POLITECNICO DI TORINO
Repository ISTITUZIONALE

Spectrums of infrastructural hybridity: insights from urban Africa for a propositional research agenda

Original
Spectrums of infrastructural hybridity: insights from urban Africa for a propositional research agenda / Cirolia, L.R., Pollio, A. - In: Handbook of Infrastructures and CitiesSTAMPA. - [s.l] : Edward Elgar, 2024. - ISBN 9781800889149. - pp. 179-195 [10.4337/9781800889156.00021]

Availability:
This version is available at: 11583/2988543 since: 2024-05-13T05:17:00Z

Publisher:
Edward Elgar

Published
DOI:10.4337/9781800889156.00021

Terms of use:

This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

Publisher copyright

(Article begins on next page)

24 June 2026

ACCEPTED MANUSCRIPT - Ask authors for latest/published version

Cites as: Cirolia, L. R. & Pollio, A. (2023, forthcoming). Spectrums of infrastructural hybridity: Insights from urban Africa for a propositional research agenda. In Coutard, O. & Florentin, D. (eds.). *Handbook on infrastructures and cities*. Edward Elgar.

Spectrums of infrastructural hybridity: Insights from urban Africa for a propositional research agenda

Abstract:

In the last decade, research on southern cities has fruitfully contributed to infrastructure debates and theorisations. A critical thread challenges the 'networked infrastructure ideal' and celebrates the diverse ways people secure access to services in the absence of uniform and centrally provided delivery systems. This chapter reflects on the value and limitations of this emerging scholarship, focusing on what is referred to as 'hybrid' or 'heterogenous' infrastructure configurations. One of the limitations, we argue, is that infrastructural hybridity is often conflated with survivability, marginality, or informality. Particularly in the study of African cities, it focusses on small scale, make-do tactics, devoid of state involvement. Attending to this narrowed focus, we identify 'spectrums' of hybridity. We use illustrations from across the continent to substantiate this framework and broaden the scope. Finally, deploying this spectral notion, we ask: what might this conceptual toolkit mean for the engaged scholar?

Keywords: African cities; Hybrid infrastructure; Southern theory; Technological ambivalence

Authors

Dr Liza Rose Cirolia,

University of Cape Town, African Centre for Cities

Dr Andrea Pollio

Politecnico di Torino, Department of Urban and Regional Studies and Planning

University of Cape Town, African Centre for Cities

1. Introduction

At the messy interfaces between partial networks, regular failures, and everyday 'gap filling', a rich body of scholarship has emerged. Straddling anthropology, geography, and development studies, research on infrastructural 'heterogeneity' or 'hybridity' theorises the limitations – empirically and conceptually – of infrastructure networks. This literature recognises that, instead of modernist, standardised modes of access to essential services such as water, transport and so forth, there exists a diversity of pathways through which urban service delivery is achieved in cities (Jaglin, 2014). In some cases, heterogeneity exists where networks have been unbundled through privatisation or fallen into disrepair in the face of local-government austerity. In others, such networks were never developed. Overall, heterogeneous infrastructure and post-networked city debates challenge a top-down view of infrastructure and underscore the diverse politics of modernity that these hybrid systems materialise (Von Schnitzler, 2008).

While the Northern/Southern binary is not particularly useful as an explanatory device, this heterogeneity manifests differently in different urban contexts. Africa's[1] contemporary infrastructural situation, for example, cannot be divorced from colonial planning (Fox, 2014). Infrastructures in many African cities were deliberately 'splintered' – to divide populations across racial lines, control urbanization, and realise the extractive goals of imperialism (Von Schnitzler, 2008). Postcolonial and developmental efforts aimed at improvement have often increased fragmentation and fallen short of their promise of integration (Bass, 2011). Consequently, in many cases networks have fallen into disrepair or, as is commonly the case, never existed (Nilsson, 2006; Jaglin, 2008; Kooy and Bakker, 2008; McFarlane and Rutherford, 2008; Akallah and Hård, 2020). There are many reasons for this, including limited fiscal/financial resources, slow bureaucratic processes, and many issues related to land ownership and access (a critical part of effective service delivery) (Jaglin, 2008; Briceño-Garmendia *et al.*, 2009).

Scholars of African cities have therefore shown how self-organised, informal, popular, and private provision dominates city systems, filling gaps in partial or fractured large technical and networked systems. A running thread in these contributions is that in contexts of infrastructural breakages and absences, urban dwellers find ways of 'suturing' and 'completing' these systemic fragments in order to survive and 'make do' against dysfunction and ruination (De Boeck and Baloji, 2016). This scholarship, as part of a 'Southerning' of urban scholarship, has both conceptually and empirically affirmed that infrastructure is always partial, heterogeneous, and emergent (Coutard, 2008; Jaglin, 2014; Coutard and Rutherford, 2015; Baptista, 2019; Guma, 2020).

Building on these works, this chapter is not so much a reflection *on* Africa (although the cases might be useful for scholars who work in and on African cities), but rather speaks *from* Africa. In other words, it uses urban Africa as a site of theory-making and wider

[1] Terms like 'Africa' or 'African' do not capture a uniform, conceptually clear or geographically coherent set of places. African cities vary dramatically in size, function, and substance. For example, Cairo and M'bour have little in common when it comes to infrastructure, planning, or statecraft. This has conceptual and practical implications. But while African cities are undeniably diverse, there are some commonalities in the extent to which they have experienced the lasting legacy of British, Dutch, French, German, Italian, and Portuguese colonial imposition, post-independence development and structural adjustment programmes, and – today – rapidly expanding metropolitan areas and new forms of infrastructure financing (Goodfellow, 2022).

application. African cities are not unique or exceptional. But they often do reflect an extremeness which positions them to contribute to more general theory on Southern infrastructure. The aim of the pages that follow is threefold:

First, we show how concepts of hybridity developed through explorations of urban Africa have evolved and contributed to debates about post-networked cities and heterogenous infrastructure. We also identify gaps and limitations in this body of work. In particular, we argue that the African perspective on heterogeneity (especially within Anglophone scholarship) is often implicitly conflated with survivability, marginality, or informality. We align ourselves with scholars such as Jaglin (2014), who have sought to divorce heterogeneity from a narrow reading of it.

Second, attending to these gaps, we propose ways in which infrastructural diversity features, and argue that – among these various attributes – there are complex arrangements that belie dichotomies but exist across overlapping spectrums. From formal to informal, off- to on-grid, high- to low-tech, large to small, public to private, it is important to substantiate heterogeneity, recognising its relational messiness. We use examples from a range of cities and infrastructures to animate and illustrate these points[2].

