3. Understanding temporalities in urban future-making

Embracing temporal mess and handling urban matter

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Introduction

It is commonplace that future-making is about time. Surprisingly, though, it seems that extant literature does not reflect this obvious conjunction in an adequate fashion. There is, on the one hand, a diverse and rapidly expanding body of work that addresses the future as well as the ways in which it is tackled. *Future*, *future-making*, and *futuring*, as subjects of conceptual reasoning and empirical research, are in vogue, most clearly in the growing field of 'transition studies' (e.g. Haugland, 2023; Ertelt and Hawxwell, 2025), but also in (economic) sociology (Beckert, 2016; Esposito, 2024), environmental policy research (Hajer and Versteeg, 2019; Oomen et al., 2022), and most recently also in management and organization studies (e.g. Wenzel et al., 2020; Comi et al., 2025). In this extensive body of work, time is obviously tackled in one way or another; however, 'an explicit discussion of temporal aspects is often quite limited', as Haugland (2023) maintains with regard to transition studies.

On the other hand, also time and temporality are experiencing a recent rediscovery in several parts of the social sciences. Whereas a 'sociology of time' had already gained traction by the 1980s with the work of Norbert Elias (1984), Anthony Giddens (1984), Eviatar Zerubavel (1985), and Helga Nowotny (1992), among others, recently, more applied disciplines such as (again) management and organization (Hernes, 2022; Blagoev et al., 2024), but also planning (Beauregard, 2015; Laurian and Inch, 2019; Abram, 2020; Dobson and Parker, 2025), have explicitly sought to integrate time and temporality into their conceptual apparatus. The future does appear in the extant work on temporality as the open-ended element within the complex entanglements between

past, present, and future. An explicit conceptualization of the future and, in particular, of future-making, remains yet to be done.

Our intention with this chapter is to help close the gap between the rich work on future-making, on one side, and time and temporality, on the other, and to relate our insights into this conjunction to the urban. This undertaking goes in several steps: We begin with three points of departure that we consider as conceptual contact zones between the two literatures. The first of these starts with the *future*, and with how the future has become and changed as a relevant temporal category; the second revolves around *time*, and the ways in which temporal structures have become reified and shape social life, but can, however, also be purposefully shaped; finally, the third starting point focuses on *making*, or on the temporalities that are inherent in social agency (Emirbayer and Mische, 1998). Next, we try to translate the result of this conceptual orientation onto our idea of urban future-making. We do this from two contrasting perspectives that, in our view, echo the two sides of professional practice in the urban built environment. That is to say, we look into the *subject* of urban future-making: the built environment professionals and their agency. More specifically, we probe into the three classic formats of professionally embracing the future. Following to that, we focus on the *target* of urban future-making, the urban spaces that built environment professionals address in their architectural, engineering, and planning activities. Here, our attention is specifically on the role of the materiality of the urban built environment. Urban matter, on one side, constitutes the object of professional agency. On the other, the built environment has its own temporalities that shape this agency.

Our argument is that the analysis of time and temporalities in urban future-making – from whatever perspective we start – reveals critical challenges: ambiguities, tensions, knowledge limitations. Urban future-makers, it seems, chronically run the risk of getting lost in what we suggest to call a temporal mess. They cannot control multiple temporalities with the tools they are trained to work with, and they lack the ability to fully oversee and anticipate the dynamics of urban matter. And yet, we consider essential for built environment professionals (and also for built environment researchers) to proactively and productively embrace time – as category that we need to understand if we seek to come to terms with urban future-making; but also as source and driver of agency that urban future-makers can leverage and purposefully shape in their professional practice. But we will now move on to the conceptual realm.

Time and future-making: Conceptual contact zones

Let us begin with the first point of departure – *future*: There is a general consensus that future and, even more, future-making are essentially modern concepts. 'Detraditionalization' (Beckert, 2016, among many others) changed the 'temporal dispositions' of societies; no longer does the cyclical reproduction of the past or the expectation of a sacred hereafter determine our understanding of the time to come. The future turned from something to be fulfilled into 'a contingent construct' (see Volont in this volume), that is, into an essentially malleable path ahead, or, in a nutshell, 'future matters' (Adam and Groves, 2007). At the same time, an open future is essentially uncertain, and the greater the variety of possible 'future presents' (Esposito, 2024), the greater the uncertainty. Matthias Wenzel, Hannes Krämer, Jochen Koch, and Andreas Reckwitz (2020) maintain that the uncertain side of future-making has become evident only quite recently, from about the 1980s onwards. Particularly in large parts of the 20th century – a period that the authors call 'organized modernity' (ibid.: 1446) – organized planning practices and the assumption of persistent progress conveyed at least the idea of a controllable future and therefore helped 'de-problematize' (ibid.: 1444) the time to come.

