban metabolism of Non/Life

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ABSTRACT

In this article, we develop the concept of urban metabolism of Non/Life. More precisely, by linking Povinelli's notion of geontopower to Urban Political Ecology (UPE), we aim to broaden the scope of UPE and ask how processes of urbanization are connected to the governance of transitions between Life and Nonlife. While previous work from UPE has focused on the relationship between society and nature, interpreting the emergence of urban sewage infrastructure as a process of taming and exploiting the natural, we argue that urbanization and sanitation are based not only on the separation of society and nature, but also of Life and Nonlife. Starting from this, we analyse the historical development of sewage treatment in Leipzig, Germany. Building on archival work, sensory ethnography and qualitative interviews, we carve out three phases of sewage treatment that target, in different ways, the specific non/living qualities of sewage. We argue that the city's growth is built on an ever-greater control of transitions between Life and Nonlife. Beyond our empirical example, the article is an invitation to consider cities from a "more-than-living" angle that does not center on the spheres of Life nor Nonlife, but foregrounds the multiple transitions and hybrids between them.

ARTICLE HISTORY
Received 19 June 2024
Accepted 6 May 2025

KEYWORDS
Urban metabolism; geontopower; more-than-living; wastewater; urban development

Introduction

> Here, the stump of a bottle confesses drunkenness, the handle of a basket tells of domestic life; here, the apple core which has had literary opinions becomes again an apple core; the face on the big sou freely covers itself with verdigris, the spittle of Caïaphas encounters Falstaff's vomit, the louis d'or which comes from the gaming-house jostles the nail from which hangs the suicide's bit of rope, a livid fœtus rolls by wrapped in the spangles which danced at the opera last Mardi Gras, a cap which has judged men wallows near a rottenness which was one of Peggy's petticoats; it is more than brotherhood, it is the closest intimacy. (Hugo, 1992, p. 1090)

Death, birth, excess, decay – the Parisian sewers in *Les Misérables* point to the limits of Life. Victor Hugo describes how expelled components of the living body encounter

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nonliving objects of urban life in the sewage, mingle and form a unit in "the closest intimacy", so that it is no longer entirely clear whether this belongs to the sphere of Life or Nonlife. Even though a lot has changed since *Les Misérables* was first published in 1862, the first author had similar experiences when he did a two-week internship at Leipzig's wastewater treatment plant (WWTP) at the end of 2023. Seeing, smelling and treating sewage every day, it appeared to him as a quasi-living, somewhat moody being that he had to take care for during his work. Each day it changed its appearance, smell and composition and the task was to adapt the operation of the WWTP to its caprices.

Inspired by this experience, in this article, we explore sewage as the in-between of Life and Nonlife and examine how its treatment has changed in the German city of Leipzig since the eighteenth century. Our overarching argument is that processes of urbanization are enabled and driven by an ever-greater control of transitions between Life and Nonlife. Thereby, we aim to develop a new critical perspective on the urban formation. Our argument unfolds in three steps, which are reflected in the structure of the article. First, we introduce our theoretical framework by linking Povinelli's (2016) concept of geontopower with work from urban political ecology (UPE) on urban metabolism (Heynen, 2014; Newell & Cousins, 2015; Swyngedouw, 1999; Swyngedouw & Heynen, 2003). Povinelli (2016) argues that Life and Nonlife cannot be understood as separated opposites, but rather as two permeable, dynamic and closely linked spheres. However, she observes a one-sided privileging of Life in Western ontologies, whereby its constitutive dependence on Nonlife becomes obscured. In order to overcome this biocentrism, Povinelli calls for greater attention to Nonlife and its transitions from and to Life. As we will demonstrate, such a "more-than-living" perspective allows for an expanded understanding of urban metabolism, focusing on the transitions between the spheres of Life and Nonlife without privileging one or the other.

Second, after discussing our methods, we take a closer look at the materiality and specific qualities of sewage. We show that sewage consists of both living and nonliving components, constantly oscillating between the spheres of Life and Nonlife, as new bacterial Life emerges from nonliving nutrients while former more-than-human Life is decomposed into its nonliving components. Based on this, we conceptualize sewage as Non/Life and argue that its specific properties pose a threat to urbanization.

Finally, we consider the historical emergence of different strategies for dealing with sewage in the city of Leipzig. Leipzig is a large city in Eastern Germany that gained great importance in the 18th and 19th centuries mainly due to its trade fair – a regular gathering of merchants trading and selling goods (Denzel, 2012). This led to a strong influx of capital into the city, which resulted in heavy industrialization, causing the city's population to grow from 32,000 people in 1800 to over 625,000 in 1914 (Walther, 2012, p. 204). However, we suggest that it is not enough to explain Leipzig's growth solely in terms of its trade fair and rapid industrialization processes. Arguing from a more-than-living perspective, we consider Leipzig's development as enabled through the control of the urban metabolism of Non/Life. As we will demonstrate throughout our analysis, techniques and strategies in sewage treatment explicitly target the non/living qualities of sewage, aiming at an ever-greater control of the transitions between Life and Nonlife. We argue that this development can be understood as the formation of an urban metabolism that works through the in-between of Life and Nonlife and in this way enables the growth of the city.

Urbanizing geontopower

The concept of geontopower was developed by anthropologist Elizabeth A. Povinelli (2016) to question and critically examine the duality of Life and Nonlife. Despite the scope of her proposal, her theoretical work has so far rarely been taken up and empirically applied (Carralero, 2024; Filho, 2021; Griffiths, 2022). However, we believe that Povinelli's (2016) concept holds great potential for urban geography as it enables to view urbanization processes from a different perspective. In the following, we therefore introduce the idea of geontopower and subsequently link it to UPE work on urban metabolism, in order to develop the concept of an urban metabolism of Non/Life.

Geontopower

In her monograph *Geontologies. A Requiem to Late Liberalism*, Povinelli (2016) draws on over thirty years of ethnographic fieldwork with members of the Belyuen community in the Northern Territory of Australia. Based on her empirical work, she argues that Western ontologies rely on privileging Life over Nonlife, thus introducing a dualism that obscures the threshold and transitions between both spheres. Povinelli refers to such ontologies as "biontologies" (Povinelli, 2016, p. 5), as they consider Life isolated from Nonlife and either ignore Nonlife or assess it according to criteria of Life. Hence, from a biontological perspective, Life would be fundamentally distinct from Nonlife through its intentionality, potentiality, the possibility of failure and death as well as the ability to reproduce and create something new (Povinelli, 2016, p. 44). Povinelli counters this by arguing that nonliving matter is the origin of all Life on this planet, which is why their difference is relative rather than absolute. Subsequently, Povinelli calls for greater emphasis on Nonlife and the symmetrization of both spheres: "Nonlife has the power to self-organize or not, to become Life or not. In this case, a zero-degree form of intention is the source of all intention. The inert is the truth of life, not is horror" (Povinelli, 2016, p. 45).