Finally, deploying this spectral notion of hybridity, we ask: What might this conceptual toolkit mean for the engaged scholar? After all, academics are increasingly asked to demonstrate the relevance of their research for policy and broader societal impact. We close with suggestions for propositional research (Baptista and Cirolia, 2022) and pointers to practically enact such an agenda.

2. African cities and the splintering of infrastructural networks

Pluralising urban infrastructure theory

The 'infrastructure turn' within urban studies is largely built on the 'splintering urbanism' hypothesis developed and popularised by Graham and Marvin in the late 1990s and early 2000s (see 1996 and 2001). This literature, and indeed the contribution of Graham and Marvin that inspired it, charted the various ways in which privatisation, financialisation, and neoliberalism fractured urban material systems driven by entrepreneurial urban governance models (Wiig *et al.*, 2022).

While this work focused initially on English-speaking cities in the global North (and only anecdotally on cities of the global South), the splintering urbanism arguments have undeniably had traction in the context of urban Africa. The rapid development of fancy (sometimes fantasy) gated housing estates and mega-malls (Watson, 2014), often next to minimally serviced informal settlements, are a vivid expression of the extreme spatial inequality evident in many African metropolitan areas. This material (and economic) fragmentation has been driven by privatisation of service delivery (a common outcome of

[2] For these cases, we draw heavily on the authors' research. Some of this is published work (for example Pollio, 2020b; Pollio, 2020c; Cirolia *et al.*, 2021). Other examples are drawn from unpublished and current research, such as the Freetown case.

1980s-style structural adjustment in Africa), and by financialisation of real estate and land markets, particularly in urban peripheries (Herbert and Murray, 2015; Goodfellow, 2017). These more current processes overlay onto colonial remains – patterns of infrastructure investment fundamentally informed by racism and extraction.

Scholars who scrutinize the splintered reality of Africa's large conurbations are not only concerned with the problematic form of cities; they have also critiqued the African urban development sector, and the Afro-optimistic discourses driving contemporary investment agendas. From the World Bank's *Africa's Cities: Opening Doors to the World* (World Bank, 2017) to PricewaterhouseCoopers' *Into Africa: The Continent's Cities of Opportunity* (PWC, 2015), a plethora of reports argue for African cities' untapped investment potential. These reports frame African cities as the next most lucrative frontier of global capital (Gillespie, 2020; Kimari and Ernstson, 2020). This hunt for so-called 'bankable projects' and untapped markets is couched in both neoliberal and neocolonial tendencies – forcing cities to be competitive with each other. For example, in an analysis of Cape Town's ambition to become a world-class destination for business and tourism, McDonald (2012) shows how policies aimed at attracting global finance have entrenched colonial and apartheid divides. More recently, Schindler *et al.* (2021) demonstrate how global development policies (in this case the Sustainable Development Goals and Special Economic Zones) contribute to urban fragmentation in Tanzanian cities. In these cases, splintering urbanism aptly captures emerging infrastructure enclaves, disjointed from broader urban realities.

Despite the importance of these critiques of colonisation, financialisation, and the neo-liberal development project, Southern scholars have drawn attention to the limits of narratives dominated by structural dynamics (Parnell and Robinson, 2012; Cirolia and Scheba, 2019; Goodfellow, 2020). Authors such as Mbembe and Nuttall (2004) calls for "writing the world from an African metropolis", upending the tendency to develop universalising concepts from a limited number of urban cases. This 'placing' of theory (Connell, 2014) reflects a call for more relational scholarship, attentive to distributed, multi-scalar, and multi-directional readings of power and politics (Larkin, 2013; Te Lintelo, 2017[3]). For instance, the idea of "enclave urbanism" (see Murray, 2017) risks flattening the ways in which African urban enclaves weave "otherwise dissimilar and distinct social practices and spaces, political desires and economic aspirations" (Nielsen *et al.*, 2021, p. 881). Similarly, reductionist critiques of estates and malls fail to attend to the variegated realities, aspirations, and aesthetics of the African middle class (Houssay-Holzschuch and Teppo, 2009; Schuermans, 2016; Korah *et al.*, 2021; Nielsen *et al.*, 2021). This scholarship aligns with the relational turn within urban studies, best represented in the debate between Neil Brenner, Colin McFarlane, AbdouMaliq Simone and others in 2011 (Simone, 2011).

In thinking *from* Africa[4], one of the concepts developed from the materiality of African cities (and more generally from Southern cities) has been that of 'hybridity' (or 'heterogeneity'), a notion used to theorise infrastructural configurations from the ground up (De Boeck, 2015), and to which we now turn our attention.

[3] This relational reading is often inspired by Foucault (1998) or assemblage thinking.

[4] We stress that thinking *from* Africa, rather than *about* Africa, ensures that concepts developed from empirical explorations of Africa are suitable for wider generalisation.

Relational hybridity

Concerns about building a conceptual toolkit for understanding the material reality of urban Africa coalesced to create a compelling case for deeper engagement with "hybrid" or "heterogeneous" infrastructures and service-delivery systems (Baptista and Cirolia, 2022). This relational approach and ensuing hybrid signifiers make several arguments, both empirical and ontological.

First, grounding theory in place, one witnesses diverse ways in which service delivery is achieved. People and firms do not all plug into one central system for water, energy, or connection to the internet. Instead, Southern infrastructure scholars have showcased many pathways and options. In doing this they expand modes of existence of infrastructures, to include not only the big investments in material systems, but also the wider set of manners in which services are used or become available. These hybrid material configurations are not just about different flows or technologies, but also about the agencies and activities that shape systems. For example, hybrid infrastructure debates have also highlighted the diversity of actors involved in the delivery of infrastructure. From water cartels to community groups, this literature shows how the state has lost (or perhaps, in Africa's context, never had) any sort of hegemony over infrastructure system management.

Second, a focus on everyday practices of infrastructural access centres people in the making of infrastructure. Often these practices involve makeshift adaptations, repairs, bypass, and technological bricolage; all of which render services – water for cleaning, energy for cooking, broadband for connectivity – dependent on multiple and overlapping technical systems. Larkin (2004), reflecting on Nollywood culture, deploys the concept of "pirate infrastructure" as an alternative mode of service delivery. Contrary to moral judgements and simplistic assumptions about the parasitism of piracy, he demonstrates that pirate infrastructures emerge in the breakdown of legitimate channels. They participate in the creation, reproduction, and distribution of "new modes of organising sensory perception, time, space, and economic networks" (2004, p. 291).