As to the second starting point, modernity and modernization, besides opening up the future, have also fundamentally transformed the role of *time* in society. Most obviously, this transformation has implied what Zerubavel (1985: 2; emphasis in original) refers to as a '*socio-temporal order*, which regulates the structure and dynamics of social life'. This order builds on 'temporal regularities' (ibid.: 1) – or 'hidden rhythms', as the author has titled his seminal book. Zerubavel explains these rhythms in terms of the different temporal 'dimensions of […] any situation or event' (ibid.): *sequence; duration*; *timing* (i.e. 'temporal location'; and the rate of *recurrence*. The rise of temporal regularities was based on the introduction of two powerful time-related devices: the *calendar* and the *clock*. Whereas the first primarily allowed for the regulation of 'the temporal location of […] collective events' (ibid.: 31), the mechanical clock standardized both the duration and the determination of actual points in time.

One cannot, however, regard the socio-temporal order as fully unalterable. In principle, temporal sequences, rhythms, durations, and timings are malleable, provided that the 'members of the broader community accept and enact the newly mandated structures' (Orlikowski and Yates, 2002). What is more, measurable time can be framed as a (limited) resource that one needs to 'opti-

mally' deploy (Zerubavel, 1985: 57). In this vein, Orlikowski and Yates introduce the notion of 'temporal structuring' (2002: 684). Time, then, not only shapes behaviour but can itself be purposefully mobilized and manipulated: '[P]eople […] can also choose (whether explicitly or implicitly) to (re)shape those temporal structures to accomplish their situated and dynamic end' (ibid.: 688).

When it comes to the future and to future-making, the socio-temporal order has contradictory implications. In a way, it renders the future predictable – at least to a certain degree, and along with other institutional elements (Adam and Groves, 2007: 8); temporal regularities engender expectations and enable scheduling and planning beyond the present moment. They afford, thus, a '*temporal anchoring of normalcy*' (Zerubavel, 1985: 20, emphasis in original) – or 'temporal landscapes' (Tavory and Eliasoph, 2013: 909) – that can be extrapolated into the future. That a university programme lasts 5 to 6 years, for instance, makes the calculation of parents' financial support possible. That municipal assemblies are re-elected every 4 to 5 years requires and allows for the alignment of plans and projects with these cycles. Deviations from normalcy – temporal irregularities – irritate, as they frustrate expectations or cause 'cognitive incongruity between social figures and temporal grounds' (Zerubavel, 1985: 22). However, deviating from extrapolated normalcy can also occur as an act of temporal structuring or – in other words – of purposeful future-making.

The third and last conceptual starting point, then, addresses more explicitly the *making* in future-making. More specifically, it relates to 'agency' and the way Mustafa Emirbayer and Ann Mische (1998) view 'agency' as 'temporally embedded', that is,

> as composed of variable and changing orientations within the flow of time. Only then will it be clear how the structural environments of action are both dynamically sustained by and also altered through human agency – by actors capable of formulating projects for the future and realizing them, even if only in small part, and with unforeseen outcomes, in the present. (ibid.: 964)

In the authors' words, those 'variable and changing orientations' form a 'chordal triad' of 'constitutive elements […]: iteration, projectivity, and practical evaluation' (ibid.: 970), corresponding broadly to different temporal orientations – the past, the future, and the present, respectively. For obvious reasons, our interest here is mainly on the future orientations, i.e. the element

of projectivity, as 'the imaginative generation […] of possible future trajectories of action' (ibid.).

What is important for our focus on urban future-making? The three elements of the 'chordal triad' interrelate and overlap. Projectivity, hence, implies different ways of reconnecting past experience and present needs with narratives of possibly alternative futures. What is more, projectivity itself exhibits its own internal 'chordal structure' (ibid., 988). As a consequence, it can oscillate between narrative imaginations and practical ('experimental') enactments – or, in short, be oriented more to the 'future' or more to 'making'.

Probing the agency of urban administrators in European cities, Barbara Czarniawska (2004) connects Emirbayer and Mische's chordal triad of past, present, and future with the different time perceptions of *chronos* (clock-time) and *kairos* (event-time): 'Chronology organizes the present (extended to the immediate future). The past and the distant future are governed by kairotic time' (ibid.: 776). Hence, for those professional urban future-makers Czarniawska refers to, the closer their perspective onto the future is to the present, the more it is dominated by the clock and the rigid temporal structures that both shape and help organize our collective life. Conversely, the greater the distance to the present, the more addressing the future is about its qualities. Reiterating our phrasing above, then, one could summarize that the actual 'making' tends to follow the clock, while the 'future' is oriented mainly along imaginaries and narratives.

