60th INTERNATIONAL MAKING CITIES LIVABLE

Conference Proceedings * April 26-28, 2024 * Newport, RI USA

Conference Information: https://www.imcl.online/2024-newport

DOI: 10.13140/RG.2.2.20110.16960

Table of Contents

| Alterman, Rachelle, Pellach, Cygall, Dubois, Bryce, and Low, Setha Beach Politics | 1 |
|--|-----|
| Bike Newport Rhode Island Streets Transformation Project | 3 |
| Chavez-Norgaard, Stefan Making Cities Liveable From Below | 4 |
| Citymakers Collective Workshop | 50 |
| Citymakers Collective Summer Studio Abstract | 51 |
| Gilderbloom, John Climate of Hope | 52 |
| Mehaffy, Michael How can we change the operating system for growth to create more livable cities and towns for all? | 76 |
| Mehaffy, Michael and Alterman, Rachelle Tall Buildings Reconsidered | 82 |
| Mehaffy and Salingaros The Surprisingly Important Role of Symmetry in Healthy Places | 107 |
| Morales, Dan The Place of Beauty | 114 |
| Mostafa, Lobna Designing Parks Together - Generative Placemaking Strategies | 119 |
| Spencer, Madeleine CITY – MAKING | 136 |
| Steuteville, Rob How Urban Research Could Build Better Cities | 144 |
| Wambalaba, Akosa Exploring user experience on improved non-motorised transport infrastructure in Nairobi | 148 |
| Westendorff, Veronica Using Urban Heat Health Score to Compare the Heat Health of Different Locations in the United States | 162 |

Beach Politics: Social, Racial, and Environmental Injustice on the Shoreline

Abstract

This panel examines beach politics at two levels: 1) specific beach conflicts occurring at distinct times and places and how they impact wider governance strategies, and 2) more general explorations of the underlying social structures and political institutions that create these conflicts. It queries the processes and practices involved in the public's loss of the beach—and most importantly--what we can do about it. What are the circumstances that allow the enclosure of the beach and restrict access to what was once a commons? Where and in what situations do these exclusionary strategies occur? How is the denial of public rights justified and rationalized—morally and legally—and then how do activists, residents, and others fight to take back these rights. These papers address these questions by uncovering contested claims and inequalities that exist in different cultural settings. By examining challenges to existing power structures, they reveal solidarities that resist, repair, and restructure injustice on the beach.

Rachelle Alterman and Cygal Pellach

Accessibility to the coastal environment: Cross-national comparative analysis

Public access to the coast is not just a matter of physically getting there. The ability to access and enjoy the coast (in permitted locations) is a centuries old legal concept and one of the very rationales for integrated coastal zone management (ICZM). Most policy reports and academic analyses of access to the coast pertains to the extent of land ownership and physical access. In this paper we argue that accessibility to coastal zones is a multi-faceted concept with important social-justice dimensions. We define five different notions of accessibility to coastal zones

- 1. Horizontal accessibility Walking, playing, swimming along the shoreline.
- 2. Vertical accessibility Reaching the shoreline from the hinterland.
- **3.** Accessibility for people with disabilities
- **4.** Social and cultural accessibility Are there "fee walls" or biased behavioral restrictions the deter access for the poor and special socio-cultural groups.
- **5.** Public visual accessibility Ability of the broad public to view the coast from within the city (not only those residing in luxury homes along the coast)

The paper will address the degree to which each of these aspects of accessibility are indeed granted to the public legally and in practice in fifteen advanced-economy countries, including the USA.

Bryce Dubois (College of the Holy Cross) Racism and the Rockaways or Surfing the Cliff: A Success Story in Rhode Island

Abstract: While beaches may feel like a social and cultural tabula rosa, or blank slate, they are impacted by the same racial and class inequities as other urban spaces. These inequities have shaped not only where people live in relation to the beach, but also how people access, are able to affect and are affected by decisions about beaches. Using the case of the Rockaways in southeast Queens, NYC, I will show how the legacy effects of the racial coastal formations there have historically and currently affect beach access and climate adaptation planning. Opportunities to understand and reform coastal management for more equitable access and adaptation will be discussed.

Kristie Daniel (Healthbridge) Scaling up: Beach Activism and Different Ability Access in Kerala, India

(Oral presentation)

Setha Low (PSRG, GC CUNY) Beach Appropriation and Exclusion Strategies: How do we Stop Them?

(Oral presentation)

The Rhode Island Streets Transformation Project (RISTP)

Bike Newport

The Rhode Island Streets Transformation Project (RISTP) is a mini-grant project launched by the Rhode Island Department of Health's Healthy Eating & Active Living Program in 2023 to fund, implement, and evaluate temporary demonstration projects that increase active transportation and the use of public spaces for physical activity.

Bike Newport is a local non-profit organization that works to create conditions that make bicycling a viable, safe, and comfortable primary choice for transportation and recreation through education, advocacy, and community engagement.

As a part of the RISTP, Bike Newport received RISTP funding to work with the City of Newport to create the Newport Traffic Garden in a large, empty lot owned by the city. This Traffic Garden was created to provide a safe space for road safety education and will remain installed until the city needs or sells the space. The Traffic Garden also set a precedent to put unused private space to public use and benefit until it is needed.

Bike Newport's Traffic Garden is a scaled-down streetscape that presents a fun, safe, and effective way to teach riders of all ages the rules of the road and how to ride safely. The Traffic Garden includes roadways with vehicle markings, crosswalks, stop signs, and even a roundabout. Riders are able to practice their skills and learn along the way whilst contained in a safe environment. By design, the Traffic Garden serves riders of all ages, bike skills, cultures, languages, and physical/cognitive abilities. This demonstration project helps to improve road safety education, enhance road-sharing skills, and fosters a culture of respect and courtesy among all road users. The opening of the traffic garden took place Tuesday, October 9th, 2023, and was attended by approximately 100 people. The project has garnered statewide media attention.

The Newport Traffic Garden not only maximizes the use of a vacant lot, but also works to improve the health, safety, and well-being of members of the community. This project stands out as an example of what temporary demonstration projects can add to a community.

Making Cities Livable from Below? Repurposing the Geography of Apartheid

Paper submission to the 60th International Making Cities Livable (IMCL) Conference Bois Doré Estate * Newport, Rhode Island USA * April 26-28, 2024

Stefan Chavez-Norgaard PhD Candidate in Urban Planning Columbia University Graduate School of Architecture, Planning, and Preservation (GSAPP) April 1 2024

Abstract (196/200 words)

Across its *longue durée* history of colonial, military, apartheid, and contemporary-democratic eras, Mahikeng, South Africa has existed in peri-urban territorial relationship to Johannesburg and Pretoria (Gauteng), and to world-economic centers of capital accumulation. This paper proposes that such patterns of peripheralization, dependency, and bi-directional cultural production are dynamic, contested, and ongoing. That contestation is expressed in part through residents' repurposing of the apartheid-era built environment. As a receiving site of apartheid-era forced relocation and site of a pre-planned 'Bantustan' capital city, Mahikeng experienced what Mosiane and Götz call "displaced urbanization"; today, heterogenous aesthetic and symbolic forms of "displaced urbanism" abound and are often resident-initiated and produced. In contrast to scholarship framing spaces of historic racialized dispossession as 'dumping grounds,' this paper seeks to humanize residents' repurposings, and typologize residents' symbolic and aesthetic interventions with attention to regional political economy. Methods include archival research, semi-structured interviews, and in situ analyses of built structures. I find that across institutional moments, Mahikeng's built form is informed by relationships with sites of surplus accumulation. Residents' reappropriations of apartheid-era spaces are themselves 'classed' and divergent phenomena, and are culturally and socioeconomically grounded, revealing multiple ambiguous meanings to 'territorial-scale peri-urban' spaces today.

Keywords: South Africa, repurposing, political economy, peri-urban, hinterland, production of space, apartheid, racial capitalism.

Author Biography (100 words)

Stefan Chavez-Norgaard is a PhD Candidate in Urban Planning at Columbia University's Graduate School of Architecture, Planning, and Preservation (GSAPP). His research interests include urban and planning theory, local-government and planning law, and mixed-methods research focused on planning practice and urban governance in the related but distinct late-liberal contexts of South Africa and the United States. Stefan is passionate about participatory democracy and how cities' public/private arrangements affect equitable and sustainable urban development. His dissertation examines areas of apartheid-era forced relocation in South Africa and how master plans have been implemented and repurposed in these geographies by residents and planners.