Third, by expanding the boundary of infrastructure to include everyday practices, people (particularly poor people) become part of the infrastructure itself. Simone uses the concept of 'people as infrastructure' (2004). This notion – also deployed by Doherty (2017) in relationship to Kampala paratransit riders, and De Boeck (2012) on Kinshasa – challenges the binarism between technology and the human. It foregrounds the body and offers a vocabulary to grasp the ways in which social collectives act as a proxy or prosthetic of broken systems. Simone's (2004) "people as infrastructure", which originally captured economic networks, inspired contributions which look at labour, work, and human bodies as integral to infrastructure systems. This concept extends to many sectors, highlighting the 'work' that goes into collection of garbage (Fredericks, 2018), entrepreneurial incubators (Pollio, 2020a), and tax collection (Mizes and Cirolia, 2017).

Fourth, some scholars demonstrate that infrastructures are not stable, but constantly made and remade in relation to the politics and history of place (Guma, 2020; Baptista and Cirolia, 2022). Infrastructure's techno-political arrangements reflect shifting material and power dynamics that link provision of services to broader ideological, moral, political, and cultural regimes (Larkin, 2013; Von Schnitzler, 2016). Von Schnitzler, for example, shows how water meters in Johannesburg become the living terrain of political struggles in South African townships. Similarly, Silver (2014) argues that social solidarity and power emerge

from incremental and collective practices of poor people in Accra working to improve energy access.

Building on these insights, Lawhon and colleagues (2018) advance the notion of "heterogeneous infrastructure configurations" (HIC) to make sense of the ways through which service delivery is achieved. For them, "heterogenous" is a better qualifier than "hybrid" (although it refers to similar composites of infrastructural practices and networks) because it captures the multiplicity of socio-material uses, users, and artefacts. Other scholars have expanded on HICs (Alba *et al.*, 2020; Schindler *et al.*, 2021). Beyond showcasing material realities of diverse arrangements, HICs are used not only to describe what *is*, but also to challenge the normative basis of the splintering hypothesis. The 'networked infrastructure ideal' implicit in Western scholarship and global policy speak about African cities is not, in fact, always ideal (Furlong, 2014; Munro, 2020; Smiley, 2020). Southern scholars and their intellectual allies thus call for academics and decision-makers to challenge the assumption that networked and centralised provision is the most effective and dignified option for infrastructure access (Coutard, 2008; Odendaal, 2011; Lawhon *et al.*, 2018).

Nested in this scholarship on heterogeneity is a unique sort of optimism, one which positions developing (and particularly African) cities not as passive sites of neoliberal destruction (as splintering might suggest), but as places of imaginative experiments, radical revision, and post-networked possibilities (Simone, 2008; Odendaal, 2021). Although some have noted the costs of, the violence of, and the need not to romanticise heterogeneity, this rich empirical basis has allowed for complex relationships to be foregrounded beyond academic debates (Smiley, 2020). Adjectives like 'hybrid' and 'pirate' are just some of many qualifiers to engage with the complexity of Africa's infrastructure configurations and beyond, in ways that do not assume a linear trajectory from the hybrid (incomplete) to the networked (complete) (Guma, 2020). Across this work, many terms have been developed, some of which are captured in Table 1.

Table 1 - Vocabularies of hybridity

Descriptor options	Object options	Relational options
Always-in-the-making Colonial/imperial Heterogeneous Hybrid Incomplete Incremental Makeshift Off-grid Paradoxical People as/Peopled Post-networked Pirate Retro-fitted Socio-technical	Infrastructure Service delivery Urban fabric	Arrangements Assemblages Configurations Dispositifs Entanglements Fragments Imaginaries Networks Remains Systems Transitions

Sutured Technological bricolage Techno-political Vital		

Source: This list of concepts – not all of which are synonymous – is drawn from a range of scholars who work on Africa, including: Kaika and Swyngedouw, 2000; Simone, 2004; Larkin, 2004; Larkin, 2008; Klaeger, 2013; Silver, 2014; Howe et al.*, 2015; De Boeck and Baloji, 2016; Jaglin, 2016; Monstadt and Schramm, 2017; Simone and Pieterse, 2017; Lawhon* et al.*, 2018; Baptista, 2019; Cupers and Meier, 2020; Guma, 2020; Kimari and Ernstson, 2020; Guma and Mwaura, 2021; Lemanski, 2021; McFarlane, 2021 and Rodima-Taylor, 2021.*

While not exhaustive, Table 1 demonstrates the richness of the vocabulary in capturing post-networked systems through a rich range of imaginative concepts, some of which build on longer lineages of theorisation.

The blind spots of hybridity

African urban scholarship on infrastructure heterogeneity has been useful, valorising everyday processes and providing much-needed specificity to conceptual debates. However, much of the literature on hybridity and HICs has focused on informal practices through which the urban poor develop illegal energy connections or burn their waste - fill fractured-network gaps with inventive socio-technical sutures. While providing a necessary corrective to a focus on formal and large-scale systems, this focus runs the risk of conflating heterogeneity with informal, off-grid, and survivalist practices. This conflation has tended to identify economic marginality and poverty as the primary (at times only) sites of hybrid configurations. While bringing into focus important practices and processes, the overemphasis obscures (and risks erasing) the ways in which hybridity is substantiated in practice.

This focus on marginality, informality, and everyday practice, while not always explicit, has tended towards a rejection of the normative basis of the networked infrastructure ideal (Lawhon *et al.*, 2018). This rejection ignores two important things: First, the many benefits of networks and the importance of large technical systems in cities. Second, it ignores (even invalidates) the importance of having clear normative projects (a necessity for considering the justness, risks, or benefits of particular infrastructural propositions) (Baptista and Cirolia, 2022). To avoid normative impositions, much of this work has focused on description and overlooked the implications of celebrating hybridity (and rejecting large-scale technical systems) at the expense of, for example, the redistributive apparatus, city politics, or the ecological systems upon which networked systems may be predicated (Cirolia and Scheba, 2019).

Some have sought to address these issues, releasing HICs from the narrow focus on informality and the urban poor (Lemanski, 2021). Jaglin (2014) and Rateau and Jaglin (2022) are examples of energy system research in Cape Town, Cotonou, and Ibadan which takes as a starting place hybrid configuration, tracing the complex practices across the system beyond informality. Similarly, Pollio and Cirolia (2022) look at the relationship between urban broadband infrastructure and innovation in fintech that link African informal economies to large technical systems of cloud computing. Building on this impulse, in the next section we highlight some of the forms through which hybridity takes shape across spectrums that require us to broaden the scope of its meanings.

3. Substantiating hybridity from an African perspective

There have always been many types of infrastructures in cities and infrastructure systems have never produced a singular mode of service delivery. This variation is key. From this point of departure, we can ask questions about the substantive nature of hybridity in African cities. Within and between infrastructures (and city contexts) there is considerable diversity in the way hybridity features. In this sense, Table 2 lists several 'spectrums' – bands of possibilities and configurations exhibiting between two opposite conditions.