Taken together, the temporalities of future-making seem to incorporate several essential ambiguities: Modernity has rendered the future both malleable and uncertain, and recent social and institutional transformations have exacerbated uncertainty. The socio-temporal order that frames social life adds to the predictability of the future but reduces the scope for substantial change. Engaging with this order, however, seems to constitute a powerful act of future-making in itself. Finally, future-making is genuinely entangled with the chordal triad of past, present, future. Acting in the present, then, has an impact beyond the current moment. In turn, visions of the future change the ways we act now.

In the next two sections of this chapter, we look into how these ambiguities translate into the actual practices of urban future-making. That is, we discuss how built environment professionals address and try to cope with the outlined time-based ambiguities, and we probe the role of urban matter with regard to these ambiguities.

Plans, projects, experiments: Temporalities of embracing urban futures

Put broadly, there are two temporal orientations that professional urban future-makers may (and possibly need to) adopt when seeking to come to terms with the future. The first aims at the *stabilization* of interactive or collective action for the time to come. This thrust parallels what Barbara Adam and Chris Groves (2007: 6, 39) call 'the future tamed'. In contrast, the second orientation focuses more on *transformation*, i.e. on the 'projective' tone in Emirbayer and Mische's (1998: 970) 'chordal triad'. While it is the projective capacity that is usually considered the core competence of architects, planners, and civil engineers, their professional expertise consists in the combination of both, that is, in the capacity of imagining as well as securing the materialization of narrated or imagined futures. This double expertise reveals itself in particular in the formats of future-making that built environment professionals usually employ: *plans*, *projects*, and, more recently, *experiments*. All three of these formats not only seek to invent and narrate alternative future trajectories, or to 'formulate and visually represent conjectures' (Thompson and Byrne, 2022: 250) about the time to come, they also seek to tame this time. And each of these formats exhibits its own set of temporalities.

Plans, most clearly, are to control the future, at least theoretically. In most classic definitions, the actual act of planning implicates two temporally sorted elements that can be ordered in either sequence: On the one hand, planning consists of a series of decisions in which the first decision (in the present) narrows the scope of and thereby establishes the premises for decisions that follow (in the future) (Luhmann, 1971; see Ibert in this volume). On the other hand, planning involves the development of objectives or visions for the future and the prescription of actions designed to achieve those objectives (Wildavsky, 1973); the plan for the *future*, then, 'acts […] as a vehicle for *present* action' (Abram, 2014: 131). As a rationalist variant of this latter order, planning anticipates future developments – for instance, with regard to employment or population growth – and derives actions from those anticipations aligned with projected needs (Beauregard, 2015: 153).

The temporalities of planning, when explicitly discussed in the pertinent literature, reach far beyond the purposeful ordering of elements related to decision-making and the ambition to tame the future. Needless to say, planning takes place 'in time' (Beauregard, 2015: 152); this time is yet composed of 'pre-existing' (ibid.: 156) but multiple temporalities – for instance, of different land

uses or trajectories of local neighbourhoods; of different time horizons that plans for the future are conceived to cover; or of different ways of mobilizing or rejecting the past (ibid.: 152 ff.; see also Nettelbladt in this volume). Some authors elaborate on this multiplicity by focusing on the 'contrasting perspectives' (Lennon and Tubridy, 2023) of professional planners on one side and residents on the other. Simone Abram's (2020) detailed account of village expansion plans northwest of London shows a drastic case in point: Planners seek to come to grips with a tense housing market, whereas residents follow the vision of a 'timeless […] and idealized image of Englishness' (ibid.: 74). Instead of being able to shape and control future trajectories, planning implies navigating different and partly conflicting temporalities. However, planning also actively shapes time by 'marking' (Beauregard, 2015: 156) or 'manipulat[ing]' (Abram, 2014: 129) it. Robert A. Beauregard (2015: 157), in this vein, refers to 'time-defining moments'. Drawing on Bruno Latour's work, the author argues that such moments, e.g. the Paris agreement on climate governance, may (re-)stabilize realities and that this stabilization affects both the past and the future.