Building on this, Povinelli (2016) introduces the concept of geontopower through a critical discussion of the Anthropocene. She describes the Anthropocene as the staging of a drama that problematizes the vulnerability of Life as such and emphasizes the danger that it will turn to ultimate Nonlife. By centering the Human, she argues, the concept of the Anthropocene implies a series of antagonists – the Nonhuman, the Dead, the Never Alive – who seem to gain the upper hand and "act out a specific drama: the end of humans excites an anxiety about the end of Life and the end of Life excites an anxiety about the transformation of the blue orb into the red planet, Earth becoming Mars, unless Mars ends up having life" (Povinelli, 2016, pp. 11–12). Thus, on the one hand, the Anthropocene "point[s] to the perforating boundary between the autonomy of Life and its opposition to and difference from Nonlife" (Povinelli, 2016, p. 14). On the other hand, the Anthropocene reproduces this juxtaposition by "hold[ing] on to the distinction between Life and Nonlife and dramatiz[ing] the possibility that Life is always at threat from […] Nonlife" (Povinelli, 2016, p. 16).

Povinelli develops the concept of geontopower to make sense of this seemingly contradictory project and to account for the "reorganization and crisis of the governance of Life and Nonlife" (Povinelli, 2016, p. 172) as well as the "set of discourse, affects, and tactics" (Povinelli, 2016, p. 4) used for this purpose. Geontopower works through the clear demarcation and antagonistic separation of Life and Nonlife in this way trying "to keep an arrangement of accumulation in place" (Povinelli, 2016, p. 173). However, since uncontrolled and undesired transitions between Life and Nonlife are inevitable, Povinelli (Povinelli, 2016, pp. 173–174) describes geontopower as an ongoing, always precarious endeavor, "an activity of fixing and co-substantiating phenomena, aggregating and assembling disparate elements into a common framework and purpose. It is a set of dominant pattern, constantly tinkered with and revised according to local materials and conditions, according to which Life is fabricated and Nonlife is used."

Thus, geontopower refers to a form of governance characterized by the separation and control of transitions between Life and Nonlife, whereby Povinelli draws on and goes beyond Foucault's (2009) concept of biopower. Povinelli argues that biopower, understood as the governance of Life and death, is based on an "unmarked ontological assertion, namely, that there is a distinction between Life and Nonlife" (Povinelli, 2016, p. 8). The rationality of "making life and letting die" can only refer to living bodies and therefore presupposes a prior distinction between Life and Nonlife which Povinelli (2016, p. 17) criticizes as biocentric. She suggests that the distinction between Life and Nonlife should not be taken for granted, but rather understood as the product of powerful demarcations (Povinelli, 2016, p. 9). This change of perspective marks the key difference between geontopower and biopower. While the concept of biopower as well as the related concepts of thanatopolitics (Agamben, 1998) and necropolitics (Mbembe, 2003) apply exclusively to mortal – and thus living – beings, the concept of geontopower includes living and nonliving entities. Thus, the analysis of geontopower focuses on the different techniques and strategies used to control interactions and transitions between Life and Nonlife – and not between Life and death as it would be from the perspective of biopower. In this way, we suggest, not only can new entities be included, but also new power structures and governance strategies become visible. In the following, we attempt to harness the analytic potential of geontopower for urban geographies by proposing a conceptual link to the already established concept of urban metabolism.

Urban metabolism

Building on our discussion of Povinelli (2016), we suggest that geontopower is not only inscribed in the concept of the Anthropocene, but also marks processes of urbanization. The analytic focus on transitions between Life and Nonlife, we think, can improve our understanding of urban development and in particular of the urban metabolism, a central concept of UPE. While UPE "is clearly not a conceptual term in itself, nor does it represent a single theory or even one research agenda" (Gandy, 2022a, p. 34), it is rather to be seen as a "guiding and form-giving field of the urban sciences" (Keil, 2003, p. 728) that is characterized by the "linking of specific analysis of urban environmental problems to larger socioecological solutions" (Keil, 2003, p. 724). UPE is characterized by the fact that it rejects the modern dualism between nature and society and instead focuses on the socio-natural production process of the city, which was conceptualized by scholars such as Erik Swyngedouw (1996) as urban metabolism. Crucially, to argue that urban natures are in any way more metabolized than others would miss the point. Rather, as Braun put it: "[…] the networks that comprise urban natures are at once more dense, and more extended, than nonurban networks" (Braun, 2005, p. 642).

By using the term urban metabolism, UPE scholars refer to Marx's (1981) historical materialism and emphasize the dynamic relationship between "nature" and society, which is structured by a certain mode of capitalist production. Heavily drawing on Marx, Neil Smith's (2008) production of nature thesis has been highly influential for the conceptualization of metabolism in UPE. For Smith (2008) an apolitical understanding of nature always has to be seen as a specific "ideology of nature". Through this ideology, the profound link between capitalism and what is thought of as nature independent of society, can actually be hidden. This line of thought is probably best captured in Smith's expression: "we must now consider there to be a social priority of nature; nature is nothing if it is not social" (Smith, 2008, p. 47). While Smith's thoughts have sometimes been critiqued for reproducing the dualism between nature and society, Loftus (2017, p. 5) has recently asserted that "beneath the provocations and the aggressive prose, the production of nature thesis is acutely sensitive to nonhuman difference, to the interrelationships between human and nonhuman, while it also remains profoundly open to nuanced readings of coproduction and nonlinear science".

The latter has been a key concern of UPE: Beyond the claim to leave behind the dualism between nature and society, working with UPEs' concept of metabolism demands attributing nonhuman entities an active, constitutive role in processes of socio-ecological change. In the words of Ekers and Prudham (2017, pp. 1378–1379): "The concept of metabolism in this [Marxist] genealogy means that if the emergence of historically and geographically specific patterns of socionatural change is tied to particular social formations, the converse is also true: Social and environmental change, seen as a single metabolism, are truly conjoined and can only be 'thought' together". Ekers and Prudham (2017, p. 1379) go on to underline the necessity to take seriously the materiality of social life and the "constitutive role of 'lively' differentiated materialities in explaining trajectories of historical-geographical social change […]".