Table 2: Spectrums of hybridity

Spectrum	**Between…**	
Economic and fiscal	Subsidised	Profit-making
Capital ratio	Labour-intensive	Capital-intensive
Class, income group	Poor	Wealthy
Consumption type and use	Residential	Commercial
Developmental	Social needs/human rights	Economic growth
Distribution	Decentralised	Centralised
Grid connectivity/ networkedness	Off-grid	On-grid
Investment lifespan	Short-term/temporary	Long-term
Regulatory	Informal	Formal
Scale	Small	Large
Social organisation	Individual	Collective
System resilience	Fracture critical/precarious	Redundant
Technological complexity	Low-tech	High-tech
Type of service provider	Private	Public

We offer this table not as a comprehensive framework for understanding the substance of heterogeneity, but rather to explore what a scheme of this sort allows us to 'see' which might otherwise have been obscured. Our suggestion is that, as the examples below show, hybridity manifests across different spectrums, often in unexpected ways. Below we unpack some useful insights which can be seen when our vocabulary of hybridity is expanded.

Configurations in transition

One of the important insights stemming from the disaggregation of infrastructural heterogeneity is the role that hybridity plays in technological transitions in Africa. Among many transition processes, the so-called 'green transition' provides a good example of how overlapping systems – public/private, on/off-grid, formal/informal – shape Africa's urban energy future. A useful view of energy hybridity focuses on the ways in which households secure energy access and reduce energy poverty through the makeshift hybridisation of networked supply (Silver, 2014; Baptista, 2019), such as illegal grid connections. They also include deployment of all manner of household-scale appliances, like solar lamps or diesel generators. Exploring these technologies already begins to shore up the ways in which hybrid technologies may be small-scale, distributed, and precarious, but also implicated in highly regulated global value chains. However, a wider exploration of the contours of energy hybridity creates opportunities to consider how more systemic transitions towards less carbon-intensive electricity are imagined and enacted. The case studies below show how infrastructural transitions not only feature but are made possible by the shifting coexistence of different modes of hybridity.

Freetown: Floating power-generation driven by private sector

Powerships can be found in coastal countries such as Ghana and Sierra Leone, responding to African countries' power needs while they work towards enhancing their generation capacity. From the Freetown City Council office block one can see a large ship docked in the small 'Kroo Bay'. The ship represents the partnership – first signed in 2018 – between the Turkish independent power producer, known as 'Karpowership', and Sierra Leone's Electricity Distribution and Supply Authority (EDSA). In 2020, a further five-year contract was signed, locking the country into a high-cost short-term contract until 2025. According to estimates by EDSA and the National Ministry of Energy, Karpowership provides almost eight percent of the country's energy needs – 89 percent of that demand is generated in Freetown. Despite the high per-capita cost, the Ministry cites "absence of any other immediate solution to power supply" and "no realistic alternatives to the Karpower extension". The alternatives, which include large investments in generation, transmission upgrades, and power pool arrangements with neighbouring states, have provided the ongoing justification needed to extend the independent power producer's role in the urban energy system. Karpowership is thus an example of a short-term, high-tech, private sector-led, and -distributed technology generating decentralised power for Freetown's network. Yet, on a temporal scale, it provides a (high-cost, but evidently much-needed) stopgap in efforts towards securing a more sustainable energy future for Sierra Leone.

Nairobi: Surplus electricity and boda boda commuting
Boda boda (motorcycle taxis) are an interesting example of a mobility system that exists in place of networked public transport. With minimal formal regulation, boda boda fill the gaps in the last-mile needs of Nairobi's residents across class and urban geographies. Motorcycles are, however, fossil fuel-dependent, and their lifecycle is short. Addressing this, many 'startups' are experimenting with retrofitting and electrifying boda bodas – giving them batteries and building charging stations. Kenya's current power generation is higher than current usage and mostly coming from green sources (more than 80% of Kenya's electricity comes from renewables). By increasing effective demand, these companies will contribute to the state fiscus by reducing its dependence on fuel imports – which are highly subsidised and therefore a constant budgetary headache for an indebted nation like Kenya. This story of 'green transition' shows how networked (green electricity) and non-networked systems (boda bodas) may exist in a symbiotic relationship.

Diverse practices and actors

As a second contribution, reorganising the study of heterogeneity of infrastructure to include the full urban system allows us to see many more practices, but also many more actors. As inferred earlier and in the example, the state is not absent from hybrid configurations in Africa – both technically and politically (Cirolia and Harber, 2021). Core to understanding this heterogeneity is a much richer reading of the African state, and the ways in which it is given effect and exercises power – albeit in partial and contested ways – and how partial decentralisation has left urban authority fragmented but still imbricated in the technopolitics of infrastructure (Croese, 2018; Goodfellow, 2020; Pollio and Cirolia, 2022).

In most cases, African cities are not under the fully-fledged custodianship of local governments. Each infrastructural sector features its own authorities and agencies, at various lengths from the state depending on the degree of privatisation, but almost always under the direction of national ministries or central cabinets. In this context, it may be tempting to – and indeed many scholars do – read the state, and even its officials, as sinister, anti-poor agents acting in a patrimonial mode of administration (Callaghy, 1987). However, interactions with public sector operators often reveal that these agencies are propelled by people who work with limited resources, redundant and dated regulations, and condescending global development actors to try to do their jobs. Like infrastructures themselves, the urban state is heterogenous, made of relationships between incomplete administrative systems and often very limited revenue-collection possibilities.

Similarly, it is not only in the supply of infrastructure that we see a gamut of different actors: on the receiving end too, heterogeneous configurations manifest across different layers of the society, from the extremely poor to the wealthy. As argued earlier, much of the descriptive focus of infrastructural hybridity in urban Africa has been directed to the practices of the economically marginal and, more seldom, to the enclave urban spaces of the uber rich. However, if one takes seriously the notion that these conditions exist on a spectrum of more variegated in-betweens, the lower rungs of the middle classes shore up as key actors in the making of HICs. While very little research exists on the infrastructural practices of these social stratums (Acey, 2019; Lemanski, 2021), it is clear that the African

middle classes are increasingly central to the story of emerging post-networkedness in the continent. The below case of Addis Ababa shows how heterogenous infrastructure is also used to support lower-middle class housing projects.