Much of the literature on the temporalities of planning addresses the changes that institutionalized planning has undergone with regard to time over the last decades; most accounts link these dynamics to the ongoing neoliberalization of Western economies and societies. Against that background, scholars have mainly addressed planning's time horizon into the future and the speed/duration of the planning process. Abram (2014: 131), for instance, identifies the loss of planners' responsibility for the 'middle-distance future': The focus is increasingly on 'Contemporary Time, […] the temporal mode of market transaction' that 'implies a logic of immediate return'. In addition, planning has increasingly been criticized for slowing down urban development, and pleas for acceleration and short-term project-led interventions have proliferated (Dobson and Parker, 2025) in order, for instance, to better align plans with real estate investment cycles. Against this backdrop, Mark Dobson and Gavin Parker (2025) – drawing on Helga Nowotny's concept of *Eigenzeit* – make the case for slowness. In quite a different vein, however, Mike Raco, Dan Durrant, and Nicola Livingstone (2018), building on research into the London planning system and real estate market, call into question how slowness paired with planning is juxtaposed against speed paired with real estate. Also private sector developers, the authors highlight, may hail the deceleration of processes as long as it secures lasting revenues.

Projects, from a critical planning and urban studies perspective, epitomize what Abram (2014: 131) calls 'a logic of immediate return' – a short-term, deliv-

ery, and profit-oriented approach to urban future-making. A 'projectification of urban change' (Torrens and von Wirth, 2021) is blamed as 'the Trojan horse of local government' (Fred, 2018). In a more positive tone, Beauregard (2015: 169) acknowledges that project planning might create a 'new commitment […] to possibilities' (ibid.: 170). Conceptualizing projects from an organizational angle, as 'temporary organizations' (Lundin and Söderholm, 1995), opens up a different view onto them with regard to time, temporalities, and future-making. In a way, projects serve as a means to tame the future by creating the idea of a linear time path that is 'cut out' of the 'continuous time flow'. In turn, this linearity renders the project period 'predictable and plannable' (ibid.: 450). Work packages to be performed for the eventual delivery of project outcomes can be efficiently organized along this time path. In addition, the finiteness of projects establishes a sense of urgency: 'time is always running out' (ibid.: 439); the final deadline enforces action towards delivery in time.

And yet, while projects promise to afford agency regarding the future, their effectiveness is limited when it comes to taming our time ahead. This restriction is mainly due to two reasons. First, there is no total linearity and predictability of the project period. The time span between the start of a project and the final deadline is subject to varying process dynamics, i.e. different rhythms and pacings within the project cycle (Jones and Lichtenstein, 2008; Söderlund, 2011). On top of that, even sophisticated project planning cannot fully eliminate ignorance and uncertainties (Kreiner, 2020; Thiel and Grabher, 2024). The longer (and the more complex) a project, the less realistic the idea of predictability is (Brookes et al., 2017). When it comes to the built environment, then, an effective taming of the future through projects might hold for small-scale and routine interventions such as single buildings; more complex projects that may also follow a transformative ambition tend to remain ventures into the unknown.

Moreover, the future does not end with the project deadline. We can therefore frame the temporality of projects by describing them as 'episodes' (Thiel and Grabher, 2021) within longer-term organizational, relational, or institutional contexts (Engwall, 2003; Grabher, 2004). This episodic nature is often conceived as functional, in terms of intended organizational change – 'transition' (Lundin and Söderholm, 1995) or 'innovation' (e.g. Davies, 2014) – in the related firms and industries. However, the functional relation between temporary structures and their more permanent environments is less straightforward than one would expect. Projects are regarded as effective vehicles of learning, but as essentially myopic when it comes to transferring

project outcomes into the post-project period. Project organizations, hence, suffer from what Grabher (2004) calls 'organizational amnesia'. Transition and innovation dynamics, it is argued, scatter across a diffuse relational and institutional space, the 'project ecology' (ibid.). When it comes to projects of urban future-making, the diffuse nature of such an ecology is particularly evident. Technically, the built environment essentially consists of 'one-offs' moored in specific spots on the earth's surface and 'assembled from myriads of components' (Thiel, 2021). While each building as a unique assemblage lives on, the lessons drawn from putting it together sediment only in parts, if at all. What is more, assembling built environment projects happens across 'an inter-organizational landscape' (Havenvid et al., 2019: 5). This diffuse landscape does not afford an organizational core in which project experiences can be transferred into a post-project future.

Urban experiments or *living laboratories*,[1] with some justification, can also be framed as 'temporary organizations' (Mukhtar-Landgren, 2021): Different stakeholders from the private and public sectors, research institutions, and civil society temporarily join in order to develop and test new practices and technologies in urban real-world environments. However, the temporariness of experimental ventures goes beyond that. Experimental formats are 'ephemeral interventions' (Wentland and Jung, 2021; Meinherz, 2025), that is, their transitional nature relates also to the outcome. Urban laboratories create new constellations in given settings in order to try out whether or not these constellations work and create added value; these constellations are dismantled once the experiment is over. Also, urban experiments are aimed at transition, or at instigating 'permanent change' (VanHoose et al., 2022). Mostly building on the multi-level perspective (MLP) concept from transition theory (Geels, 2002), experiments are framed as generators of niche innovations that need to be adopted in or translated to the 'regime'.