Since the very beginning of UPE dating back into the late 1990s and early 2000s, a large number of works have examined urbanization processes using metabolism as an analytical framework (Gandy, 2004; Heynen et al., 2006; Newell & Cousins, 2015; Swyngedouw & Heynen, 2003). In recent years, there has been a broader reflection within UPE with the aim of opening up new fields of research and integrating new conceptual approaches (Gandy, 2022a; Tzaninis et al., 2021). In his progress report, Heynen (2014) takes Smith (2006, p. xiii) as his starting point, who emphasizes "a sense of creativity" in the concept of metabolism, enabling new conceptual connections. Similarly, Newell and Cousins (2015, p. 718) propose to understand "urban metabolism as a boundary metaphor [that] offers the potential to bring together multiple attitudes and beliefs around a shared and recognizable concept". Doshi (2017, p. 125) in turn "makes a case for a more rigorous treatment of the body as a material and political site within the sub-field of urban political ecology" and conceptualizes urban metabolisms as embodied, whereby she argues for a stronger focus on social reproduction, politics of difference, affects, emotions and subjectivity. For her, metabolism is not just a metaphor, it "is embodied politics", which resembles Gandy's (1999, p. 36) much earlier argument that "[w]ater provides a powerful link between the body and the built environment, within which competing conceptions of public health and spatial order have become entwined". Finally, Barua (2019) and Barua and Sinha (2023) turn to non-human metabolisms and examine how both domesticated and free-roaming animals shape the city, thereby linking UPE with the growing field of animal and more-than-human geographies.

Encouraged by its framing as creative boundary metaphor (Newell & Cousins, 2015; Smith, 2006), we suggest to extend the understanding of metabolism as it may not only refer to the processing and circulation of matter, but also to the controlled transitioning of Nonlife into Life and vice versa: Metabolizing organisms integrate living and nonliving entities from the outside, process them inside their living bodies and subsequently excrete them as no-longer-living matter. In this sense, we aim to open up the study of urban metabolism to include Povinelli's (2016) notion of geontopower, focusing on how the control of material transitions between Life and Nonlife enfolds in and through urban contexts. This is fully in line with Swyngedouw and Heynen's (2003, p. 912) understanding of urban development as "predicated upon the transformation or metabolism of physical, chemical or biological components". However, while works from UPE emphasize the materiality, liveliness and agentic capacities of matter in analyzing urban metabolism, we go beyond this by understanding metabolism not exclusively as property of Life, but as powerful process in which Life and Nonlife are merged and separated. With such a more-than-living perspective, we aim to broaden the scope of UPE and ask how processes of urbanization are enabled by controlling the transitions between Life and Nonlife.

Beyond this broadening of scope, we consider the conceptual integration of the concept of geontopower into UPE to be justified and beneficial for three further reasons. First, just like UPE, Povinelli employs a non-dualistic method: while UPE attempts to overcome the opposition of society and nature by focusing on socionatures, the concept of geontopower helps to grasp the transitions and hybrids between Life and Nonlife. This enables UPE to overcome a further dualism firmly anchored in Western thought allowing, secondly, for a stronger understanding of environmental problems – the main object of investigation of UPE (cf. Keil, 2003). As Povinelli (2016, p. 174) points out, current ecological crises are decisively constituted by power structures that influence "which life is fabricated and nonlife is used". Third, Povinelli argues that the symmetrization of Life and Nonlife engenders an arising awareness of the intimate co-relation between the two spheres, which induces the repoliticization of Nonlife. Thus, the concept of geontopower contributes to the eponymous objective of UPE and strengthens a political perspective on urban ecologies.

Researching sewage in Leipzig

Although early work from UPE has already dealt extensively with water in the city (Bakker, 2003; Keil, 2003; Swyngedouw, 1999, 2004), it has focused primarily on domestic and industrial water supply and only marginally considered the disposal of sewage (cf. Karpouzoglou & Zimmer, 2016, p. 150). This has changed over the years so that a robust body of literature exists on the management of sewage in different places, focusing on its risk to human health (Karpouzoglou & Zimmer, 2016), its ecological damage (Casiano Flores & de Boer, 2015) or the financial structures of its treatment (McCulligh, 2023) and highlighting the political and economic dimensions of its management (see also Delgado-Ramos, 2015; Finewood, 2016).

However, inspired by the emerging field of discard studies (Boudia et al., 2022; Liboiron & Lepawsky, 2022), we aim to take a different approach and foreground the materiality of sewage. Boudia et al. (2022, p. 10) criticize that "residues are material objects, though often neglected or treated as immaterial", calling for greater scientific attention for their specific material properties. They argue that "residues are unruly, behaving and transforming unpredictably" (Boudia et al., 2022, p. 12), so that they "have a way of escaping modern production and regulatory systems" (Boudia et al., 2022, p. 11). In a similar vein, Liboiron and Lepawsky (2022, p. 33) strive to "show that systems and power are at the heart of wasting […] and to offer frameworks to identify and describe these modes of power". Methodologically, they propose a strategy of defamiliarization in order to "to interrupt popular, intuitive, expected, and common narratives about waste and wasting by using empirical research and cases from a range of disciplines" (Liboiron & Lepawsky, 2022, p. 11). A good example is Holmberg's (2021, p. 17) ethnographic method of "trash tracing", with which she follows sewage along its "metabolic pathways" and examines the interactions between sewage and more-than-human actors in wastewater treatment.

Building on this, we suggest that an ethnographic approach focusing on the unruly materiality of sewage is particularly suitable for our empirical investigation of the urban metabolism of Non/Life for two reasons. First, in this way, we aim to take seriously the origins of Povinelli's concept of geontopower, which she developed through many years of ethnographic fieldwork. In each chapter of her monograph, Povinelli (2016) focuses on a different non-human entity (e.g. mountains, fog formations or sea reefs) and examines how her collaborators engage with them. Her concept of geontopower thus arises from a careful ethnographic analysis of interactions with and perspectives on specific materialities, which we intend to do justice to in the following. Second, such an approach responds to Rademacher's (2015) call for a stronger integration of ethnographic methods into UPE. Starting from the criticism that Political Ecology has often been "politics without ecology" (Vayda & Walters, 1999, p. 168), she argues that an "ethnographic urban political ecology" (Rademacher, 2015, p. 146) has the potential to capture and analyze the entanglements between biophysical and social dynamics in a unique way, ultimately fostering a more cohesive understanding (see also Braun, 2005).

The starting point for our research was the already mentioned internship of the first author in the Leipzig WWTP in December 2023. The internship was designed as a two-week explorative participant observation which was inspired by sensory ethnography (Calvey, 2021; Valtonen et al., 2010) and focused not only on the spoken conservations with colleagues, but also on "the multisensoriality of experience, perception, knowing and practice" (Pink, 2009, p. 1). The aim of the internship was not only to gain insights into the functioning of the WWTP, but also to approach the sewage through smell, touch, sensation and affect. From this initial field phase, we developed an awareness of the unruly materiality of sewage, whose changing composition and biodynamic properties require constant adjustments to the treatment techniques. Building on this, we became interested in the extent to which the materiality of sewage structures not only the short-term adaptation of treatment techniques, but also the long-term developments of sewerage and WWTP since their beginnings over 250 years ago. As the majority of the original historical documents on the city's sewage infrastructure were burned during the Second World War, the first author conducted 15 semi-structured, qualitative interviews with experts from academia and practice in spring 2024 in order to obtain more information about the causes and reasons for the changes in sewage treatment. These interviews were recorded, transcribed and analyzed using qualitative content analysis (Kohlbacher, 2006). Furthermore, the first author conducted archival work in the *Deutsche Nationalbibliothek* (DNB) and the *Sächsisches Staatsarchiv* (SSA) in Leipzig and researched official documents and newspaper articles on sewage, its treatment and effects on the city. To supplement this, we have consulted historical and up-to-date technical literature on sewage treatment in Germany as well as secondary sources on the city's history.