Paper follows, and is 9,347 words

Introduction

Mahikeng, South Africa, is currently capital of the North West Province and lies about 290km, or ~4 hours, to the northwest of Johannesburg. Much of the first 90 minutes driving between Johannesburg and Mahikeng is spent passing sprawling suburbs and 'edge cities' in the broader metropolitan region known since 1994 as Gauteng.¹ Much of the following hours driving to Mahikeng is spent passing large-scale agro-industrial farms and platinum mines: what Brenner and Katsikis (2020) call "operational landscapes" of Gauteng's hinterlands (23). Yet compared with nearby mining cities like Rustenburg or agricultural towns like Lichtenburg, Mahikeng is an oddity. Notes Parnell (1986), Mahikeng "arises directly out of apartheid practice" and is a "peripheral centre" that "has long been something other than an ordinary South African country town" (203). Its history is multi-layered, existing first as Mafeking, a British colonial city in erstwhile Bechuanaland and then as Mmabatho, the "capital city" of the independent 'Bantustan' of Bophuthatswana (see also Jones, 2000; Drummond et al., 2021).² During the apartheid and 'Bantustan' eras, Mafikeng (as it was then called) was ajoined with Mmabatho and received extensive forced resettlement of Black, ethnic Tswana residents from the Johannesburg and Pretoria metropolitan areas. As pre-planned capital of Bophuthatswana, the city housed a small but notable overclass of civil servants and governing officials. In 2010, the African National Congress (ANC) re-named the city *Mahikeng* to better reflect Setswana linguistic conventions.

Looking territorially at Mahikeng in relationship to Gauteng, and specifically to the urban centers of Johannesburg and Pretoria, as well as in relationship to global circuits of speculative

¹ Gauteng is a word in Sesotho and Setswana meaning "place of gold." The province was so-named after South Africa's first democratic elections in 1994; the metropolitan region was previously known as the Transvaal Province or was referred to as the Pretoria–Witwatersrand–Vereeniging (PWV) agglomerative area.

² While 'Bantustans' were fictitious, illegitimate, onomastic constructions, they also had "material consequences for millions of people" (Ally and Lissoni, 2017: *ii*). I use the term 'Bantustan' to convey that material weight and the weight of history, but at times use 'scare quotes' to signal my belief that the territorial regime to which the term gestures is fraudulent and democratically illegitimate.

financial capital derived from resource extraction, this paper proposes that Mahikeng's urban morphology reveals longstanding patterns of peripheralization, dependency, and cultural production exist that are dynamic, contested, and ongoing. That contestation is expressed in part through residents' repurposing of apartheid-era built sites. Exploring Mahikeng's "territorial periurban" status both extends and adds nuance to Brenner's dialectic of "concentrated and extended urbanization" (2013: 96) and furthers Brenner and Katsikis' (2020) concept of "operational landscapes" by considering post-apartheid *afterlives* of a South African secondary city haunted by white-minority rule.

Mahikeng was a receiving site of apartheid-era "displaced urbanization" (Murray, 1988; Mosiane and Götz, 2022) as part of Mmabatho, pre-planned capital of the Bophuthatswana 'Bantustan.' South African 'Bantustans' were created in the 1960s and 1970s through forced relocation and dispossession to 'Native lands,' and illegitimately declared self-governing entities or 'independent republics' until the end of apartheid. In this era of pre-planned modernist citybuilding, scholars like Mbao (2018) considered Mmabatho to be an "artifice," propped up by apartheid subsidies and an overclass of indirect-rule elites: civil servants, nurses, teachers, and firefights for the illegitimate Bophuthatswana "national state." In contrast to scholarship framing spaces like Mmabatho/Mahikeng solely as 'dumping grounds,' however, this paper seeks to humanize enclaves of dispossession as sites of city living by exploring residents' repurposings. This paper likewise considers the implications of such repurposings for Mahikeng's contemporary regional political economy, and for present-day extended-urban linkages. Complementing work on changing South African planning processes by Oldfield (2004, 2000), Cirolia et al. (2021), and Ngwane (2021), this presentation explores how ordinary residents

leverage those processes in acts of repurposing. What emerges are heterogenous aesthetic and symbolic forms of "displaced urbanism" (Mosiane and Götz, 2022).

I define "repurposings" as actions to transform urban space in accordance with visions or vernacular uses of space *other than* those originally anticipated by professional planners. Focusing on institutional and relational planning in Mahikeng, and with an attention to both mutating racial-capitalist political-economic and urban-metabolic processes, I ask: how and why do residents repurpose space? With what consequences?

In the 1990s' transition from apartheid to democracy, Mahikeng quickly and dramatically transitioned from being a site of forced relocation and indirect-rule authoritarian subjugation to a tertiary regional center on the geographical and political-economic margins of Gauteng. One might expect Mahikeng today to be filled with derelict buildings haunted by past legacies of erstwhile white-minority rule and 'Bantustan' oppression. Yet this is not the case: today, Mahikeng's built environment is marked by heterogenous (and diverging) spatial forms and creative social and material assemblages. Its built spaces are in aesthetic and economic conversation with urban sites of surplus accumulation elsewhere in South Africa. Repurposing animates the local geography of Mahikeng. The practice provides clues into how residents might endogenously produce space and generate prosperity and creativity from supposedly marginalized peri-urban contexts.

What do such spatial interventions look like in practice? Mass-built housing customized with roof decks, double-story additions, garages, and elaborate security gates. "Car washes" where residents braai meat, play popular contemporary music, dance, and gather on weekends. Former apartheid buildings creatively re-used as sites of public or civic gathering. And local creches, nurseries, or daycare centers emerging in the same matchbox-style homes that were

4

once receiving sites of forced relocation. Repurposing is distinct from auto-construction, coproducing, or "self-building" (Caldeira, 2017; Ewing, 2021, 395; Izar, 2022): when repurposing, residents employ the same spatial container from an earlier, undemocratic era for vastly different purposes. However, repurposing is likewise "a way of producing peripheral spaces through unstable, improvised and fragmented ways and relationships between citizens and the state" (Meth et al., 2021; Izar et al., 2023).

The paper proceeds as follows: first, literature reviews explore scholarship on territory, displaced urbanization, repurposing, and displaced urbanism, as each conceptual lens is informed by scholars from South Africa and those working to understand contemporary South African urbanization. Next, I discuss underlying research methods which include archival research, semistructured interviews, and *in situ* analyses of repurposed built structures in and around Mahikeng. Through evocative examples of repurposing (case studies), I then discuss study findings. Namely, I find that across institutional moments, Mahikeng's built form is informed by relationships with sites of surplus accumulation. Residents' reappropriations of apartheid-era spaces are themselves 'classed' and divergent phenomena, and are culturally and socioeconomically grounded, revealing multiple ambiguous meanings to 'territorial-scale periurban' spaces today. Critically, repurposing invokes an alternative urban imaginary (Urson et al., 2022) of a more just city, and of planning itself. Displaced urbanization and displaced urbanism can both productively be understood as "modes of urbanization," themselves present in other contexts globally. Displaced urbanism is an urban morphology of residents' responses to unjust top-down professional planning: these resident responses offer an implicit framework for resident-led incremental and vernacular planning to which scholars and practicing planners globally should attend.

5

Placing Territorial Peri-Urban Mahikeng in Urban Theory

Territory and the Territorial-Scale

Much like property, territory can be productively understood as a bundle of social and relational claims (Elden, 2013) caught in a dialectic between fixity or boundedness and movement (see also: Sack, 1986; Meyer and Norgaard, 2022: 1396). In a tradition of Hobbes (1968), sociologist Charles Tilly (1985) argues that "classic" European colonial paradigms of territory are the product of both state "protection" (organized crime protection rackets) and "extraction" (of capital), enabling state-making as "war-making" (1983). Writes Tilly:

The word 'territory' should not mislead us. Until the eighteenth century, the greatest powers were maritime states, and naval warfare remained crucial to international position...Looking back, one cannot help but be struck by the seemingly symbiotic relationship existing between the state, military power, and the private economy's efficiency in the age of absolutism...Thus, the sheer size of the government varied directly with the effort devoted to extraction, state making, protection, and, especially, war making, but inversely with the commercialization of the economy and the extent of the resource base...Clearly, war making, extraction, state making, and protection were interdependent (178–182).

This assertion of points to a conceptualization of territory that seeks to assert control or occupancy over a given place. Territory indeed involves violent military infrastructures—of borders, weapons—but also operates at the level of narrative—memory and imaginary. Notably, the nation-state is a specific category of territoriality that, in a *longue durée* context of Western, Weberian, colonial geopolitics and statecraft, holds heightened weight and power in the territorial frame.