When it comes to temporalities of urban experiments more explicitly, several aspects can be pointed out: Most fundamentally, there is an inherent tension between the shortsightedness and project-based composition of experimental interventions and their ambition of achieving long-term change to mainstream social behavioural and institutional patterns (e.g. Manganelli, 2024). Maarit Särkilahti, Maria Åkerman, Ari Jokinen, and Jukka Rintala (2022: 1350) argue that 'the creation of transformative capacity via experimentation

1 There is an extensive and increasing body of literature on urban experiments and living laboratories. As a key source and overview, see Bulkeley et al., 2019.

requires a long development trajectory extending beyond a single experiment'. Transforming both inert patterns of everyday life and established institutional settings takes a long time and occurs only incrementally. Moreover, also experimental formats require navigating different temporalities. For instance, in their study of the experimental implementation of a circular district in the city of Tampere, again Särkilahti, Åkerman, Jokinen, and Rintala (2022) emphasize the competing timescales of land-use planning, the overall laboratory format, and specific technology instruments. And yet, competing temporalities can also afford opportunities: Franziska Meinherz (2025) foregrounds the serious disruptions engendered by the Covid pandemic that functioned as a leverage for trying out solutions, particularly in the mobility sector, that under normal circumstances would not have had any chance of being implemented. Finally, the timing of experiments is regarded as crucial (Meinherz, 2025). The timing question relates, for instance, to the alignment with electoral cycles, but also to annual seasons: Starting to open street space for other uses than car traffic in winter would certainly not engender prompt adoption by users.

In addition to the outlined ambivalent temporal features of experiments, these interventions, though ephemeral, have the potential of funnelling (and even exacerbating) conflicts about the qualities of urban futures (Günay, 2025). Based on a recent study on street experiments in two German cities, Melis Günay maintains that conflicts in arenas related to the experiments have a temporal dimension: They reflect and 'funnel' (ibid.: 123) wider societal disagreements about what transformations are necessary for a sustainable urban future. In their work on current societal polarization dynamics, Steffen Mau, Thomas Lux, and Linus Westheuser (2023) locate these in a 'today-tomorrow arena'. As experiments temporarily, but realistically, anticipate alternative futures of the urban built environment, they render transformation – and potential concomitant sacrifices – tangible. Experimental interventions in the built environment can therefore turn into what Mau, Lux, and Westheuser (2023) call 'trigger points' of polarizing dynamics (see also Grubbauer et al., 2024).

Taken together, all three of the examined modes of how built environment professionals seek to embrace the future seem not able to factor out the tensions inherent in the ambition to both stabilize and transform. Plans are supposed to gain control about collective urban futures, but planners face multiple temporalities and conflicting perspectives about how the future should look like; projects are good at delivering tangible outputs, but tend to fail in reaching beyond their temporal boundaries; experiments also exhibit difficulties in creating longer-term impact. What is more, they even fore-

ground divergent visions of the future and thereby may exacerbate societal conflicts. And yet, the temporalities of urban future-making offer options for agency – through proactively addressing time: 'marking' it (Beauregard, 2015: 156), leveraging different temporalities, or simply choosing the right time for whatever activity. Yet, when dealing with urban contexts, professionals are confronted with the temporalities of the built environment; handling urban matter brings about a range of temporal complexities to be discussed in the next section.

Substance, skills, and future demands: Temporalities of handling urban matter

One of the most fascinating things about cities is their longevity. The buildings that shape the face of cities inevitably stem from different historical periods, in most cases extending beyond the lived experience of any single generation. Depending on the *zeitgeist* and the relevant identity narratives, such historic buildings are attributed societal value. They stand as witnesses of past events and are perceived to convey stories about how life unfolded in past times (Schlögel, 2003). Less visible but even more long-lived are the structures beneath the surface of cities. The material infrastructures that constitute the backbone of cities are often their oldest material elements. In the European context, most parts of the infrastructural networks of modern cities emerged in the 19th century to provide water, sanitation, gas, and electricity (Lees and Lees, 2007). These networks and technological systems have survived much of the destruction of World War II as well as more recent periods of urban transformation, and as Mikael Hård and Thomas Misa note, over time they 'have become so common and pervasive in everyday life that they mostly inhabit only the background of our consciousness' (Hård and Misa, 2008: 8). Yet, also elements of premodern infrastructures have left their imprint on cities, with road networks of ancient times or medieval fortifications still shaping the layout of urban spaces today. Thus, the longevity of cities is manifested not only in single objects, but also on the level of infrastructural networks, settlement patterns, and urban morphology; all of this is foundational for present-day social practices, cultural meanings, and planning policies, even though the political dimension of infrastructural networks as 'hidden underbelly' of the city usually remains less visible (Moss, 2020: 2).