Addis Ababa: High-tech decentralised sanitation driven by the city authority
In Addis Ababa, Ethiopia's capital, the city government has encouraged the use of decentralised technologies for the middle classes. In Addis, less than 10 percent of the city is covered by networked sanitation. Instead, vacuum trucks collect sewage from households. In sub-urban developments on the outskirts, where middle class households have purchased subsidised houses, the water and sanitation company has experimented with high-tech decentralised solutions – such as membrane bioreactors (MBRs) and similar decentralised options. Originally conceived for industrial usage, MBRs are now used for medium-scale building complexes without access to networked wastewater systems. The city's water and sewerage company has been involved in deployment and management of these systems. In the case of Addis's condominiums, modalities which are not imagined as part of the centralised and state-provided network are in fact state-provided, and even subsidised. They are smaller self-contained mini-grids - connecting a grouping of houses to an isolated system. These are solutions aimed at the middle class, not the very poor; solutions necessary for unlocking the (highly political) housing projects which have forged forward despite the lack of infrastructural connectivity. The case suggests that heterogeneity can be seen in high-tech, middle-income, small-scale solutions which are driven by the state but exist outside of its regular functionalities.

The re-emergence of LTSs

While infrastructural heterogeneity seemingly implies a fall of large technical systems (LTS), Table 2 helps us see how they are also re-emerging (Coutard, 1999; Nilsson, 2021). In the last two decades of the twentieth century, investment in large-scale infrastructure in Africa dwindled as the modern ideal that underpinned the development era (1950-1980) entered a deep crisis, and development finance institutions began to privilege small-scale interventions (Fine, 1999; Elyachar, 2002). However, this neoliberal turn is waning. Over the past decade, a combination of factors has translated into a "re-enchantment with big infrastructure" in Africa (Nugent, 2018, p. 22). We can see this in the sorts of urban mega-infrastructure projects facilitated by Chinese and other investors across Africa (Wiig and Silver, 2019; Kimari and Ernstson, 2020).

These infrastructure corridors linking, for example, large highways, port developments, rail and logistics hubs, and special economic zones (SEZs), reflect huge investments in and around African cities. However, far from being the outcome of a single technological and financial standard, these corridors not only interface more capillary networks through which goods and people move in urban Africa, showing how their capacity to handle large-scale flows depends on their hybridity, they also manifest diverse capital lifespans, modes of cost recovery, technological complexity, and labour regimes.

Beyond the mega-projects, that animate this enchantment, we also see the rise of large technical systems through the delivery of information and communication technologies. Like elsewhere, digital infrastructures are a growing large technical system, a "planetary-scale computation system", as Bratton (2016) puts it. In Africa this digital infrastructure has a unique urban footprint, a path-dependent outcome of colonial legacies and current patterns of access to networked systems such as electricity (Mattern, 2016). Therefore, while digital technologies in Africa are often read against the grain of micro-practices – from water ATMs (Guma and Wiig, 2022) to digital radios (Avle, 2020) – it is important to foreground the incredible scale of the broadband connectivity and data hosting systems that enable such practices. Inherently heterogeneous, these digital LTS belie any simplistic assumption about whether they are centralised or decentralised, public or private, individual or collective.

Cape Town: Hub for the global cloud

Amazon and Microsoft, the major providers of cloud computing services, launched African cloud regions in Cape Town, in 2020 and 2019 respectively. The city benefits from privileged geography: like older colonial telegraph lines, undersea cables must pass Cape Town when connecting Atlantic and Indian ocean coasts. A regional node of cloud services means Cape Town data centres now host distributed computing and storage power on behalf of these large-scale providers. In fact, the city has a relatively long regional advantage in hosting and exchange of information flows: Africa's busiest internet exchange – that is, a data centre where different internet providers and infrastructures coalesce to reduce latency in the exchange of information – is in the city. Combined with a capital-intensive push by the local government to connect businesses to this infrastructure, Cape Town has also emerged as a capital of decentralised financial technologies – such as Bitcoin wallets – which are data-hungry and require a generous and redundant hosting capacity. Many pan-African cryptocurrency wallets have therefore chosen Cape Town as their hub, from Lumo to Valr. With this example, not only do we see how large technical systems – such as the global cloud – emerge through systems that are both decentralised and recentralised, but also how decentralised, privatised financial infrastructure relies on the centripetal, agglomerating capacities of these data-hosting networks.

These cases contain examples from different African cities and hint to the need for expanding and substantiating our descriptions of hybridity, taking into account the diverse, overlapping and at times contradictory spectrums across which the techno-politics of infrastructure manifest. However, this enriched vocabulary of hybridity cannot be simply a more accurate description of complexity. It must equally contribute to the advancement of theoretical propositions which include – but also extend beyond – the African urban context. In other words, to speak *from* Africa, rather than simply *on* Africa, it is vital that the complexity we surface in these cases provides insights with significance for the exploration and understanding of infrastructure and cities at large.

4. Beyond describing complexity

As many authors of Southern urbanism have argued (Simone and Pieterse, 2017; Bhan, 2019), describing heterogeneity and hybridity is not enough. Description does allow us to have a much richer understanding of what is really happening, yet a decisive agenda for propositional (re)configuration must not only be able to articulate what is, but what *could be*.

We suggest that what is needed is a combination between a more "ambivalent" orientation towards heterogeneous infrastructural technologies (von Schnitzler, 2016) (such as those discussed in Part 3), coupled with a willingness to be explicit about the underlying normative agendas which shape imaginations. These become legible across some of the spectrums identified, and against many artefacts or speculative sites, from Afro-futurist films to dusty policy documents, all of which reflect the infrastructural futures of African cities and beyond.

Ambivalence

We begin with ambivalence. Ambivalence should not be confused with neutrality – nor should it be reduced to a descriptive gesture. Instead, infrastructure needs to be understood as "suspended between different possibilities" and a "scene of struggle" (Feenberg 1991, p. 12). In this sense, contemporary infrastructure arrangements reflect a contingent history of decisions, and the contemporary options for alternatives are neither infinite nor fixed. Core to this project is a release of technology from any sort of determinist frame (e.g., techno-pessimism/-optimism). Heterogeneity, like any technological configuration, is always in a tension between different political, moral, and ethical regimes. Hence, a narrow reading of the heterogeneous – as we have suggested – has the tendency to romanticise the premodern, the marginal, the anti-expert, etc., at the expense of a more ambitious, imaginative, and aspirational view of what infrastructural hybridity could convey.

Reading hybridity through the lenses of ambivalence also means interrogating what could have been, had the design and implementation of a certain system shaped up differently. We are cognisant that large technical systems in urban Africa follow the traces of colonial and developmental trajectories that brought violence and ruination to the continent. Yet a critique of the coloniality and political economy of infrastructure too often jumps to conclusions about infrastructures and service-delivery systems themselves, as if inherently flawed. In this sense, ambivalence implies avoiding this conceptual jump, even when it seems convenient, because both techno-pessimist and techno-optimist perspectives confine African urban infrastructure to only certain aspects of their pasts, and in doing so they overlook scripts (Akrich, 1992) of their design that might have been desirable, and foreclose the futures that these alternative options might have carried.