In the context of apartheid-era Mahikeng, its territorial function was as a *de facto* labor reserve for relocated Black South Africans enmeshed in a common, racial capitalist political economy (see, i.e., Levenson and Paret, 2022). Writes Halbach (1988): "From an economic

viewpoint, ['Bantustans'] have remained overcrowded, peripheral, and poverty-stricken regions despite some attempts at development. Their economic significance has been reduced more and more to that of a labour reservoir and a dumping ground for surplus labour, which - in effect - has always been their implicit role" (508). A widespread racialized and gendered system of migrant labor connected male workers in the former 'Bantustans' like Bophuthatswana with faraway white-owned mines and factories. Some female workers performed unpaid care and social welfare functions in the 'Bantustan', and others worked as domestic workers, cleaners, or nannies in white South African households. Mine and factory workers often stayed in hostels or dormitories for some 10–11 months of the year.³ In Bophuthatswana in 1980, for example, the 'Bantustan's' economic statistics office recorded a resident population of around 1.3 million. Of that population, around 339,000 workers were recorded as working in "White Areas," and just 33,000 in the "Local Modern Sector." For all income sources, per-capita income for residents of Bophuthatswana in 1980 was \$250 USD per annum ("South Africa's Black Homelands," 1982: 5–6).

Scholars like Margaret Moore (2015) add nuance to this Hobbesian understanding of territory with concepts including territorial rights and territorial justice. Following work by Moore and others, territorial claims "from below" can assert collective and popular-democratic rights to, and in, bounded territories beyond elites' capital accumulation or supposed protection from warring groups. Asking questions such as: "Who has the right to what territory, and what should such territorial rights include?" Moore's accounts find that principles of self-

³ SAHA's Neil Coleman collection includes extensive primary-source files about this forced migrant labor system, including contracts, commute times, and workers' daily activities (through interview questionnaires). Notably, the Coleman collection interviews both contract migrant workers and mine and factory staff, and documents pay scales, leave times, and migration pathways. The project was commissioned by the Labour Research Committee (LRC) between 1979 and 1981, for a publication that never materialized. See: "The Neil Coleman Collection," 2009. For a relevant representative interview with a white foreman see: "Interview with Besterecta - Johann Botha," 1980. For a relevant representative interview with a contract workers, see: "Interview with Million Sambo," 1980.

determination and distributive justice extend within, and through, territorial claims (Moore, 2012: 84). Mahikeng's sovereignty as a local political community, in other words, exists in a dialectic between residents' self-determination and territorial exploitation within historic and contemporary sites of South African surplus accumulation. We can fruitfully extend Moore's account from the realm of politics and governance to circuits of aesthetics and cultural production, much like residents of Mahikeng are doing today.

Displaced Urbanization

Inspired by critical urban theory—which interprets cities' territorial bounds broadly, extending to a planetary scale—Mosiane and Götz (2022) consider Gauteng's "mesozone" and plot relative economic output versus population contributions of different geographies in relation to both Gauteng and its peripheries (7–10). They find, with clear links to apartheid-era planning, that former apartheid-era 'Bantustan' areas, as well as non-white townships, are overrepresented in their relative share of population contribution to their share of economic contribution in Gauteng (8–10). The authors write: "Displaced urbanisation' refers to human settlement development that would have gravitated to the traditional urban core were it not for apartheid. Apartheid boundaries and restrictions on mobility forced millions of African people with urban aspirations to build homes and livelihoods in homeland areas as close as possible to – but nonetheless still at some distance from – the economic opportunities in the urban centres reserved for white residents" (10). Displaced urbanization in Mahikeng thus arises in large part from past racist and draconian juridical dictates.

Displaced urbanization as a conceptual label pre-dates Mosiane and Götz's more recent engagement: scholars writing in the 1980s during the heyday of the effects of displaced

urbanization used the term as well, through an analytical lens of gendered and class developmentalism (see, i.e., Murray, 1988). Extending its definition beyond the historically contingent events of apartheid planning, I define "displaced urbanization" as a mode of urbanization that deliberately results from the de- and re-territorializations of hinterlands and formerly non-city spaces alongside the operationalization of formerly peripheral landscapes, marshaled into a common territorial urban project. In the case of South Africa's 'Bantustan' system, that project was territorial-scale apartheid: racial segregation and the apartheid politicaleconomic project of "separate development" (Jones, 2000: 580). The goals of this separation were clearly articulated: wealth and capital accumulation for 'White' South Africa and South Africans, and labor and exploitation and confinement (subjugation) for Black South Africans.

Displaced urbanization complements other traditional *modes of urbanization* such as the colonial city, the monocentric industrial city, the financial-capital command-and-control center, or the resource-developmental city. Much as Brenner and Schmid (2015) argue that urban studies scholars must both revisit, and revise, inherited ontologies and conceptions of "the urban" to account for the contemporary scale of global capitalism, displaced urbanization speaks to the nuances and variegations of that global capitalist project over time and across places. Mabin (1988) underscores the tremendous diversity even within these displaced-urban settlement patterns within the greater Gauteng functional-urban region: "They vary from places which are urban only in the negative sense that they are not primarily agricultural and have fairly high densities, to almost-urban areas with a modicum of services…and their geographical location varies from those in close proximity to city centres…to hundreds of kilometres from the metropolitan cores" (9–10). Across varied spatial forms, however, was a common purpose: a means of governing "non-consenting populations who proved difficult to observe and record"

(Robinson, 1997: 366). Similarly, geographer David M. Smith writes of the former 'Bantustan' of Bophuthatswana: "Despite the drawing of an 'international border' and such trappings of statehood as a legislative assembly, a coat of arms, and flag, Bophuthatswana remains an integral part of the South African capitalist system...the homeland [border] comes within 20km of the 'white' city, and it is just across the border that the major dormitories for African workers were built...Thus workers who would previously have been housed in townships on the edge of Pretoria in 'white South Africa'...became foreign residents" (1982: 39), still located within the White South African economy.⁴ In short, the distinctive racial-capitalist regime of spatial diffusion inherent to apartheid 'separate development' gave rise to a wide array of distinctive morphological forms that endure today, for example in high-density, peripheral, settlement patterns.⁵

Yet if displaced urbanization speaks to the structural underpinnings of the apartheid-era production of space—on exploitative and unequal racial terms—the term must be paired dialectically with residents' efforts to repurpose and remake these geographies. Residents' citymaking strategies—a production of space "from below"—is achieved through tactics of repurposing apartheid built space at various scales. These tactics and repertoires of repurposing are grounded in historical antecedents of contestation and the transgressive reappropriation of spaces originally designed for unjust purposes. Repurposing gives rise to a wide array of

⁴ Although as Smith notes parts of the apartheid-era Bophuthatswana 'Bantustan' were less than 20km away from Johannesburg or Pretoria, Mahikeng and other peripheral centres were located nearly 300km away from the agglomerative core.

⁵ Note Mosiane and Götz (2022: 10), other South African scholars have used a variety of related terms to descrive the distinctive urban morphology of apartheid racial capitalism: "Simkins (1983) called them 'closer settlements,' Murray (1988) used the term 'displaced urbanization' as well as 'rural slums,' Bradford (1987) called them 'rural ghettoes,' and Hindson (1987) coined the term 'quasi-urban' settlements to underscore the absence of an agrarian base" (10).

symbolic and aesthetic forms and vernacular architectural styles, productively understood through the conceptual label of "displaced urbanism."

Repurposing

Three features of repurposing, as I conceptualize it, are worth highlighting here: the practice is tied to broader structural urban transformations that are themselves culturally and contextually grounded; the term is both a material-economic resident intervention and an aesthetic, or symbolic, affective intervention; and the term gestures toward an incremental, negotiated planning regime by which residents engage their local state. South African scholars at times employ different conceptual labels that nonetheless reference similar processes of urban transformation. Writing about this topic in a 2006 special issue of the journal *Urban Studies*, Robinson (2006) uses the phrase "imaginative reclamation and re-use" (256); Pieterse frames such metropolitan dynamism as "building with ruins and dreams" (2006: 285); Harrison contextualizes the moment as "planning on the edge of reason" (2006: 319); and Simone (2006) discusses "reworking social and symbolic infrastructures" (357–370). For Gandy, the framework of "anti-planning" is as useful to engage as planning (371). Repurposing as a term, per se, does not appear in this special issue. But the definitional contours of the term animate the special issue and speak to a set of conditions in planning theory perceived theoretically and empirically by many South African theorists and South African urban dwellers.