Yet, despite rich historical knowledge and methods of modern archaeology including radiocarbon dating, DNA analysis, and satellite imagery, which allow the age and location of historic built structures to be determined with much precision, knowledge about the material substance of contemporary cities is necessarily incomplete. Cities usually have a multitude of historical layers and are products of incremental processes that evade complete documentation. This relates also to questions of resource flows and material use that shaped daily life in the past, as these were rarely an object of historiography, and historians have only fairly recently started to examine such questions in the growing field of urban environmental and material history (Schott et al., 2005; Haumann et al., 2020). In the case of construction, for instance, building documentation has not been regarded as a relevant historical source and in many cases has been lost over time or is incomplete, even for buildings of the 20th century (see Meyer in this volume). Thus, urban construction is still full of surprises and encounters with artefacts of the past in different stages of aging and decay. Moreover, what is recognized only recently, is that construction sites also allow for encounters with the multispecies world found in soil and the subterranean realm, leading to potential disruption, delay, or even complete blockage of construction work – these encounters 'could principally change *everything*' as Christine Neubert points out with reference to the agency of trees and their root activities within roadworks (2025: 226; emphasis in original). The argument advanced here is that *partial knowledge* is indeed a constitutive feature of dealing with urban matter. This partiality or incompleteness is essentially temporal, i.e. it results from the longevity of cities and their co-evolution with the related ecological systems, but it is also due to several other factors that are concomitant with history and are less obvious, as will be shown in the following. We argue that a more fine-grained inspection of the temporalities of urban matter is necessary, taking into account not only the materiality and form of existing settlement patterns but also the influence that the historic evolution of building materials exerts on today's actions and decisions around urban futures.

Let us now look at the first aspect in terms of the physical *substance* of urban matter. Admittedly, premodern materials in today's cities are rare, as most of the substance is now from the 19th to 21st centuries. Concrete is the modern building material par excellence, though it is complemented by steel and other metals. These materials are pervasive and appear normal in today's urban contexts (Forty, 2012). Yet, it has become increasingly clear that modern urbanization and its practices of building and construction are based on a massive

externalization of ecological and social costs (UNEP, 2025). Whole landscapes have been altered due to the sourcing of materials for modern construction. This includes, most importantly and most visibly, the mining and processing of coal and metal ores, but more recently, scientists have expanded their analysis of this dynamic to include other materials, such as siliceous sands for glass production, limestone for iron processing and cement production, as well as very basic minerals such as stone, gravel, and sand needed to produce concrete (Smil, 2014; Edensor, 2020; Haumann, 2023). Sites of resource extraction that emerged in times of industrialization have, in the past decades, become globalized. Even sand as one of the few remaining 'common-pool resources', i.e. resources 'open to all because access can be limited only at high cost', is now becoming a global commodity – thus the sites of extraction are growing in size and the resource frontier is continuously expanded to new territories (Torres et al., 2017: 970).

Today, faced with the increasing scarcity of natural resources, scientists and practitioners have a high interest in understanding the built environment as a source for the reuse of building materials, or of material in general. Urban mining approaches attempt to map out and calculate these resources (Heisel and Hebel, 2021), whereas more comprehensive research programmes attempt to map all urban resources and material use into comprehensive models of metabolic flows (e.g. Schiller et al., 2017; Heeren and Hellweg, 2019). It has now become clear how the resources constituted by the built environment, including waste and particularly construction waste, are – at least theoretically – extremely valuable. However, in practice the circularity of such resources is inhibited by limitations in how material flows are governed and managed; technical methods also need to be advanced before these materials can efficiently be separated into usable components that are also able to meet regulatory standards (e.g. Kuchta et al., 2021). A main challenge to overcome is the diversity of modern construction materials; since World War II, synthetic materials and chemicals have become common in construction waste, thus when replacing buildings, such complex mixtures of materials are difficult to sort and isolate for reuse (e.g. Schnell et al., 2024).