Thus, our research draws on and combines data from participant observation, qualitative interviews and archival work. Although the impressions from the internship are only marginally addressed in the following, they provided the initial impetus to think about the in-between of Life and Nonlife and constitute the center and starting point of our argument. The interviews and archived documents, however, serve primarily as sources on which we base our historical reconstruction of the development of Leipzig's sewage treatment.

Metabolizing Non/Life: the development of sewage treatment in Leipzig

Sewage is an extremely heterogeneous substance, whose composition largely depends on the type of sewer system. While systems exist that separate rainwater from domestic and industrial wastewater (Ortleb & Kadner, 1960), Leipzig uses a combined system in which all runoff from the city is collected together (Brix et al., 1934, p. 558). While this procedure has the disadvantage that significantly higher volumes of sewage arrive at the WWTP and have to be processed there, its advantages are that it is "cheap, has developed from the existing system and is the most adaptable when the city expands" (Ortleb & Kadner, 1960, p. 44). Thus, in Leipzig, sewage "actually consists of everything that can fit through your toilet or the gully" as a worker at the WWTP stated.

However, in German WWTPs, no comprehensive analyses of sewage compositions are carried out on daily basis, but only the measurement of the total proportion of organic substances, the concentration of phosphate and nitrogen compounds and the pH value (Felber & Fischer, 2019, p. 59f.). Measurements of other components – for example micro plastics or drug residues – are usually not conducted due to a lack of methods, as a WWTP operator explains:

> And when we talk about drug residues, that's a broad field. Can I compare aspirin with an X-ray contrast agent, a cancer medication with this or that? Do I then have a sum parameter for all drug residues? […] We have no valid data basis. […] And now that we are talking about micro plastics, this is actually a substance that has only emerged in recent years. […] People have said that I can sift out a bit and count the pieces, but you can't get that far with it. Good methods are still lacking.

The precise composition of sewage is not only unknown, but also varies throughout the year, which is mainly due to different dietary habits. While in winter people tend to eat more nutritious food and thus produce more excrement, in summer sewage is more watery and contains fewer nutrients. At the WWTP in Leipzig, it was explained to me this way: "At Christmas, people eat a lot and then shit a lot. And in summer, many people eat salad … or are on vacation."

Moreover, sewage is not a static substance, but very dynamic and biologically active. Intestinal bacteria enter the sewage with human excrement, where they can multiply quickly due to the large amount of nutrients, break down organic components and consume oxygen in the process. If there is a lack of oxygen, the sewage starts to putrefy and produces hydrogen sulphide, which can lead to headaches, dizziness and unconsciousness. To prevent this, sewage is supplied with oxygen, as an employee of the Leipzig sewer system explains to me: "If you have poorly ventilated sewers, the sewage quickly putrefies. That typical smell that you get when you walk through the city, especially on warm days or when the weather changes. This is of course favored by a lack of oxygen. That's why we have sewer coverings with holes in it". Thus, the smell of putrefaction points to a process in which former Life is decomposed into its non-living, inorganic components thereby enabling new, bacterial Life. But it is not only bacteria and other microorganisms that multiply in and through sewage. Another employee mentions plants growing in the sewer system: "People eat tomatoes with seeds, they excrete them. And of course, if a tomato seed is left lying somewhere, on a platform or somewhere where there are a bit of nutrients, a bit of soil, a bit of sediment is sometimes enough, then it starts to germinate down there." In addition, sewage may also enable rats to proliferate: "Usually, if you use the toilet properly, the rat won't find anything in the toilet that is of interest to it. But if we dispose of food through these sewer nets, then the rat picks up the pasta or meat that we have thrown in there and then feeds on it."

Taken together, sewage consists of living, nonliving, no-longer-living and not-yet-living components, and constantly moves between Life and Nonlife by creating new Life on the one hand and decomposing former Life into Nonlife on the other. From this perspective, sewage cannot be clearly classified as either Life or Nonlife, as it blurs and confuses the differences between both categories, which is why we consider it non/living. We suggest that the non/living quality of sewage implies a number of characteristics that pose a threat to urbanization, as they hold the potential to undermine growth and accumulation processes. This includes its brown, semi-solid appearance, which can cause disgust, the intense stench that occurs during putrefaction, its unknown components, whose consequences for humans and the environment cannot be predicted, and its high nutrient concentration, which can lead to eutrophication in water bodies. Moreover and perhaps most importantly in this regard are the bacteria and viruses that enter the sewage through human excreta. This means, on the one hand, that sewage poses a serious health risk to the urban population; on the other, the presence of pathogens in the wastewater allows the monitoring of infection rates, which was implemented in Leipzig during the Covid-19 pandemic (Helmholtz Centre for Environmental Research, 2024).

This last aspect in particular connects our work with current debates within UPE that are investigating the links between the city and the spread of diseases. As scholars have demonstrated, urbanization not only leads to increased population density and thus to greater vulnerability to infectious diseases (Keil & Ali, 2007), but can also be understood as a cause of disease emergence. For example, Gandy (2022b, p. 213) examines the "zoonotic dynamics of urbanization" and argues that diseases that can be transmitted from animals to humans are caused and driven by the growth of cities and associated phenomena such as poverty, fluctuating market prices and illegal trade. Similarly, Treffers et al. (2022) argue that urbanization processes are often shaped by capitalist dynamics that alter sociocultural and material flows in ways that make the emergence of new zoonotic diseases more likely. Urbanization processes and infectious diseases thus stand in a dialectical relation and mutually affect each other. We propose a similar understanding of the relationship between non/living sewage and the city: On the one hand, urban populations and industries generate non/living sewage along with its unpleasant, health-threatening properties. On the other hand, the non/living quality of sewage is seen as potential threat to urbanization and the cause of the emergence of important urban infrastructures such as the sewer system or the WWTP, as we will argue in our analysis.