Cirolia et al. (2021) do use the term repurposing explicitly, alongside retrofitting and replacing, in their article examining residents' occupation of a formerly vacant hospital building near the Cape Town city center (Cissie Gool House). They argue that residents employ a "logic of 'retrofit city-making'" to take a building originally designed for an institutional use on

racialized terms and transform it into a space to fulfill material and affective needs (144). Building on this intervention, co-authors Scheba and Millington (2023) posit that Cissie Gool House is a "reparative urban infrastructure" for residents as they claim and remake the space (1).

The articles by Cirolia et al. and Scheba and Millington, like others, gesture toward an incremental, negotiated approach to planning and city-making, something Adebayo (2011) also discusses regarding potential for post-apartheid housing, and Harrison et al. (2018) consider in their report on "daily practices of informality amidst urban poverty" in Johannesburg and the Cape Town township of Delft. Other scholars have discussed the generative potential and at times impressive track record of this incremental and negotiated planning approach, for example through slum upgrading of South African informal settlements (Huchzermeyer, 2006) or what Huchzermeyer and Misselwitz (2016) call "co-producing inclusive cities." That said, unlike insitu upgrading, repurposing is not solely a future-focused, developmental approach to city-making. As the term repurposing itself suggests, repurposing is deeply in tune with, and shaped by, past forms and inherited purposes. Repurposing, as defined here, is a territorialization of both mnemonic and futurist city-making practices (Meyer and Norgaard, 2022). It offers an entry point for resident experimentation and word-making precisely because, while inherited purposes linger, they fail to uphold their hegemonic power (Sacks, 2022).

A final aspect of repurposing is the power of residents to engage their state, not necessarily through formal procedural means but at the level of everyday relationships and tactics of engagement that are in turn formal and informal, legal and illegal, cooperative and confrontational (Bénit-Gbaffou and Oldfield, 2011: 445). This engagement often happens *in situ:* at the physical site of spatial experimentation. With repurposing, residents' everyday re-use and re-appropriation of space at times inspires and at times rankles local-state officials. Importantly,

however, repurposing reveals the ways in which such re-invented spaces point to a tacitly shared ideal of city living, one in which the State actually serves marginalized populations; the structural-economic dynamics of cities are designed to further residents' (and especially poor residents') well-being and quality of life; and creativity and gathering are prioritized as development imperatives.

Accordingly, I define "repurposings" as actions to transform urban space in accordance with visions or vernacular uses of space other than those originally anticipated by professional planners. To operationalize repurposing, I attend to both processual forms and outcome-based types. As described further in the study's methods section, I visit and typologize over 80 spatial sites in Mahikeng, seeking to understand building-level repurposings and place them in a broader regional and political-economic context.

The logic between territory, displaced urbanization, repurposing, and displaced urbanism is as follows: through a white supremacist and militarized logic of *territorial* hegemony, South Africa's apartheid state—including state planners, elected officials, and indirect-rule elites envisioned and constructed former 'Bantustans' and their capital cities (including Mmabatho/Mahikeng). The widespread forced relocation of Black South Africans achieved through racialized dispossession led to a consolidation of the urban morphology of *displaced urbanization*. What emerged was a built environment ill-suited to residents' needs. Residents of Mahikeng did not receive this built environment passively. Through tactics of contestation, destruction, and re-invention—collectively what I label *repurposing*—residents' reappropriations of various built sites led to highly variegated, yet often functional, built environments for individual and collective needs. What emerges are aesthetic and symbolic urban forms of

displaced urbanism that are marked by creative material and social assemblages, heterogenous (and socioeconomically divergent) spatial forms, and continuities existing alongside change.

Displaced Urbanism

Displaced urbanism makes reference to the varied urban forms and aesthetics resulting from processes of displaced urbanization and residents' tactics of repurposing. The term has scholarly origins that are tied to aesthetics and cultural production: Bank (2015) uses "displaced urbanism" as a conceptual label to discuss "migrant culture" of rural homesteads in coastal areas of the former Transkei 'Bantustan' in South Africa (1067–1069); Osborne (2004: 64) looks at how art, public and otherwise, can function as a type of displaced urbanism; and de Boeck (2021) employs the term displaced urbanism in the context of Kinshasa to understand how "exclusive new urbanisms often take the form of a 'modernization as spectacle'" marked by "political theatricality" and grandiose architectural interventions for elites alongside a "pauperized precariat."

Although Mahikeng residents repurpose in service of a tacitly shared ideal of workable city living, the actual practices of repurposing that I observed were extraordinarily diverse. The affective and aesthetic interventions of these residents nonetheless point to a vernacular register of built form: *displaced urbanism. In situ trans*formations ranged from the destruction of apartheid-era buildings to nostalgic efforts at renovation. A mix of class, ethnic, and neighborhood-geography identities inform and differentiate displaced urbanism, even as longing for an alternative urban imaginary remains the connecting tissue underpinning residents' wideranging actions.

As a set of spatial interventions "from below," displaced urbanism speaks to a longstanding yet ever-changing resident-initiated playbook that responds to top-down authoritarian planning by the 'planned upon.' At times it seeks simply to contest unworkable planning, or the demise or destruction of unjust spaces. At times, residents employ transgressive tactics and engage state-legitimated deliberative consensus processes. At other times, repurposed planning "muddles through" with imperfect, incremental interventions. And at times, it embodies, in space, residents' frustrations with the urban status quo as much as any desire for a programmatic, popular-democratic alternative.

Just as there were colonial origins to land-use planning, there were colonial origins to urban design and aesthetics, with rigid building codes, design guidelines, and licensed materials permitted (see: High Commissioner's Notice No. 1," 1963). In the apartheid era, aesthetic and design guidelines emphasized *uniformity* and *homogeneity*. Given the historical links between forced relocation and monolithic urban design, it is perhaps not surprising that residents in repurposed buildings in contemporary Mahikeng are deliberatively differentiated spaces, with cultural, symbolic, and aesthetic interventions. Such a perspective aligns with the scholarship from Cante et al. (2023)'s "re-arrangements collective," which foregrounds the artfulness and aesthetics of repurposing that might not fit into a formal Western category of life, as well as Simone's (2022) book *The Surrounds*, which contends that "urban spaces beyond control and capture...exist as a locus of rebellion and invention" where residents use spaces in creative ways for which they were not designed (6–8). Yet such symbolic and aesthetic urban forms are 'classed' phenomena, marked by increasingly divergent cultural forms (**Table1**). Ballard, Mosiane, and Hamman (2021) discuss "Unfolding spatial transformations in the democratic era" and "underscore the dispersed [sic] nature of the energies producing urban space, and the need to understand and work with these energies as we find them in directing spatial transformation" (2). They go on to note six spatial trends occurring in post-apartheid South Africa, which include uneven densification, socio-economic segregation, and spatial mismatch. The forms of displaced urbanism that result are, therefore, neither monolithic nor uniform. **Table 1**, below, points to some key axes of difference.

| | Class approximation | Political aesthetic characteristics | Examples |
|--|--|--|--|
| Enduring landscapes of poverty or despair | Low-income and low-assets | Use of corrugated iron, asbestos, and local clay for makeshift dwellings; shipping containers; and inhabiting derelict land or planned projects | Half-shack half-house compounds in Itsoseng, Lonely Park; informally re- used partially destroyed, abandoned housing on Zeerust Rd. |
| Survival with innovation and optimism | Low-income with ties to collective and/or cultural assets | Creative use of re-cycled and locally sourced materials | Tyre House in Mothibistad; car washes |
| Luxury and the aspirational good life | Higher-income and assets | Verdant landscaping; security gates; double-story additions; architecturally ambitious extensions | Mmabatho Unit 6's Garona Lodge; Renovated housing security gates in Mmabatho Unit 8 |

Table 1: Divergence among Displaced Urbanism

Methods

This paper offers both a theoretical contribution and an empirical analysis of one extended case-study research site: Mahikeng, South Africa. I conduct an academic literature review related to modes of urbanization (especially including displaced urbanization), racialized dispossession, and urban development in South Africa, symbolic and affective urban form (including displaced urbanism), and resident interventions in the production of space in the Global South. Scholarship related to these topics include work in urban planning, critical human geography, history, and anthropology, and interdisciplinary fields such as global studies, science and technology studies, media and communications, public policy, and area studies (i.e. South African studies). Theoretical work related to urbanization often generatively foregrounds a scholarly tradition of institutional political economy, which I employ as well (see, i.e., Brenner, 2004; Slater, 2021; Wacquant, 2022).