A second aspect relevant when discussing urban matter relates to the *expertise and skills* of handling such matter. The emergence of the modern professional world of architecture, planning, and engineering was accompanied by a division of labour that created a distance, or gap, between built environment professionals with an academic education and those with a focus on execution, such as the manufacturers and suppliers of building materials

and products, the craftspeople and specialists in different trades, and the construction workers on-site (Sage and Vitry, 2018; Dimitrova, 2024). A result of this division is that specialized knowledge on the handling of materials has gradually been lost, especially with regard to historical materials. In European contexts, the numbers of young people choosing a professional education in the skilled crafts that contribute to building are constantly decreasing, and many local craftspeople have problems finding successors to whom they can hand over their business when they retire. These structural problems create a knowledge gap, as high-quality execution depends on skilled craftsmanship, especially for renovations and adaptations that defies standardization and require customized solutions. In exceptional cases, local clusters of high-quality craftsmanship together with professional expertise can emerge (Grabher, 2018); these collaborations allow trustful relations to be developed between built environment professionals and construction firms and lead to innovation in the industry (which is usually renowned for its lack of innovation) (Thiel et al., 2021).

Yet, at the very end of the supply chain is the local construction site, which is and will, at least in the near future, still be a site of hard manual labour. Within the labour markets of Western societies, the construction industry stands out for it precarious, unregulated, and dangerous jobs that sometimes cost lives (Sage, 2013; Torres et al., 2013). To deliver projects as cheaply as possible, costs for human labour on the construction site are minimized through various strategies: Commissions are outsourced to several chains of subcontractors, with individual workers often forced to act in forms of false self-employment. Media coverage has reported that, on large construction sites, knowledge about who is present and which processes they are in charge of is mostly inaccessible to the public administration responsible for enforcing quality standards (Heinemann and Twickel, 2024). In European contexts, language barriers also play a role, as construction work is mostly carried out by migrants. For field research, the construction industry is a difficult terrain, with construction sites being mostly inaccessible to researchers, and because of the gendered nature of the business (Sage, 2013).

The third factor contributing to our limited understanding of urban matter is the *uncertainty around the conditions* under which buildings and infrastructures will have to function in the future; again, this has consequences in terms of the temporalities involved. New conditions brought about by climate change and extreme weather events will affect building materials, but exactly how these materials will react is often unclear. Importantly, this has a temporal

dimension: The lifespan of urban matter differs depending on the substance. Lifespans of modern buildings are calculated with established standards. Yet, such calculations are now up for revision, as no prior experience with the new conditions exists, and an overhaul to risk-management is needed as well (Alfen et al., 2010), especially given the recent ambition to include aspects of social and ecological sustainability previously not considered in risk calculations (e.g. Backes and Traverso, 2024).

Furthermore, uncertainty is also derived from changing expectations and daily practices around the reuse of resources and the priorities given to keeping existing structures (Gram-Hanssen and Georg, 2018; Shove, 2018). Life cycle calculations now have to be revised or even calculated for the first time. The latter holds for objects that exist much longer than they were meant to, or for objects that eventually turned out to serve a purpose different from what was originally conceived (Petit-Boix et al., 2017). Examples of this include transport infrastructures, such as bridges or tunnels, that have outrun their projected service time but are still operational due to additional reinforcements (e.g. Steinbock and Wetzel, 2021). Lastly, also practices of maintenance and repair are subject to change in the future. Depending on financial resources, political priorities, and ownership changes, such work is sometimes higher and sometimes lower on the agenda. Such dynamics create conflicting temporal horizons to arise, as repair and maintenance cycles need to be planned for and calculated into a future far beyond the short-term cycles of political elections. This is particularly complicated for overlapping and entangled systems of different infrastructures as the work of Lena Enne shows (see Enne in this volume). Similarly, Olivier Coutard in his discussion of the temporal registers of infrastructure points out how 'infrastructure-based futuring' is based on the 'promise of future improved *material* conditions' (Coutard, 2024: 80; emphasis added); a promise that appears increasingly hollow in the face of present challenges.

Interestingly, a return to natural building materials is, at the moment, seen as promising. It is hoped that these materials can prove to be more resilient and adaptable to new climatic conditions, and possibly more sustainable in terms of the energy needed for their production and their environmental impact (Posani et al., 2025). Fully compostable materials such as wood, earth, organic fibre, adobe, and others are also discussed in the light of their suitability for circular approaches. However, problems of sourcing are partly ignored in the current professional discourse, or sourcing information is difficult to come by due to a lack of transparency and knowledge around the commodity chains.

This fetishism around natural material as 'noble' (Vellinga, 2013) is sometimes disturbing, as at closer inspection much of these practices are not necessarily sustainable (Grubbauer, 2017).