Furthermore, our notion of Non/Life mirrors Povinelli's (2016, p. 19) thoughts on the figure of the virus, "which seeks to disrupt the current arrangements of Life and Nonlife by claiming that it is a difference that makes no difference". In this sense, non/living sewage undermines the very foundation of geontopower as it questions the legitimacy of the categories of Life and Nonlife. However, Povinelli (2016, p. 19) clarifies that "while the Virus may seem to be the radical exit from geontopower at first glance, to be the Virus is to be subject to intense abjection and attacks". Crucially, Non/Life does not escape geontopower, but becomes its main target. In the following, we show how the strategies of repression, separation and appropriation emerged historically one after the other, resulting in an increased metabolization of non/living sewage and an intensified control of the transitions between Life and Nonlife.

1744: repressing Non/Life

The emergence of sewage treatment in Leipzig is closely linked to the economic development of the city and the history of its trade fair. Markets were held in Leipzig from as early as the thirteenth century, steadily growing in importance until the sixteenth century and becoming "the most important marketplace in central Germany with a distinctly supra-regional appeal" (Denzel, 2012, p. 97). The seventeenth century was largely characterized by the Thirty Years' War (1618 - 1648), which resulted in many deaths and the destruction of Leipzig, as well as a high level of debt for the city due to war burdens, which hampered economic development (Denzel, 2012). From 1680, however, Leipzig entered a "period of slow but steady growth" (Hasse, 1885, p. 123), in which innovations in trade policy played an important role. In 1682, a separate court for trade fair operations was established, which was intended to resolve disputes more quickly, increase legal certainty and in this way outperform other cities (Moltke, 1904). As result, the importance of the fair rose enormously and from the mid-eighteenth century Leipzig was the most important international fair in the Holy Roman Empire, with the city taking a central position in the circulation of "goods, money and information between the west and east of the continent" (Denzel, 2012, p. 99).

The rise of the trade fair led to strong population growth during the eighteenth century (Gränitz, 2013). In this time, the city's development was characterized by an increase in new and conversion of older buildings and with great emphasis being placed on representative facades and the combination of residential and commercial spaces (Mundus, 2016, p. 595). This period also marked the development of the first sewage infrastructures in Leipzig. While the sewage had previously been channeled into the city moat in open drains, from 1744 onwards the drains were covered and bricked up, making the sewage less visible (Liebich, 1928, p. 1). The coverage of the drains was initially limited to the city center, but at the end of the eighteenth century, the inhabitants of the suburbs demanded improvements and complained about the difficulties "caused by the fact that the existing drains froze in winter and had to be painstakingly chopped open. [...] When it thawed, the spilled garbage spread a terrible stench" (Liebich, 1928, p. 5). In response, the construction of canals was extended to the suburbs, so that by 1850 the entire city was covered (Liebich, 1928, p. 7).

However, the sewers constructed in this way differed significantly from their current form, as they were designed to exclusively drain liquids and were generally not connected to the houses. Solids were not disposed of through the sewers but in pits, allowing faeces to seep into the ground (Sanitätsausschuss Leipzig, 1869). This rather rudimentary disposal infrastructure facilitated the spread of deadly diseases such as typhoid and cholera: Between 1861 and 1866, the mortality rate in Leipzig rose from 2.4 to 4.7 percent, which the Leipzig Sanitary Committee attributed "in no small part" (Sanitätsausschuss Leipzig, 1869, p. 6) to the inadequate sewerage system, referring to experiences from England (Chadwick, 1842; Morley, 2007).

From the middle of the nineteenth century, not only the mortality rate in Leipzig rose sharply, but also the population grew in the course of the city's industrialization. Wealthy merchants from Leipzig invested in important key sectors of industrialization such as the railroad, coal mining and the textile industry, following the English example (Schäfer, 2012). Initially, these investments were made hesitantly, which is why Leipzig's industrialization progressed slowly. From 1870, however, they bear fruit and a large number of factories started up (Gränitz, 2013, p. 189). This was accompanied by exponential population growth: while 32,000 people lived in Leipzig in 1800, this rose to around 106,000 in 1870 and 625,000 in 1914 (Walther, 2012, p. 204).

In order to improve the health situation and at the same time enable the city's ongoing growth, the sewage system was restructured and greatly expanded. To drain the new residential and industrial city areas and to connect it to the existing sewage system, large central sewers were built which collected the sewage from the smaller sewers and led it directly into the river (Liebich, 1928, p. 9). These so-called *Vorflutschleusen* formed the main veins of the sewer system and were successively extended between 1883 and 1914 until they reached a total length of 26.5 kilometers (Liebich, 1928, p. 10). Another innovation was the introduction of municipal water pipes, which meant that flush toilets could be installed from 1876, enabling an alluvial sewer system and the drainage of sewage directly from the house (Mundus, 2018, p. 437). During this time, the total length of Leipzig's sewer system grew enormously: Whereas in 1883 it was a total of 83 kilometers, it grew to 225 in 1890 and to over 645 in 1927 (Liebich, 1928, p. 10).

The ongoing growth and industrialization of Leipzig was also reflected in the maintenance of the sewer system. For a long time, sewers were cleaned exclusively with hand brooms, which was laborious and time-consuming. Moreover, there was only one central equipment site in the east of the city, which meant that the workers had to move long distances to the sewer sections to be cleaned. The result was that "in 1901, only 120 km of the 280 km network of locks could be cleaned once, while the rest remained uncleaned" (Liebich, 1928, p. 14). This led to problems as, on the one hand, the sewage could back up and, on the other, deposited substances began to putrefy, causing a strong stench. To counteract this, four cleaning districts were set up from 1901, each with a head of department, two foremen and around 150 workers. Mechanical equipment was also purchased to facilitate the cleaning of the sewers (Liebich, 1928, p. 14).

Taken together, over a period of around 150 years, the sensory perception of sewage through eyes, nose, and touch became ever more minimized. We understand this development as an attempt to increasingly repress sewage and its transitions between Life and Nonlife from the city by expanding the sewer infrastructure in order to combat its non/living qualities of foul stench and the spread of disease. In this way, the growth of the city was facilitated and secured through a more representative appearance and an improved health situation. At the same time, the increasing exclusion of the in-between of Life and Nonlife produced an intensified separation and duality between both spheres. For Paris, Gandy (1999) describes a similar development: by the end of the nineteenth century, the sewer system there had also been massively expanded and restructured, which overcame "pre-modern conceptions of urban order and introduced a new set of relationships between water and urban society" – a process he understands as "the rationalization of urban space" (Gandy, 1999, p. 31). Building on this, we suggest to conceptualize the expansion of urban sewer systems as transformation of the urban metabolism, which enabled the economic and spatial growth of the city through the repression of Non/Life.