I apply theoretical interventions in the thick institutional context of Mahikeng, including the city's past experiences of processes of urbanization. Methods include analysis of historical and archival material from seven archives in South Africa, including official reports, plans, maps, and government documents; semi-structured interviews, participant observation, and personal communications with planners, current and former civil servants, civil-society practitioners, and residents of Mahikeng;⁶ and an *in situ* close analytic reading of over 80 specific buildings and sites in Mahikeng, including photographs, videos, extemporaneous conversations, transect walks, and roving focus groups with residents. Building-level analysis allowed me to consider processes of repurposing and aesthetic and affective forms of *displaced urbanism* amidst the structural and historic backdrop of the city's experience of *displaced urbanization*. I conducted research in Mahikeng in three phases: a preliminary visit to the city in March 2022, core fieldwork from August through December 2022, and a follow-up visit with research colleagues and presentations in May 2023. The research draws on 44 interviews and over 200 engagements with residents and planners in Mahikeng (72% with residents under 65, and 28% over 65).

Discussion and interview topics included residents' motivations and explanations for local spatial interventions, tactics and repertoires of spatial recontextualization, and various types and forms of repurposing. I also asked research subjects about their own personal experiences

⁶ The names of all research subjects have been anonymized per my dissertation's Institutional Review Board (IRB) protocol, [ANON.] University protocol #IRB-AAAT9511, which includes a waiver of documentation of consent.

living in Mahikeng during changing institutional regimes. I paired these methodological engagements with daily self-reflections and field notes, and coded data using ATLAS.ti. My overall approach to coding was inspired by Creswell and Poth's (2018) grounded theory (88–89, 132–133), and by the work of Allen and Davey (2018), who propose a set of specific analytic activities for "constructivist grounded theory for built environment researchers" (222–223).

Research participants were those with current or former ties to Mahikeng. Some were government officials, academics, activists, or members or leaders of movements, and others were ordinary residents working to transform the urban landscape of Mahikeng through micro-scale changes in land-use or aesthetic form. Eighty percent of interviewees were Black South African, and the vast majority Setswana speaking; 18% of interviewees were White South African, and about 2% of interviewees identified as mixed race or more than one race.

A limitation to this research is one of external validity: owing in part to its exceptionally multi-layered history as a colonial capital, master-planned 'Bantustan' capital, and today provincial capital, insights from Mahikeng should not be equated with other South African cities or rural areas, and insights should *not* presume that cities' experiences of displaced urbanization, displaced urbanism, or territorial peri-urban arrangements are monolithic. Moreover, because attitudes, values, beliefs, and memories about the *past* are often grafted onto contemporary experiences of the *present* (Dlamini 2009), it is worth noting that when I conducted these interviews, South Africa was just emerging from years of economic decline due to the COVID-19 pandemic, and was battling struggles over service-delivery (in particular power and water cuts), inflation, and corruption allegations in the North West Province. These current events may have shaped respondents' perspectives, particularly with regard to cynicism about professional-planning and local-state interventions as they relate to issues of territorial self-determination.

Findings

The research methods above led to three insights about repurposing and the 'territorialscale peri-urban' in Mahikeng: first, it reveals Mahikeng's multi-layered history as existing in fluid, dialectical relationship to sites of surplus accumulation (including Johannesburg and Pretoria, and at times world-economic centers of financial capital). These relational understandings of Mahikeng as a peri-urban territorial site change as political-economic regimes and institutional arrangements change; nonetheless, a through line exists regarding the city's extended-urban morphology. Second, elites' visions of Mahikeng and the durability of Mahikeng as an apartheid-era receiving site of relocation reveal *displaced urbanization* as a mode of the urban. And finally, the longstanding presence of residents' creative and differentiated responses to top-down territorial planning premises speaks to *displaced urbanism* as an urban morphological regime in its own right: displaced urbanism exists as a culmination of residents' repurposings and underlife tactics of otherwise hostile or simply unworkable built spaces.

Territory, Territoriality, and the Territorial-Scale Peri-Urban

We ought to understand Mahikeng not merely as a static urban site, but as a site of territorial peri-urban relationality. Two dialectics are generative in doing so: Brenner's (2019) conceptual dialectic of "concentrated and extended urbanization," by which cores of surplus accumulation pair with planetary-scale hinterlands; and Mosiane and Götz's (2022) discussion of displaced urbanization and displaced urbanism. Since its establishment in the mid-19th century, the area of present-day Mahikeng has been host to many different settlements, including indigenous Tswana villages, Afrikaner (or Boer) encampments, and a British colonial railway outpost ("*Mafeking*"), in addition to being a former 'Bantustan' administrative capital and now a

provincial capital and tertiary regional center. To simplify a very complicated, multi-layered history, the city has directly experienced at least four dramatic institutional reformulations loosely tied to colonial, military, apartheid, and post-apartheid democratic periods. Mahikeng's multi-layered history speaks to various contested territorial claims grafted onto this landscape over time. The city retains residues of past territorial claims even as residents and elites assert new claims in the contemporary moment.

Contemporary Mahikeng residents' histories of oppression and resistance pre-date apartheid and continue into the present era.⁷ Yet they are all territorial in nature. Tswana people have resided in the area of present-day Mahikeng since 600–900 CE, with histories of settlement documented comprehensively by historians including Andy Manson, Bernard Mbenga, Freddy Khunou, and others.⁸ Various 19th century treaties with British colonial authorities sought protection from Afrikaner *Voortrekkers*, who violently entered the region starting in 1832 (Lange, 2009: 143). There is a direct historical arc from South African colonial-era segregated land and property laws to the creation of the former 'Bantustans'. Levy (2019) traces South African racialized landed property regimes to the 1894 Glen Grey Act, arguing:

The Glen Grey Act...enshrine[d] in law the residential separation of the races. It was also the basis for the notorious Natives Land Act of 1913, which in its final form allocated a mere thirteen per cent of all arable land to the black majority. This land was held in 'native reserves,' under the authority of African chiefs. There were no individual property rights on the reserves, so no land could be sold.

The Glen Grey Act also limited African land inheritance to the eldest son ("South Africa's

Black Homelands: A Handbook," 1982: 2), yet taxed both male migratory labor and women

⁷ Following Rao (2015), Mahikeng residents have been subject to "repetitive structure[s] of violence," ranging from those of forced relocation to authoritarian indirect rule to re-tribalization that are, in key ways, both "instrumental, but also symbolically overdetermined and purposive in character."

⁸ See Khunou, 2013; Khunou, 2017; and Manson and Mbenga, 2014. Perspectives on the links between precolonial Tswana settlement structures, colonial-era dispossession, and the creation of the former 'Bantustans' are informed by personal communication #89 with academic and historian, September 22, 2022; interview #84 with community member, resident, and local historian; as well as work by Rubin and Harrison, 2015: 124–125.

²³

through a "hut tax," the latter an indirect tax with profound effects on social reproduction (Redding, 1993: 49–50). With the government prohibiting land ownership and exchange rights by Black individuals in economic markets, tribal and customary landed-property regimes filled the gap. One could consider the enduring presence of tribal and customary land as an historic continuity, as a land regime borne out of necessity, or as a land regie complicit in the machinery of apartheid, overseen by local elites hand selected by apartheid officials.⁹ One might also see in these parallel yet distinct land and legal systems a racialized territorial regime of urbanization that would shape subsequent population, settlement, and economic-development dynamics.

After the 1948 election of the Afrikaner National Party, through the 1951 Bantu Authorities Act, the State dissolved Western-style systems of local government in Black areas, replacing them with tribal, regional, and territorial authorities.¹⁰ The Promotion of Bantu Self-Government Act recognized "eight Black national units," made implicit provisions for the eventual "independence" of them, and planned for large-scale dispossession of Black South Africans from cities and rural areas to them. Kruger (1951: 6) advocated total rural dispossession and 'ordered' life for Black South Africans. Critics called this 'Bantustan' system "a scheme for total, unadulterated apartheid, or segregation" ("An Afrikaner," 1952: 112). Politically, then, 'Bantustans' were an artificial production and designation of territory for specific non-white ethnic groups within apartheid South Africa's racist hierarchy, through the use of borders and sham nation-state constructions (Lalu, 2006).¹¹ 'Bantustans' were also a device to transform

⁹ Notably, the Glen Grey Act was implemented by the Cape Colony and first affected areas of the apartheid-era Transkei and present-day Eastern Cape. Colonial-era Mafeking, which was capital and part of the crown colony of British Bechuanaland, was incorporated into the Cape Colony in 1895 and then into the Union of South Africa. ¹⁰ Hill, writing with nuance about the 'Bantustan' system, provides an alternative perspective. He notes that "they are the only areas in which Africans can enjoy freehold title to land...'The importance of the sense of security which

genuine ownership brings with it cannot be over-estimated (Hill, 1964: 95, as quoted in Nkosi, 1964: 87–88). ¹¹ 'Bantustans' did not only take place in South Africa, but also in Namibia, known as South-West Africa and controlled by the apartheid state until 1990.