Normative propositionality

We turn now to the normative. Within these possible futures, who decides what is actually desirable and, indeed, good? And how? Again, when Africa's infrastructure is an object of inquiry, it is tempting to jump blindly onto the anti-expertise bandwagon[5] and argue that the urban poor must tell us what they want, how to intervene, what to propose, and, ultimately, what kind of hybridity is preferable. Of course, what people in cities want and

[5] A point made long ago by James Ferguson in the epilogue to *The Antipolitics Machine* (1994).

need is important, but imagining city-scale infrastructural intervention in complex systems is not so straightforward. Instead, it requires engaging with a multiplicity of normativities – the relationships between them and the trade-offs they impose on one another. It also requires that scholars are comfortable making claims about what might in fact be good, at the risk that this can (and likely will, as that is the manner of the academy) be open for critique.

How to do so? An imaginative engagement with infrastructural futures, in our reading, must start with explicit attention to the rich diversity of imaginaries that are circulated, debated, and tested at an unprecedented time for African urbanisation. These imaginaries must be read not only against the spectrums of hybridity that we have discussed, but also against the grain of the politics that shape our research projects and presence in the field. This is, of course, not a call for blind pragmatism or quick-fix solutions. In fact, a call to be propositional is not a call to be practical, or to ensure that one's work appeals directly to policy or practice. It is also not an imperative for participatory research (which has its place and can often be propositional).

Instead, it is an orientation which begins with critical reflection, but aims towards generating ideas not only about what is, but what could or should be. It is a commitment to reunite infrastructure debates with wider political projects. In other words, rather than urban scholars implicitly applying their own ideas of justice or acceptability on the configurations they see or those imagined/suggested by those with whom they have directly engaged (such as communities or engineers), it would be useful for scholars to engage deeply and directly with political theory, where a plethora of frameworks for social justice have been developed, and make such connections explicit, not just for the purpose of critique, but for that of generating thoughtful engagements. It should be noted here that Southern urban theory is not at odds with the application of canonical perspectives on the political economy of cities.

The role of the researcher, in this sense, would be to expose the assumptions, intentions, and implications that exist in the scripts of different normative projects (large and small). The foundation for imagining how systems might not only be understood as what they are becoming, but also how they might be reconfigured (by whom, and with what tools) provides yet another fruitful avenue for considering how academic scholarship comes to be embedded in the very stakes it seeks to expose. In part, proportionality also means engagement with what could or should be, speculations of future ways of being, doing, or thinking. How can scholars engage in meaningful ways with disciplines that have made it their work to do such things? Of course, the answer to this – like with the question of power and the political – requires meaningful transdisciplinary engagement. Conversations in philosophy, art, economics and architecture have all – in very different ways – orientated themselves towards the development of propositions.

Obviously, both for engagements with politics and speculations, the risk of doing these things badly abounds. It is vital that scholars avoid sloppy incorporation of Afro-futuristic imagery or a-historicised and decontextualised philosophical traditions. Failing to ground these visions in their place and time, for example with cultural studies, has led to a revival of mystical readings of African urban culture, which runs many risks of replicating problematic tropes and logics. Yet a more careful engagement with key issues within the space of speculation provides some potential building blocks through which to develop and assess propositions.

In closing, our suggestion in this chapter is that an expanded view of hybrid infrastructures in African cities, and their ambivalence, must be held together with a propositional ethos, a commitment to the fact that our research agendas are inextricably imbricated in the very systems that become our object of academic study. Not an easy task, we admit, but one that can start with questions of what could or should be – and the role of the researcher in making sense of these (often diverse) spectrums of possibilities.

6. References

Acey, C.S. (2019) 'Silence and Voice in Nigeria's Hybrid Urban Water Markets: Implications for Local Governance of Public Goods', *International Journal of Urban and Regional Research*, 43(2), pp. 313–336.

Akallah, J.A. and Hård, M. (2020) 'Under the historian's radar: Local water supply practices in Nairobi, 1940-1980', *Water Alternatives*, 13(3), pp. 886–901.

Akrich, M. (1992) 'The De-scription of Technical Objects', in Bijker, W.E. and Law, J. (eds.) *Shaping technology/building society*. Cambridge: MIT Press.

Alba, R., Kooy, M. and Bruns, A. (2020) 'Conflicts, cooperation and experimentation: Analysing the politics of urban water through Accra's heterogeneous water supply infrastructure', *Environment and Planning E: Nature and Space*, 5(1). doi: https://doi.org/10.1177/2514848620975342

Avle, S. (2020) 'Radio via mobile phones: the intersecting logics of media technologies in Ghana', *Media, Culture & Society*, 42(5), pp. 789–799.

Baptista, I. (2019) 'Electricity services always in the making: Informality and the work of infrastructure maintenance and repair in an African city', *Urban Studies*, 56(3), pp. 510–525.

Baptista, I. and Cirolia, L. R. (2022) 'From problematisation to propositionality: Advancing southern urban infrastructure debates', *Transactions of the Institute of British Geographers*, 47(4), pp. 927-939.

Bass, O. (2011) 'Palimpsest African urbanity: connecting pre-colonial and post-apartheid urban narratives in Durban', *Social Dynamics*, 37(1), pp. 125–147.

Bratton, B. H. (2016) *The Stack: On Software and Sovereignty*. Cambridge: MIT Press.

Briceño-Garmendia, C., Smits, K. and Foster, V. (2009) *Financing Public Infrastructure in Sub-Saharan Africa: Patterns and Emerging Issues*. Washington, DC: World Bank.

Callaghy, T. M. (1987) 'The state as lame leviathan: The patrimonial administrative state in Africa', in Ergas, Z. (ed.) *The African state in transition*. London: Palgrave Macmillan, pp. 87–116.

Castán Broto, V. (2017) 'Energy Landscapes and Urban Trajectories towards Sustainability', *Energy Policy*, 108, pp. 755–764.

Cirolia, L. R. and Harber, J. (2021) 'Urban statecraft: The governance of transport infrastructures in African cities', *Urban Studies*, 59(12). doi: https://doi.org/10.1177/00420980211028106

Cirolia, L. R. and Scheba, S. (2019) 'Towards a multi-scalar reading of informality in Delft, South Africa: Weaving the "everyday" with wider structural tracings', *Urban Studies*, 56(3), pp. 594–611.