Our argument resonates with the work of Laporte (2002), who understands public hygiene infrastructure as the precondition for Western urbanization and the emergence of the modern subject. From a legal perspective, Benidickson (2007) argues that the introduction of flush toilets made the urban population more dependent on public infrastructure, which gave urban authorities more power and influenced urban planning. Further to this, Hawkins (2005, p. 67) claims that public responsibility for the disposal of private excrements led to "an ethical blindness about its management", so that issues of sustainable production and consumption became less relevant laying the foundations for capitalist urban development.

Interestingly, the links between capitalism, urbanization and the introduction of sewerage systems were already noted in the 1860s by Karl Marx (1981), who was living in London at the time. The introduction of the sewer system there led to human excrement being discharged directly into the Thames, which meant that the nutrients it contained could no longer be used for agriculture, as they had been before in the so-called nightsoil system. Based on these observations, Marx argued that social alienation from nature under capitalism results in the destruction of ecological cycles, from which Foster (1999) later developed and popularized the concept of the metabolic rift (see also Clark & Foster, 2009; Foster, 2000; McClintock, 2010; Napoletano et al., 2019). Taking up this debate, our more-than-living perspective suggests that with the introduction of the sewer system, not only did a rift in nutrient cycles and between society and nature emerge, but also between Life and Nonlife, since their non/living transitions and hybrids became increasingly repressed from the city.

Centering on the non/living quality of sewage, we suggest conceptualizing its intensified repression as a process of abjection. The concept of abjection is largely based on the philosophical work of Bataille and Kristeva, both of whom understand abjection as an act of exclusion. While Bataille (1970, p. 218) refers to a part of the population that is "excluded from life by a prohibition of contact", Kristeva (1982, p. 4) takes the term to name something that "disturbs identity, system, order". In the context of more-than-human geographies, Fleischmann (2023, p. 5) recently argued that processes of abjection "work towards the exclusion and rejection of both human and nonhuman parts of the socio-material order, which, for one reason or another, confuse dominant categorizations, trespass certain spatial boundaries or challenge socially produced distinctions and hierarchies". This seems to be particularly true for the case of non/living sewage, which consists of no-longer-living excrement, spreads putrid stench and can cause cholera and typhoid through multiplying bacteria, in this way undermining the distinction between Life and Nonlife and jeopardizing the growth and productivity of the city. In her essay *Powers of Horror*, Kristeva (1982) explicitly points to human excretions and argues that these are not abject because of a "lack of cleanliness or health" (1982, p. 4), but because they challenge the boundaries of Life: "These body fluids, this defilement, this shit are what life withstands, hardly and with difficulty, on the part of death. There, I am at the border of my condition as a living being. My body extricates itself, as being alive, from that border. Such wastes drop so that I might live […]" (1982, p. 3). Thus, in order to secure Life, it is not Nonlife that must be excluded, but rather the ambiguous in-between – a logic that manifested itself in the repression of sewage in Leipzig.

1893: separating Non/Life

Nevertheless, it soon became obvious, that the repression of sewage merely shifted the problem "from the street to the river" (Ortleb & Kadner, 1960, p. 11). This was not only due to the fact that the sewage was disposed of untreated into the rivers, but also to the construction of the sewers, which were intentionally lengthened to keep the gradient as low as possible and allow solids to sediment (Liebich, 1928, p. 15). The reason for this was the belief that it was more economical to remove solid components of the sewage from the sewers rather than from the rivers. However, no consideration was given to the fact that dissolved components would begin to foul themselves through prolonged contact with the decaying deposits. The consequences were devastating: in the archived files of the city of Leipzig, there are repeated reports of mass fish kills, excessive algae growth and severe river pollution, whereby the following quote is particularly impressive: "The river had a dirty coffee-brown color when it was at normal flow. As the water level gradually dropped, an inky-looking, thick, spongy mass of sludge appeared, which initially undulated back and forth sluggishly. The sludge seemed to be alive; it spread a pestilential stench. […] The sight of the blackened mass of water, covered in dirty mud and bubbles, was indescribably disgusting" (SSA: 20028-3963).

As increasing complaints came from mills, other water-dependent industries and the surrounding villages, a new strategy for the treatment of sewage had to be found. The Leipzig City Council was under great pressure because, on the one hand, the companies threatened to file a complaint with the Chamber of Commerce (SSA: 20028-3964). On the other hand, the strong population growth led to the city conducting negotiations with the surrounding municipalities from the end of the nineteenth century in order to incorporate them and continue to grow. For these reasons, the city council decided in 1893 to invest in a WWTP and to issue a public competition for its planning (Zeitschrift für Transportwesen und Straßenbau, 1894). Out of 42 participants, the Cologne engineers Steuernagel and Berger won with their proposal, which was "designed on a large, manageable scale and based on clear, proven chemical and physical processes, guaranteeing simple, safe and cheap operation" (Steuernagel, 1894, p. 137).

Already in 1894, the construction of the WWTP began, which initially consisted of a screening station, in which coarse components were filtered out of the sewage, and of four settling basins in which the flow rate of the sewage was reduced so that solids could settle to the bottom. The resulting sludge was delivered directly to the farmers, who used it to fertilize their fields. While the sludge was initially removed from the basins by hand using shovels and scrapers, the first power house was built at the WWTP in 1902, allowing sludge pumps to be operated. In 1907, a sand filter was constructed, in which the flow rate was reduced less than in the settling basins so that only heavier substances could settle there. Furthermore, iron sulphate was added to the sewage as a precipitating agent, whereby dissolved phosphate compounds and hydrogen sulphide are bound and settle as sludge (Imhoff, 1953, p. 115). From 1928, chlorine gas was also added to the sewage, which "kills plant and animal life" (Imhoff, 1953, p. 117) and thus contributes to the disinfection and containment of epidemics, as bacterial pathogens are eliminated (Arnold, 1953, p. 307).

Due to the mechanical and chemical treatment processes at the WWTP, sewage is no longer simply repressed from the city, but is separated into different parts. Undissolved solids are removed from the sewage through sieves and the reduction of flow velocity, whereby the arrangement of the stations enables sorting. While larger components are filtered out in the screening station, the heavier and predominantly inorganic components sediment in the sand filter and the lighter, organic solids are removed in the settling basins. In this way, the sewage was separated along the axes of size, weight and organic/inorganic, which on the one hand led to reduced pollution of the rivers. Visible components of the sewage no longer entered the rivers, inorganic pollutants were partially filtered out and the deposition and chlorination of organic components reduced the load of pathogens and nutrients, which also reduced the smell of putrefaction. On the other hand, the separation of sewage enabled a more efficient use of the deposited sludge. While residues were initially collected and put into the fields all together, the sand filter made it possible to largely isolate the inorganic substances without fertilizing effects, which were then deposited on landfills. The predominantly organic deposits from the settling basins were pumped onto plots and dried there for three to four months, depending on weather conditions, which was intended to reduce its volume, increase the nutrient concentration, eliminate pathogens and thus produce an improved fertilizer (Mahler, 1966).