In sum, these various factors contribute to decisive knowledge limitations around urban matter. Importantly, the layering and entanglement of different materials in urban environments has a temporal dimension: It influences the calculation of lifespans, it shapes construction work on site, and it preconditions the temporal rhythms of repair and maintenance. Moreover, the chemical processes that modern construction materials and urban metabolic flows generate over time, are becoming more visible now. Many of these processes are slow and take place invisibly, but they contribute to polluting urban soil, water, air, and other matter in the long run (Kowalik et al., 2019). This partial knowledge, which becomes visible and takes effect only over time, seems to be paradoxical, given the expertise of the professions involved, the high level of bureaucracy around construction in Western contexts, and, most recently, the promise of full transparency that is associated with digital data. Various digital models are currently being developed to make the built environment, including its material properties, more or even fully accessible to professional analysis and to allow for better predictions of future developments. Yet, there is a risk that the abstraction behind such models and the selectivity of the data used will remain veiled. Indeed, these models may further serve to distance professionals from the on-site handling of matter, and thus complicate the temporalities of urban future-making.

Conclusion

With this chapter we have sought to purposefully connect conceptual work on urban future-making and on time and we proceeded in two steps. First, we mapped the relation between future-making and time, starting from three conceptual contact zones between the two notions (and the literatures behind them): the advent of open but increasingly uncertain futures in the late modern (or so) world; the emergence of a 'socio-temporal order' (Zerubavel, 1985) that frames forward thinking but may also be an object of engaging with the future; and the embedding of human agency into the flow of time (Emirbayer and Mische, 1998), implying an intricate relation between enacting 'present futures' and imagining 'future presents' (Esposito, 2024). Our other step comprised translating this map onto our idea of urban future-making

from two sides: through the future-making formats that built environment professionals usually employ to both envision and control the future, and through the complex temporalities the physical built environment exhibits and that future-makers need to deal with.

Neither the mapping nor the translation is likely to have reduced the complexity of how time and temporality impinge on urban future-making. From whatever direction we look at this conjunction we find that urban future-makers essentially face what one could call a *temporal mess*, i.e. a multiplicity of interconnected temporalities, from the lifecycles of grains of sand to the vision of climate-neutral cities mankind is supposed to realize within the next 25 years. Navigating this mess, it seems, is what professional activity in and with the urban built environment is fundamentally about. Both in research and in professional built environment practice we need to acknowledge that. This is not to say urban-future making implies arbitrarily struggling with a time chaos. We see three more specific take-aways from this chapter that might give some orientation. These conclusions have the modest ambition to both inspire further research on time and future-making and support the actual navigation of professional practice in the 'turbulent future' (Amin, 2013) that we are likely to face.

First of all, we hold that the mess should not be regarded as a problem but as an asset. 'Embracing' instead of seeking (in vain) to eliminate 'temporal ambiguities' (Thiel and Grabher, 2021), tensions, knowledge gaps might be a way to deal with the mess in a proactive and productive fashion. Embracing the mess might help avoid difficult trade-offs (ibid.) and enable future-makers to seize opportunities they would not have even identified otherwise, such as the mentioned occasion of using the Covid lockdown for street experiments. This is no plea for a disorganized professional practice – rather for what Helga Nowotny (2017) calls 'orderly mess:' In our existence 'poised between order and disorder', this orderly mess is 'the promise of an always precarious, but perhaps achievable, optimal balance between them' (ibid.: 14).

And, secondly, part of this mess owes to the complex materiality of the urban. Each of the multiple materials of the city exhibits its own temporality, or *Eigenzeit*, as again Nowotny (2017: 61ff.) would phrase it. These *proper times* of urban matter reach far beyond what we usually perceive as the astonishing permanence and resilience of urban structures. They carry millions of years of history before they are used as building material, and this use has an imprint that reaches far into the future and hinges on complex encounters with the multispecies world. Needless to say, the research and practice of urban future-mak-

ing must take these complex and far-stretched temporalities seriously. Doing so does not necessarily seek to sideline the social dimension of built environment research. Rather, taking materiality seriously calls for an intensified dialogue between research and practice as well as between different disciplines involved in urban future-making.

Finally, this chapter is a claim for explicitly and deliberately incorporating time and temporalities as a crucial element of urban future-making, both in research and in practice. Recognizing different, but entangled temporalities; acknowledging and possibly leveraging legacies of past future-makings; admitting that 'temporal structures' (Orlikowski and Yates, 2002) powerfully frame the ways of how built environment professionals can use their tools, but realizing that using these structures – 'temporal structuring' (ibid.) – offers novel sources of agency – a temporal lens helps us to better capture the contingencies of urban futures both analytically and in terms of professional practice: While the future is likely to differ from what we expect, there is in fact scope for urban future-making.

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