Cirolia, L. R. *et al.* (2021) 'Infrastructure governance in the post-networked city: State-led, high-tech sanitation in Addis Ababa's condominium housing', *Environment and Planning C: Politics and Space*, 39(7), pp. 1606–1624.

Connell, R. (2014) 'Using southern theory: Decolonizing social thought in theory, research and application', *Planning Theory*, 13(2), pp. 210–223.

Coutard, O. (2008) 'Placing splintering urbanism: Introduction', *Geoforum*, 39(6), pp. 1815–1820.

Coutard, O. and Rutherford, J. (2015) 'Beyond the networked city: An introduction', in Coutard, O. and Rutherford, J. (eds.) *Beyond the networked city*. London: Routledge, pp. 19–43.

Cupers, K. and Meier, P. (2020) 'Infrastructure between statehood and selfhood: The trans-African highway', *Journal of the Society of Architectural Historians*, 79(1), pp. 61–81.

De Boeck, F. (2012) 'Infrastructure: Commentary from Filip De Boeck', *Cultural Anthropology*, *2012*. Available at: https://journal.culanth.org/index.php/ca/infrastructure-filip-de-boeck (Accessed: 27 February 2023)

De Boeck, F. (2015) '"Divining" the city: rhythm, amalgamation and knotting as forms of urbanity', *Social Dynamics*, 41(1), pp. 47–58.

De Boeck, F. and Baloji, S. (2016) *Suturing the City. Living Together in Congo's Urban Worlds*. London: Autograph.

Doherty, J. (2017) 'Life (and limb) in the fast-lane: disposable people as infrastructure in Kampala's boda boda industry', *Critical African Studies*, 9(2), pp. 192–209.

Elyachar, J. (2002) 'Empowerment Money: The World Bank, Non-governmental Organizations, and the Value of Culture in Egypt', *Public Culture*, 14(3), pp. 493–513.

Ferguson, J. (1994) *The Anti-politics Machine: "Development," Depoliticization, and Bureaucratic Power in Lesotho*. Minneapolis: University of Minnesota Press.

Fine, B. (1999) 'The developmental state is dead – long live social capital?', *Development and Change*, 30(1), pp. 1–19.

Fox, S. (2014) 'The political economy of slums: Theory and evidence from Sub-Saharan Africa', *World Development*, 54, pp. 191–203.

Fredericks, R. (2018) *Garbage Citizenship: Vital Infrastructures of Labor in Dakar, Senegal*. Durham: Duke University Press.

Furlong, K. (2014) 'STS beyond the "modern infrastructure ideal": Extending theory by engaging with infrastructure challenges in the South', *Technology in Society*, 38, pp. 139–147.

Gillespie, T. (2020) 'The real estate frontier', *International Journal of Urban and Regional Research*, 44(4), pp. 599–616.

Goodfellow, T. (2022) *Politics and the Urban Frontier: Transformation and Divergence in Late Urbanizing East Africa*. Oxford: Oxford University Press.

Guma, P. K. (2020) 'Incompleteness of urban infrastructures in transition: Scenarios from the mobile age in Nairobi', *Social Studies of Science*, 50(5), pp. 728–750.

Guma, P. K. and Mwaura, M. (2021) 'Infrastructural configurations of mobile telephony in urban Africa: Vignettes from Buru Buru, Nairobi', *Journal of Eastern African Studies*, 15(4), pp. 527–545.

Guma, P. K. and Wiig, A. (2022) 'Smartness Beyond the Network: Water ATMs and Disruptions from Below in Mathare Valley, Nairobi', *Journal of Urban Technology*, 29(4), pp. 1–21.

Herbert, C. W. and Murray, M. J. (2015) 'Building from scratch: New cities, privatized urbanism and the spatial restructuring of Johannesburg after apartheid', *International Journal of Urban and Regional Research*, 39(3), pp. 471–494.

Houssay-Holzschuch, M. and Teppo, A. (2009) 'A mall for all? Race and public space in post-apartheid Cape Town', *Cultural Geographies*, 16(3), pp. 351–379.

Howe, C. *et al.* (2015) 'Paradoxical infrastructures: ruins, retrofit, and risk', *Science, Technology & Human Values*, 41(3). doi: https://doi.org/10.1177/0162243915620017

Jaglin, S. (2008) 'Differentiating networked services in Cape Town: Echoes of splintering urbanism?', *Geoforum*, 39(6), pp. 1897–1906.

Jaglin, S. (2014) 'Rethinking urban heterogeneity', in Parnell, S. and Oldfield, S. (eds.) *The Routledge Handbook on Cities of the Global South*. Abingdon: Routledge, pp. 434–446.

Jaglin, S. (2016) 'Is the network challenged by the pragmatic turn in African cities? Urban transition and hybrid delivery configurations', in Coutard, O. and Rutherford, J. (eds.) *Beyond the Networked City: Infrastructure Reconfigurations and Urban Change in the North and South*. London: Routledge, pp. 182–203.

Kaika, M. and Swyngedouw, E. (2000) 'Fetishizing the modern city: the phantasmagoria of urban technological networks', *International Journal of Urban and Regional Research*, 24(1), pp. 120–138.

Kimari, W. and Ernstson, H. (2020) 'Imperial remains and imperial invitations: Centering race within the contemporary large-scale infrastructures of East Africa', *Antipode*, 52(3), pp. 825–846.

Kooy, M. and Bakker, K. (2008) 'Splintered networks: The colonial and contemporary waters of Jakarta', *Geoforum*, 39(6), pp. 1843–1858.

Korah, P. I., Osborne, N. and Matthews, T. (2021) 'Enclave urbanism in Ghana's Greater Accra Region: Examining the socio-spatial consequences', *Land Use Policy,* 111, pp. 1-11.

Larkin, B. (2004) 'Degraded images, distorted sounds: Nigerian video and the infrastructure of piracy', *Public Culture*, 16(2), pp. 289–314.

Larkin, B. (2008) *Signal and Noise: Media, Infrastructure, and Urban Culture in Nigeria*. Durham: Duke University Press.

Larkin, B. (2013) 'The politics and poetics of infrastructure', *Annual Review of Anthropology*, 42, pp. 327–343.

Lawhon, M. *et al.* (2018) 'Thinking through heterogeneous infrastructure configurations', *Urban Studies*, 55(4), pp. 720–732.

Lemanski, C. (2021) 'Broadening the landscape of post-network cities: a call to research the off-grid infrastructure transitions of the non-poor', *Landscape Research*, pp. 1–13. doi: https://doi.org/10.1080/01426397.2021.1972952

Mattern, S. (2016) 'Deep time of media infrastructure', in Acland, C.R. *et al.* (eds.) *Signal Traffic: Critical Studies of Media Infrastructures*. Chicago: University of Illinois Press, pp. 94–112.