We understand the separation of sewage as a direct response to its unruly non/livingness. As sewage resisted its complete repression from the city through its stench, the clogging of sewers, and the pollution of rivers, a new strategy to govern Leipzig's metabolism and maintain the city's growth had to be developed. The enormous pressure that the non/living quality of sewage can exert on the governance of cities is particularly evident in Tarr and Yosie's (2005) environmental history of Pittsburgh's sewage infrastructure. Although political decision-makers were reluctant to make the high investments in the introduction of a WWTP and corresponding adjustments to the sewer system until the middle of the twentieth century, persistent river pollution and the ongoing spread of infectious diseases made these inevitable, so that they finally had to undertake the necessary measures. Against this background, we argue that the techniques in the WWTP explicitly target the non/living quality of sewage, attempting to isolate organic from inorganic components as best as technically possible. Additionally, the use of chemicals aimed to reduce processes of putrefaction, the proliferation of bacteria and the eutrophication of rivers thereby suppressing undesired transitions between Life and Nonlife more strongly. Thus, the WWTP separated sewage into as homogeneous parts as possible so that they can be managed according to their specific properties.

Our findings support Kaika's (2005) earlier argument that European urban development in the late 19th and early 20th centuries was characterized by the disciplining and combating of natural processes. Using the example of the water supply in Athens, she illustrates the emergence "of the city as independent from the function of a now tamed nature, thus positing the city as a realm separate from nature's processes" (Kaika, 2005, p. 137). The chemical treatment of pathogens with chlorine gas also points to the idea of the "bacteriological city", described by Gandy (2006) as an administrative, technical and political formation shaped by advances in disease epidemiology between the end of the 19th and the middle of the twentieth century and leading to extensive infrastructural measures (see also Melosi, 2000).

Moreover, the strategy of separation resonates with what Deleuze and Guattari (1987, p. 352) describe as process of stratification: Through reinforced boundaries and increased demarcations, differences are restricted and homogeneous bodies with determinable qualities are produced. In this way, formerly smooth spaces, characterized by boundlessness, dynamism and continuous becoming, are transformed into clearly defined, static, and – most importantly – controllable spaces. Drawing on the idea of stratification, we argue that Leipzig's WWTP governed the city's metabolism by separating sewage in order to reinforce the opposition of Life and Nonlife, better control the transitions between both spheres and secure the city's growth.

1987: appropriating Non/Life

Although the mechanical and chemical separation of sewage in the WWTP had already led to significant improvements, two new problems emerged over time. First, although the population in Leipzig declined after the Second World War and shrank slowly during the German Democratic Republic, the volume of sewage in Leipzig continued to rise, mainly due to the expansion of water pipes and increasing water consumption in households and industry (SSA: 20028-3965). In the WWTP, the increase in sewage required correspondingly larger quantities of chemicals to bind nutrients, which would result in significantly higher operating costs. As the WWTP did not have sufficient financial resources for this, more and more phosphorus and nitrogen compounds entered the river, resulting in eutrophication and consequent fish kills and strong algae growth. Second, the months-long drying of the sewage sludge in open pits led to the accumulation of plant seeds in it, which hindered its agricultural use. Furthermore, despite the long storage period, pathogens were found in the dried sludge, which posed a potential risk to grazing livestock and the consumption of farmed crops (Mahler, 1966, p. 40).

In order to enable cost-effective nutrient elimination with persistently high sewage volumes, there were various experiments with biological methods of sewage treatment in Leipzig since the beginning of the twentieth century (SSA: 20028-3965). Because of the initial lack of funding and space, it was not until 1987 that a large-scale biological treatment process was integrated into the WWTP and an activated sludge method was chosen. For this purpose, an additional basin was built behind the settling basins in which the sewage flows through a total of four cascades. In this process, the sewage becomes mixed with activated sludge populated by bacteria and other microorganisms, which, according to a WWTP operator, do not differ substantially from the microbes already present in the sewage. During the internship, it was explained to the first author that the sewage acts as food for the microbes: In order to multiply, they extract carbon, oxygen, phosphorus and nitrogen from the sewage, breaking down organic and inorganic compounds. Biological decomposition processes that also take place in sewer systems or rivers are concentrated in the WWTP, which solves the problems of putrefaction and eutrophication. In this sense, Imhoff (1953, p. 153) describes the activated sludge process as "artificially enhanced self-purification. The processes are exactly the same as those in a natural river or lake. The only difference is that the organisms responsible for purification are crowded together in the aeration tanks in enormous numbers in a small space. An artificial supply of air ensures that the organisms still find sufficient oxygen despite their concentration." But not only does oxygen have to be added to the activated sludge, the sewage must also be kept in motion and repeatedly mixed so that the sludge does not settle. Furthermore, lime is added to the sewage so that its pH value corresponds to the optimal living conditions of the microbes. Moreover, acetic acid is used to add extra carbon to the sewage, which "feeds" the microbes and makes them more efficient, as a worker at the WWTP explained to me.

After the sewage has passed the activated sludge basin, it reaches the secondary clarifier, where the sludge settles to the bottom. Most of the activated sludge is pumped back from there and mixed with "fresh" sewage – however, as the microbes multiply, the volume of the sludge grows and part of it has to be removed. Together with the organic sediments from the settling basins, it is pumped into digestion towers, which were put into operation in 1995. As in the activated sludge process, the operation of the digestion towers is based on the work of microbes that enter the tower with the sludge. However, as no oxygen is added during digestion, anaerobic bacteria living under low-oxygen conditions are primarily responsible for the decomposition processes that take place there (Imhoff, 1953, p. 181). In Leipzig, the sludge remains in the digestion tower for around 27 days and is kept at a constant 30 degrees Celsius, which enhances the activity of the bacteria and accelerates the digestion process.

The degradation proceeds in several stages, whereby the microbes produce methane gas, causing the sludge to decrease in volume and reducing the costs for its disposal (Felber & Fischer, 2019, p. 215). Furthermore, in Leipzig the methane gas produced by the digestion process is extracted from the digestion tower and is burned in a combined heat and power plant since 2006, allowing the WWTP to cover a large part of its energy demand itself. Since treatment in the digestion tower, in contrast to drying in the field, prevents plant seeds from contaminating the sludge, sewage sludge remained a popular fertilizer for many years, which made it cheaper for the WWTP to dispose of. However, as heavy metals, micro plastics and so-called forever chemicals accumulate in it, its use is being viewed increasingly critically, with the result that its agricultural application will be gradually banned in Germany from 2029. Nevertheless, the operation of the digestion towers reduced the overall costs for sewage treatment significantly, so that the sewage charge paid by the city's residents has been lowered.