Black citizens to non-political subjects through the invention of communally divided histories, economies, narratives, and trajectories (Mamdani, 1996). The processes through which 'Bantustans' were implemented—marked by violent forced resettlement followed by social-class differentiation and then indirect rule—arguably sought to pacify and otherwise mutate the South African struggle against white supremacy (Phillips, 2020; Ally, 2011).

If one historical-institutional moments looms large in Mahikeng's history, it is the cityregion's dramatic experiences receiving forcibly relocated residents and serving as a pre-planned capital city of the Bophuthatswana 'Bantustan' under the name Mmabatho during the 1970s and 1980s. Indeed, the ontological rupture of forced relocation followed by pre-planned city-building is a key structural reality that may have partially inspired residents' repurposing and the contemporary morphological response of displaced urbanism. The combination of forced relocation and master-planning created a landscape ill-fit for purpose, reminiscent throughout apartheid State Modernism but particularly extreme here. In the 1990s, the city then went from being a 'Bantustan' capital and site of tremendous, unsettled violence at the end of apartheid, as well as a locus of indirect-rule authoritarianism complicit in apartheid, to a provincial capital. During this 1990s' democratic transition, the jurisdictionally separate cities of Mmabatho and Mafikeng were combined into the Mahikeng Local Municipality city-region, which is the latest move in a long history of jurisdictional transformations going back to British Colonialism (Parnell, 1986; Drummond, 1991).¹²

Resistance to this racist system of land ownership and political ontology was longstanding. At the most basic level, in their population movements, economic activities, and campaigns of political disobedience, Black South Africans refused to abide by this segregated

¹² The city's changing names from colonial *Mafeking* to apartheid-era *Mafikeng* and *Mmabatho* to post-2010 *Mahikeng Local Municipality* speak to these changes. See also: Jones, 2000: 28.

territorial-urban regime and forged solidaristic alliances to dismantle it. Resisting apartheid elites' constructs of territory and territoriality, residents refused to see themselves as citizens of the non-contiguous islands of 'Bantustan' states like Bophuthatswana, and instead asserted their common, solidaristic cause with other Black South Africans. In economic and political activities, residents of Mahikeng were in frequent contact with others in Johannesburg and Pretoria, on both exploitative and clandestine political terms: for example, migrant labor regimes enlisted Black men to work in mines and factories throughout Gauteng, with surplus flowing to white elites in Johannesburg and economic elites in financial centers globally, yet on the other hand groups like the Surplus People Project (SPP) and the Transvaal Rural Action Committee (TRAC) worked across 'borders' to organize Black South Africans against oppression. More broadly, compositions of ethnic identity were tested and recomposed throughout the 'Bantustan' and apartheid eras. Successful contestation to top-down spatial planning helped build broad liberation movements in and through former 'Bantustans' that transcended territorial boundaries and lines of ethnicity and precipitated the pacted transition from apartheid to democracy. Mangashe (2018) traces how pan-ethnic solidarity movements across the 'Bantustan' system transcended tribalism, something unanticipated by the apartheid state, leading to indigenous traditions and an "underground movement" the apartheid state could not contain (49). At the same time, these movements' demands threatened the elite-led pacted transition from apartheid to democracy with concerns including jurisdictional integration from formerly segregated apartheid-era boundaries to a wall-to-wall system of district and local municipalities (Ally and Lissoni, 2017; Wotshela 2021).13

¹³ For an account of the varied impacts of the territorial 'Bantustan' system in Bophuthatswana on Setswana nationalism, for example, see: Motlhamne, 2023. For an account the system's effects on processes of jurisdictional reincorporation, see: Drummond, 1991.

²⁶

Mahikeng's peri-urban morphology was thus the result of both forced relocation and high-density city-building. Intensive demographic and socio-spatial processes of dispossession and forced relocation were paired with the modernist construction of former 'Bantustan' capitals. During apartheid from 1948–1994, South Africa's state forcibly dispossessed approximately 3.5 million Black South Africans of their land, and well over one million to 'Bantustans' (Christopher, 2001: 5; Figure 1). Temporary 'resettlement camps' were themselves pre-planned cities of sorts, and their spatial legacies endure today as well, within 'Bantustan' borders (Personal communication #42 with academic and planner, April 4, 2022). As seen in Figure 1, The Black Sash, and TRAC document forced relocation statistically. The numbers are extensive. As just one example, in Bophuthatswana some 100,000 people were forcibly relocated from areas near Rustenburg in the platinum belt to a settlement known as Rhamatlabama, and given only land plats and water hookups, but were expected to construct their own houses (Personal communication #42 with academic and planner, April 4, 2022; see also Campion, 1977; Bickford-Smith, 2008). Many of the relocations were from urban areas, but others were rural-torural relocations. Hindson (1987) uses the language of "alternative urbanization strategies" to describe the suite of apartheid-state processes (583).



Figure 1: Map of Apartheid Forced Relocation^{14, 15*}

These regimes of forced relocation should be understood as *territorial* because of the ever-presence of racialized state power and control in justifying Mahikeng's existence as a builtup settlement (see, i.e., Elden, 2013). Mahikeng should be understood as 'peri-urban' because even though it was located hundreds of kilometers away from South Africa's urban agglomeration of Johannesburg and Pretoria, Bophuthatswana was still enmeshed within a common regional political economy through racialized mechanisms of migrant labor, mining, and factories.

In this role as labor reserve, the White South African apartheid state *needed* Mahikeng and Bophuthatswana, and they needed docile and compliant subjects contained within its sham

¹⁴ This hand-drawn map, developed by the anti-apartheid organization The Black Sash, is annotated with examples of forced relocation. The map documents specific numbers of people and their circumstances of relocation from cities, towns, and farms to 'Bantustans.' 'Bantustans' are color-coded and hatched according to ethnicity. Published in 1977, this map documents only some of the earlier processes of forced relocation. It reveals relocation to have occurred in countless waves, with varied experiences of physical or psychological violence. *Sources*: "A Land Divided Against Itself," 1977. Reproduced with permission.

¹⁵ *Please visit the Mission Basel Archive website to view a higher-resolution, interactive copy of this map: https://www.bmarchives.org/items/show/100204688#p=1.

borders. As we will see, however, the displacement and containment of Bophuthatswana instead became a threat to South African social order, because of residents' resistant tactics. Residents' *subversion* of regimes of territorial control continues through to this day.

Displaced Urbanization as a Mode of the Urban

As the previous section reveals, territorial-scale imperatives to link Mahikeng with both sites of surplus accumulation and raw extractive materials—from a distance using technologies of 'borders' and differentiated citizenship—are essential to understanding the city's origin, 20th century trajectory, and contemporary predicament. This section argues that these imperatives gesture to a broader *mode of urbanization*, a set of processes by which cities grow and by which elites produce space. Such processes, with political-economic and world-systems implications, we might productively call "displaced urbanization."

During apartheid, the top-down city-building of the pre-planned capital city of Mmabatho (now Mahikeng) took place through a type of 'artificial urbanization' meant to prop up separation far away from the white metropolis to prevent uprising (see, i.e., Mbao, 2018). Apartheid elites sought both to divide and rule along ethnic lines, and to mimic processes of decolonization occurring elsewhere in Africa (Evans, 2019: 89). The strategic use of boundaries, borders, checkpoints, and social differentiation sought to further divide Black South Africans and prevent a solidaristic uprising. This regime of urbanization employed specific material technologies: David M. Smith (1982) examines the strategic role of the border (38–44); Götz, Wray, and Mubiwa (2001) write about the strategic use of various "scales of displacement"; Wellings and Black (1986) discuss spatial-Keynesian economic policies including "growth centres" and other such poles to promote economic growth and investment away from then-

occurring political-economic linkages; and Christopher (2001) examines the creation of "growth points" in a similar light. Collectively, displaced urbanization was paired with a politicaleconomic regime of apartheid "separate development" by which Black and white urban centers during apartheid would supposedly develop separately, notwithstanding the intimately tied, exploitative, relations between these communities (Laurence, 1980).