Mbembe, A. and Nuttall, S. (2004) 'Writing the world from an African metropolis', *Public Culture*, 16(3), pp. 347–72.

McDonald, D. A. (2012) *World City Syndrome: Neoliberalism and Inequality in Cape Town*. London: Routledge.

McFarlane, C. (2021) *Fragments of the City: Making and Remaking Urban Worlds*. Berkeley: University of California Press.

McFarlane, C. and Rutherford, J. (2008) 'Political infrastructures: governing and experiencing the fabric of the city', *International Journal of Urban and Regional Research*, 32(2), pp. 363–374.

Mizes, J. C. and Cirolia, L. R. (2018) 'Bypass: Informal exceptions to urban land taxation in M'Bour and Kisumu', *Politique Africaine*, 151(3), pp. 17–37.

Munro, P. (2020) 'On, off, below and beyond the urban electrical grid the energy bricoleurs of Gulu Town', *Urban Geography*, 41(3), pp. 428–447.

Murray, M. J. (2017) *The Urbanism of Exception*. Cambridge University Press.

Nielsen, M., Sumich, J. and Bertelsen, B. E. (2021) 'Enclaving: Spatial detachment as an aesthetics of imagination in an urban sub-Saharan African context', *Urban Studies*, 58(5), pp. 881–902.

Nilsson, D. (2006) 'A heritage of unsustainability? Reviewing the origin of the large-scale water and sanitation system in Kampala, Uganda', *Environment and Urbanization*, 18(2), pp. 369–385.

Nilsson, D. (2021) 'Why we need both the large and the small stories. Response to "Under the historian's radar: Local water supply practices in Nairobi" by J.A. Akallah and M. Hård (2020)', *Water Alternatives*, 14(1), pp. 315–318

Nugent, P. (2018) 'Africa's re-enchantment with big infrastructure: White elephants dancing in virtuous circles?', in Schubert, J., Engel, U. and Macamo, E. (eds.) *Extractive industries and changing state dynamics in Africa*. London: Routledge, pp. 22–40.

Odendaal, N. (2011) 'Splintering urbanism or split agendas? Examining the spatial distribution of technology access in relation to ICT policy in Durban, South Africa', *Urban Studies*, 48(11), pp. 2375–2397.

Odendaal, N. (2021) 'Platform urbanism and hybrid places in African cities,' in Aurigi, A. and Odendaal, N. (eds.) *Shaping Smart for Better Cities*. Cambridge, Massachusetts: Academic Press, pp. 203–219.

Parnell, S. and Robinson, J. (2012) '(Re)Theorizing cities from the Global South: Looking beyond neoliberalism', *Urban Geography*, 33(4), pp. 593–617.

Pollio, A. (2020a) 'Incubators at the frontiers of capital: An ethnographic encounter with Startup Weekend in Khayelitsha, Cape Town', *Annals of the American Association of Geographers*, 110(4), pp. 1244–1259.

Pollio, A. (2020b) 'The Cloud, geographical advantage, and the metaphors of the Earth', *Issues*, 3. doi: https://doi.org/10.51142/issues-journal-3-1-2

Pollio, A. (2020c) 'Making the silicon cape of Africa: Tales, theories and the narration of startup urbanism', *Urban Studies*, 57(13), pp. 2715–2732.

Pollio, A. and Cirolia, L.R. (2022) 'Fintech urbanism in the startup capital of Africa', *Journal of Cultural Economy*, 15(4), pp. 508–523.

PWC (2015) *Into Africa: The Continent's Cities of Opportunity*. Available at: http://www.pwc.com/gx/en/issues/strategy/emerging-markets/africa/assets/into-africa-report.pdf (Accessed: February 24 2023)

Rateau, M. and Jaglin, S. (2022) 'Co-production of access and hybridisation of configurations: A socio-technical approach to urban electricity in Cotonou and Ibadan', *International Journal of Urban Sustainable Development*, 14(1), pp. 1–16.

Rodima-Taylor, D. (2021) 'Digitalizing land administration: The geographies and temporalities of infrastructural promise', *Geoforum*, 122, pp. 140–151.

Schindler, S., Nguyen, N. D. and Barongo, D. G. (2021) 'Transformative top-down planning in a small African city: How residents in Bagamoyo, Tanzania connect with a city in motion', *Environment and Planning C: Politics and Space*, 39(2), pp. 336–353.

Schuermans, N. (2016) 'Enclave urbanism as telescopic urbanism? Encounters of middle class whites in Cape Town', *Cities*, 59, pp. 183–192.

Silver, J. (2014) 'Incremental infrastructures: Material improvisation and social collaboration across post-colonial Accra', *Urban Geography*, 35(6), pp. 788–804.

Simone, A. (2004) 'People as infrastructure: Intersecting fragments in Johannesburg', *Public Culture*, 16(3), pp. 407–429.

Simone, A. (2006) 'Pirate towns: Reworking social and symbolic infrastructures in Johannesburg and Douala', *Urban Studies*, 43(2), pp. 357–370.

Simone, A. (2008) 'The politics of the possible: Making urban life in Phnom Penh', *Singapore Journal of Tropical Geography*, 29(2), pp. 186–204.

Simone, A. (2011) 'The surfacing of urban life: A response to Colin McFarlane and Neil Brenner, David Madden and David Wachsmuth', *City*, 15(3-4), pp. 355–364.

Simone, A. and Pieterse, E. (2017) *New Urban Worlds: Inhabiting Dissonant Times*. Cambridge: Polity.

Smiley, S. L. (2020) 'Heterogeneous water provision in Dar es Salaam: The role of networked infrastructures and alternative systems in informal areas', *Environment and Planning E: Nature and Space*, 3(4), pp. 1215–1231.

Von Schnitzler, A. (2008) 'Citizenship prepaid: Water, calculability, and techno-politics in South Africa', *Journal of Southern African Studies*, 34(4), pp. 899–917.

Von Schnitzler, A. (2016) *Democracy's Infrastructure*. Princeton: Princeton University Press.

Wiig, A. and Silver, J. (2019) 'Turbulent presents, precarious futures: Urbanization and the deployment of global infrastructure', *Regional Studies*, 53(6), pp. 912–923.

Wiig, A. *et al.* (2022) 'From the Guest Editors: Splintering Urbanism at 20: Mapping Trajectories of Research on Urban Infrastructures', *Journal of Urban Technology*, 29(1), pp 1–11.

World Bank (2017) *Africa's Cities: Opening Doors to the World.* Available at: https://openknowledge.worldbank.org/handle/10986/25896 (Accessed: February 24 2023)