Thus, both the activated sludge process and the digestion towers adopt biological processes in order to reduce the nutrient content in the sewage and the costs for the disposal of the resulting sludge, making sewage treatment more efficient. We suggest understanding this strategy as the appropriation of the non/living quality of sewage: The transitions between Life and Nonlife taking place in sewage are no longer merely repressed by the sewer system or suppressed by methods of separation, but are now spatially concentrated, intentionally stimulated and increasingly integrated into sewage treatment. By appropriating the non/living attributes of fertility and fouling, the eutrophication of rivers, undesired plant growth in the field or the spread of disease can be prevented more effectively, which points to an intensified control of the transitions between Life and Nonlife.

Our observation resonates with Deleuze and Guattari's (1987, p. 355) claim that processes of stratification often involve strategies of appropriation. As an example, they refer to the historical instrumentalization of water, whose dynamic, "smooth" power is forced into determined paths and thus itself contributes to further stratification: "the State needs to subordinate hydraulic force to conduits, pipes, embankments, which prevent turbulence, which constrain movement to go from one point to another, and space itself to be striated and measured, which makes the fluid depend on the solid, and flows proceed by parallel, laminar layers" (Deleuze & Guattari, 1987, p. 363). Analogously, non/living sewage is appropriated by the WWTP – the high nutrient content, proliferating bacteria and processes of putrefaction in sewage are no longer only seen as danger to the urban growth, but also as an opportunity to control the transitions between Life and Nonlife more intensively and effectively. Our argument echoes the work of Schneider (2011, p. xvi), who describes the biological processes in the WWTP as an "industrial ecosystem" in which "the metabolic processes of an ecosystem are exploited to extract resources such as food, fabrics, pharmaceuticals, or fuel". Following this, we understand the appropriation of Non/Life as a third strategy to govern and stabilize Leipzig's metabolism in order to enable the city's growth.

Throughout this article, we have demonstrated that the actual techniques and strategies for sewage treatment can only be fully understood through the theoretical awareness of and methodological engagement with the non/living materiality of sewage. Interestingly, the resulting periodization of Leipzig's sewage treatment into the paradigms of repression (1744 – 1893), separation (1893 – 1987) and appropriation (1987 – today) shows strong parallels to the work of the environmental historian Martin Melosi (2000), who divides the sanitary development of American cities into the age of miasmas (from Colonial Times – 1880), the bacteriological revolution (1880 – 1945) and the new ecology paradigm (1945 – today). In his study, Melosi (2000, p. 6) focuses on technological choices "informed by and within the context of the prevailing environmental theory of the day" and thus understands sewage infrastructure as dynamic manifestation of historically evolved knowledge systems.

Building on our empirical research in Leipzig, however, we suggest that urban development and sewage infrastructure cannot be understood as the sole result of social structures, but rather as co-constituted by sewage and its unruly materiality, which repeatedly exceeds human control. Even by appropriating Non/Life through the activated sludge method, the unruliness of sewage persists and, as Bradshaw (2024) has recently shown, antimicrobial resistance presents a persistent danger. As he puts it: "within the confines of the WWTP, the complex, heterogenous and cross-cutting chemical flows of late modernity (principally of antibiotics, heavy metals, pharmaceuticals and pesticides from urban wastewater and runoff) interact with microorganisms to sculpt the latter's adaptive evolutionary trajectories" (Bradshaw, 2024, p. 9). In our view, this supports Povinelli's (2016) claim that geontopower and its control of the transitions between Life and Nonlife can only ever be a precarious endeavor.

Conclusion

The aim of this article was to develop a more-than-living perspective as a new framework for understanding urban development by focusing on the transitions between Life and Nonlife. To this end, we first integrated Povinelli's (2016) concept of geontopower into the study of urban metabolism and argued for understanding metabolism as a powerful process in which Life and Nonlife are merged and separated. In order to demonstrate the analytical fruitfulness of our approach, we used the case of sewage treatment in Leipzig and identified repression, separation and appropriation as three complementary strategies of geontopower, which increased the efficiency of sewage treatment and, in this way, enabled the growth the city.

Although much has been written on the significance of sewage infrastructures in urbanization processes, we believe that our more-than-living perspective, adds an important layer to ongoing debates in UPE and beyond. While previous work from UPE has focused primarily on the relationship between society and nature in the city, interpreting the emergence of urban sewage infrastructure as a process of taming and exploiting the natural (cf. Kaika, 2005; Schneider, 2011), we argue that urbanization and sanitation are based not only on dichotomous constructions of society and nature, but also of Life and Nonlife. However, we have shown that such a dichotomy has never been achieved in Leipzig and is constantly subverted by the unruly materiality of sewage. Thus, geontopower – understood as the governance of urban metabolism by controlling the transitions between Life and Nonlife – ensures und drives urbanization but is at the same time always prone to uncontrolled and undesired transitions. We suggest that a more-than-living perspective that centers on these processes allows for a refined understanding of the governance of urban metabolism and provides a productive starting point for further research.

Beyond our example of sewage treatment, the article is an invitation to consider cities from a more-than-living perspective that foregrounds unruly materialities and their multiple transitions between Life and Nonlife. We suggest that three approaches are particularly suitable for this: First, by looking at non/living *processes* – for example, digestion, putrefaction or fermentation – it can be explored how the emergence of Life and decomposition into Nonlife subvert or become integrated into urban formations. Second, focusing on non/living *entities* – for example mold, sewage or autumn leaves – allows for new perspectives on urban techniques, strategies and infrastructures that deal with them. Third, non/living *spaces* – for example, circular halls and cemeteries, but also breweries and WWTPs – can be examined to understand how controlled and uncontrolled transitions and hybrids between Life and Nonlife influence and constitute urban spaces. Ultimately, we hope that greater awareness of the different qualities of Non/Life and how humans and non-humans deal with them will not only help us to deepen our understanding of the urban, but also to explore new ways of becoming in the context of planetary crises.

Acknowledgements

We would like to thank the two anonymous reviewers as well as the working groups of human geography and economic geography at the Catholic University of Eichstätt-Ingolstadt for their valuable feedback on this paper. In addition, the first author thanks all his interlocutors for their time taken and the insights provided. Finally, he thanks and apologizes to Julia Findeisen and Max Osmann for recurring discussions about sewage and Non/Life, which helped to develop the overall argument.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Research ethics and consent

All interlocutors gave their informed consent to contribute to the research anonymously. Consent was given, written in the case of scheduled interviews and verbally in the case of chance encounters and spontaneous conversations during the internship at the wastewater treatment plant.

Data availability statement

The data that supports the findings of this study were mostly derived from resources available in the public domain, as indicated in the reference list and methodological discussion. The interviews and observations conducted by the first author will not be made public, as no consent was obtained for this purpose.

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