In Mahikeng, a specific yet wide-ranging network of planners, contractors, developers, architects, and governing officials benefitted from city-building through this regime of displaced urbanization. Some 30–40% of Bophuthatswana public revenues went to Town Planning during the city-building years of the 1970s and early 1980s ("Table 4," 1982; "Table 5," 1982). Planning firm Mallows, Louw and Hoffe and Partners (MLH) drafted the Bophuthatswana territorial plans and Mmabatho's master plan and five-year plans (see Jones, 1997; for territorial regions plans see "Bophuthatswana Streek (Region) 5," 1975; for the Mmabatho plan itself see MLH, 1981).¹⁶ MLH was a well-known, government-connected architecture and planning firm in South Africa, with offices across the country and connected with architects like Bannie Britz and Michael Scholes. MLH also had contracts in many of South Africa's other 'Bantustans.' One interviewee, a planner who worked closely with MLH on past projects, explained how these planners benefitted from constructing Mmabatho and other former 'Bantustan' capitals:

Many of [the planners who worked in the 'Bantustans'] came from Wits' first intake – it was [the class of] 1965/1966...They went to places like Mmabatho and Umtata [capital of the former Transkei]. There was just *so much money* in the Bantustans. Those guys took advantage. They made money like you can't imagine (Interview #150 with planning academic and former planner [anonymous], November 14, 2022).

¹⁶ MLH's territorial plans focused on regional geology and political geography, for example showing interest in mining extraction and potential migrant labor and transportation routes. The Mmabatho master plans focused on physical town planning, for example noting layout of streets and residential zones. Finally, the five-year plans were visions guiding implementation of political and economic activities in the Bophuthatswana 'Bantustan' and in Mahikeng / Mmabatho in particular.

Government officials also participated in this network promoting "displaced urbanization." When I first reviewed archival documents about Bophuthatswana's cabinet, I was surprised that around half of cabinet members were White ("A Nation on the March," 1987: 28–29). These White officials from apartheid South Africa and elsewhere helped facilitate of government contracts, in planning and other domains. Government officials promoted costly projects in the realm of planning and public architecture. As one example, to implement a policy of agricultural extension developed in collaboration with the State of Israel, Bophuthatswana built the Agricor Complex, Thusano Cooperative, the Market Board, and the Agricultural Bank, all financed through state-backed loans. A shocking archival report revealed that more money in Mmabatho was spent on propping up these agricultural state-owned enterprises than on Bophuthatswana's total agricultural production per year ("Time Running Out," 1991).

Bophuthatswana 'Bantustan' President Mangope played an ambiguous role in the mechanics of this planning network. On the one hand, as later revealed by independent political analyst John Seiler and Brendan Seery of the *Johannesburg Sunday Tribune*, Mangope was a personal beneficiary of this planning system, with his family's vast compound in Lehurutshe Village financed by public money (Seiler and Seery, 1995). On the other hand, President Mangope also shaped the direction of this network considerably. As scholars Boden (1992) and Jones (2000) have remarked, Mangope negotiated with planners and government officials on the design and aesthetics of Mmabatho projects, and communicated about these projects directly with Bophuthatswana residents, often using state radio ("Chief Lucas Mangope," 1990). In short, Mangope was both a personal beneficiary and active agent in Bophuthatswana's racial modernist planning regime.

The network promoting "displaced urbanization" in aparthied-era Mmabatho was multinational in nature. Argues sociologist Jonathan Hyslop, 'Bantustan', bureaucracies became "a happy hunting ground for shady entrepreneurs from South Africa and abroad" (2005: 783). Indeed, as with the Agricor and Thusano Agricultural initiatives, Mmabatho's urban-planning network had multinational links.

Looking beyond Mahikeng, territorial-scale displaced peri-urban settlements productively contribute to Brenner's (2019) typology of "new urban spaces" and Brenner and Katsikis' (2020) accounting of "operational landscapes" and "hinterlands of the capitalocene." In the specific case of Mahikeng, an erstwhile, apartheid-era territorial regime of racialized wealth capture alongside exploited migrant labor and indirect-rule authoritarian subjugation *enabled* capital (including from platinum mines, agro-industry, and manufacturing hubs) to flow to white cities like Johannesburg and through global financial circuits. Even migrant workers' tax payments flowed to white jurisdictions (Geldenhuys, 1980: 35–36; see Interview #175 with politician, local resident, and activist, December 6, 2022). Yet despite its centrality to urban processes of global financialized command and control, places like Mahikeng are typically seen by urban theorists like Robinson (2002) as sites "off the map," under-studied and seen as sites of theoretical *application*, rather than of theory-generation.

Following Brenner and Katsikis (2020) on the periphery and operationalization of the hinterlands, and Gupta's (2024) engagement of *Planetary Hinterlands*, we ought to view Mahikeng as a constitutive part of both South African urbanization, and of planetary urbanization. Whether or not the city is located within a certain number of kilometers to Johannesburg's city core is functionally immaterial, especially given the longstanding political and economic links between the two places.

Indeed, in terms of apartheid-era Mmabatho's built environment as it emerged, it was both lavish, *and* constructed largely by elite white South Africans living in Johannesburg or Pretoria with direct ties to the apartheid state. In the 1980s, planners, contractors, architects, and urban designers constructed an international airport, a stadium, vast array of architecturally *avant garde* government buildings, pre-planned residential housing units with state-of-the-art public services, and arts and cultural centers. These spaces were planned by apartheid elites and subsidized by Pretoria (see, i.e., Evans, 2019; Table 4 – Total Expenditure of the Government Sector," 1982; see **Figure 2**). However, these zones were intentionally designed for a small overclass of civil servants. At the same time, the numerical majority of Mahikeng residents found themselves forcibly relocated subjects stripped of South African citizenship as "citizens of Bophuthatswana." The majority of Mahikeng residents lived in informal housing with little access to public services and few if any means to participate in the city's production of space (Phillips, 2020). They were the 'planned upon.'

While the democratic legitimacy of such a mode of displaced urbanization was, for most Mahikeng residents, low and uneven, the material consequences of this urbanization regime for relocated residents were severe. Mosiane and Götz (2022) and Mosiane and Modiba (2018) focus on the political-economic dimensions of such transitions, including re-tribalization and the engagements with customary-communal institutions in place of public ones. Mbao (2018) takes an entirely different approach, offering more of a literacy commentary on the perceptual and sensorial experiences of displaced urbanization as artifice.

Much of the political-economic vision enabling displaced urbanization –spatial-Keynesian subsidies, industrial clusters, growth points, and deconcentration – failed (Halbach, 1988: 508; Kerby, 2016; Hirsch, 1984). Ultimately, the model did not produce endogenous

³³

economic growth, did not convince relocated residents of Bophuthatswana's governing legitimacy, and hit Pretoria with a hefty bill. Few ever saw the system as legitimate. Residents, moreover, undermined it through tactics of underlife and repurposing, and through such tactics helped sow the seeds for apartheid's demise. In its wake, this system also created Mmabatho/Mahikeng as a center of displaced urbanism.



Figure 2: Displaced urbanization and top-down city-building in Mmabatho¹⁷

¹⁷ The promotional tourism brochure above, titled "Visit Bophuthatswana," advertises city planning in the City of Mmabatho, the capital of the erstwhile 'Bantustan' of Bophuthatswana (today Mahikeng) ("Visit Bophuthatswana," 1989: 12).
Resident Responses: Displaced Urbanism as Insurgent Urban Morphology?

As noted in the section above, the city-building regime of "displaced urbanization" involved myriad actors in constructing Mahikeng far away from natural political-economic linkages. Indeed, town planning was typically the largest budget line item in the 'Bantustans' (Wolpe, 1975). Yet the planned towns, like Mmabatho, were "simple in the extreme, supplying little in the way of…services and infrastructure" (Wolpe, 1972, 454). Flashy, unnecessary, and lavish "white-elephant" monuments, administration buildings, and showpiece centers of governance, by contrast, were costly. Apartheid South African state planners had complete control over master-planning the 'Bantustans,' a policy laid out in Regulation No. R293 of 1962 ("R293," 1962). The Regulation stated that "Until the State President is satisfied that the Bantu inhabitants have attained such degree of development as to warrant the introduction of [a local authority of government], interim regulations should be promulgated for the control of the said townships" (373). Such "control" included the ability to acquire and sell land and establish residential deeds registries.

Just as there were colonial origins to land-use planning, there were colonial origins to the urban design and aesthetics guidelines specified in R293 (see: High Commissioner's Notice No. 1," 1963). In the apartheid era, matchbox-style homes in rectilinear rows were built quickly and sold *en masse* As an example, one interviewee described the mass-built nature housing of Itsoseng, a receiving site of forced relocation in apartheid-era Bophuthatswana not far from Mahikeng, as follows:

I remember a white man named only Bandrah. Or at least we knew him only as that. He led this local housing operation. The materials they used? It was asbestos and brick. It used to be shack and brick. Those were the first to be built. Asbestos they found worked better that corrugated iron, for the temperature. It was better to regulate temperature. My address is 1047: it's the 1,047th house to be built! This is the house number, they made them as it was constructed. Itsoseng, you see, was a planned township. It was originally a

farm. This is Zone 1 Itsoseng. (Interview #175 with politician, local resident, and activist, December 6, 2022).

Today, however, Mahikeng's built environment is *not* marked by uniformity or homogeneity. Indeed, residents have responded to the historic city-building regime of displaced urbanization with a wide array of creative material and social assemblages, spatial amalgams, and heterogenous (and diverging) spatial forms. *Displaced urbanism* is a conceptual label that gestures to these vernacular, stylistic customizations, and re-workings of space (see, i.e., Mosiane and Götz, 2022). Such spatial re-appropriations still necessarily occur at a territorial peri-urban scale. They are in stylistic conversation with innovations and cultural forms happening in Johannesburg and elsewhere in South Africa. City residents remain enmeshed in a common regional political economy.

Given the historical links between forced relocation and monolithic urban design, it is perhaps not surprising that residents' responses are rooted in apartheid-era contestation and destruction of spaces constructed for unjust and democratic purposes—like Mmabatho's Civic Centre, or the Itsoseng Shopping Centre (Seiler, 1988; Personal communication #182 with local resident, youth activist, and scholar, December 9, 2022; see **Figure 3**). Such repertoires and tactics of spatial contestation, I find, are then generatively paired with a creative experimentation and re-envisioning of built sites as spaces of collective care and meaning (Maape, 2023; Ngwenya, 2023; **Figure 3**). As a top-down city-building and urban morphological regime, displaced urbanization suggests that residents living under this regime had no agency. Displaced urbanism, by contrast, reveals residents' agency. They are city-makers. Their repurposing gestures to an alternative planning system and imaginary by which residents shape the production of space: incremental vernacular planning.





3d





Areas like Ramatlabama or Lonely Park are today both home to thousands of residents despite no history of natural political-economic linkages. If displaced urbanization had not occurred with such muscular territorial logics, these places would not like be there, and most

3a

3c

¹⁸ Figures 3a–3d: Residents torched and destroyed the Mmabana Arts Foundation building in April 2018 in protest to then-Premier Supra Mahumapelo's perceived corruption (Figure 3a). Yet such destruction has long historical roots. In the late 1980s, in solidaristic protest against apartheid authoritarianism, residents torched and destroyed the Itsoseng Shopping Complex and all that remains is the project's foundations (Figure 3b). Yet such destruction is often followed with innovation and re-invention. In the case of Tyre House, innovation and re-invention involves the creative use of local materials like clay produced from local soils, and recycled tires from regional mine houses (Figures 5.3c and 5.3d). Sources: Figures 5.3a and 5.3b by author. Figures 5.3c and 5.3d: Maape, 2023.

certainly would not be as vast. But they are here now, and, accordingly, residents are reappropriating these spaces with new meanings.

Residents' bottom-up spatial interventions are in cultural and spatial conversation with urban design interventions in Johannesburg. They are also in visual conversation with both their neighbors, and their collective aspirational goals. As one interviewee explained to me: "It's selfexpression and identity. People are using houses to show the life they want. And so if one person now includes a corrugated roof, then everyone nearby does it! If one person builds with tile? Everyone follows!" (Interview #131 with local resident and planning researcher, October 24, 2022; see also Capps, 2010). As another example, an interviewee explained the frequent use of siding and security-details as being "imported" from Johannesburg, as younger family members take inspiration from their frequent trips to and from the metropolitan core:

With these conversations and relationships, people are helped to make their home luxury. Make it their own...like a double-story. But with unemployment, sometimes there's no extra money. Sometimes it's luxury...sometimes it's just survival. It's both alongside one another. Older people die off sometimes, and younger people might be living in Joburg. And so what do they do? They lease or rent their [elders'] homes...Older houses have bigger plots, so people subdivide. Now? [The plots are] getting smaller and smaller. (Interview #145 with planning scholar, academic, and local resident, November 3, 2022).

Residents' repurposing through *displaced urbanism*, according to this interviewee, is *not* an 'ideal condition' or an 'end state.' Residents' re-workings may be in service of aesthetic expression—what this interviewee calls "luxury"—or in service of survival. Regardless, repurposing is a point of breakdown and subsequent individual or collective action, when decolonial aspirations confront enduring, post-colonial realities. It is a process not neatly bounded, but in fluid relation to, contestation, destruction, and invention.

In this context, the normative content of Mahikeng residents' *displaced ubranism* can be ambiguous. On the one hand, we might see in repurposing's roots longstanding contestation to

apartheid racial modernism and more broadly to top-down planning developed without locals' participation. On the other hand, many residents use their basic income grants to repurpose, in ways that suggest practical spatial alterations largely compatible within contemporary status-quo paradigms (paradigms which themselves might be viewed alternatively as democratic or market-exploiting; see Gago and Mason-Deese, 2017). And their spatial interventions are themselves 'classed' phenomena, with differences emerging across city neighborhoods and between formal housing plats with full access to public services and lower-income areas of historic forced relocation that continue to see a low rate of public-services provision to this day ("Mahikeng Local Municipality Spatial Development Framework." 2019).

The binary boundaries between State and market, self-help style entrepreneurialization and counter-hegemonic social welfare, and contemporary planning practice driven by restitution versus by developer interests and private-property rights effectively collapse within the conceptual label of displaced urbanism. Displaced urbanism foregrounds fluid, mutually implicated sets of relationships that occur as residents respond to top-down planning with their own variegated alternatives at a territorial peri-urban scale.

Conclusion

This paper employs an extended case-study research design in Mahikeng, South Africa, a South African secondary city that during apartheid was a 'Bantustan' capital and receiving site of widespread forced relocation. Despite Mahikeng's location hundreds of kilometers from Johannesburg and Pretoria, I argue that Mahikeng's urban morphology can productively be understood by analyzing patterns of peripheralization, dependency, and bi-directional cultural

production that are dynamic, contested, and ongoing—at extended metropolitan, and planetary, scales.

Mahikeng can be understood as an historic and contemporary urban site by employing a critical lens of territory and territorial imperatives (Elden, 2013; Robinson, 1997; Sack, 1986). While apartheid-era contractors, planners, designers, architects, and political officials envisioned the city through a logic of *displaced urbanization* that involved offsetting population and density far away from the 'white' city, Mahikeng was also envisioned to be in a dialectical relationship with city cores in Johannesburg and Pretoria, and through global financial circuits. Indeed, regimes of migrant labor and flows of capital surplus flowed from Mahikeng to concentrated urban centers throughout apartheid, and architectural and political-economic subsidies from Pretoria sought to contain relocated subjects, and inspire a type of political obedience. Yet residents responded with their own morphological alternatives: *displaced urbanism*, including various types and forms of repurposing at parcel-level scales and incremental and vernacular urban-planning and design alternatives, which ultimately reveals the extent to which residents shape the production of space in Mahikeng, across institutional moments.

There are bourgeoning seedlings and past remnants of both 'displaced urbanization' and 'displaced urbanism' that exist across timescales. Put differently, there is no 'neat' break, and certainly not one aligned with South Africa's national-level transition from apartheid to democracy. Indeed, displaced urbanization endures and the continuing presence of extractive mining, domestic labor, and circular migration to Johannesburg and Pretoria from Mahikeng and throughout the contemporary North West speak to such processes. Moreover, aesthetic customizations assuredly occurred, whether permitted or not, in the apartheid past as well.

Urbanization likewise occurs at various scales today: there are endogenous micro-urban economies confined more to Mahikeng, and others articulated well-past the South African territory and toward global or planetary urban markets and logics (Implats' Impala Platinum Mining cluster offers an example). Yet the territorial peri-urban is a particular and distinctive spatial scale: in Mahikeng, it allows us to understand processes of state re-scaling (from the national-state to the planetary) that occurred alongside South Africa's pacted transitions of regime change (from apartheid to democracy). Moreover, it enables us to see how such institutional transitions are associated with changes to spatial morphology: in Mahikeng, this includes a broad set of changing city-building approaches from displaced urbanization to displaced urbanism.

South African cities that received forcibly relocated subjects remain subject to the structural weight of history and geography: they are areas of poverty, unemployment, and challenge. But as this paper reveals, they are also zones of creative experimentation and creativity. Displaced urbanism takes root in peripheral peri-urban locations, through agglomerations of people in specific places. Displaced urbanization and displaced urbanism should be understood as an active dialectic marked by a tension between rigidity and creativity, homogeneity and differentiation, nuance and ambiguity, and historical structures and alongside residents' alternatives.

Unpublished Primary Interviews

- Personal communication #42 with academic and planner [anonymous]. Zoom conversation notes; 45:00. April 4, 2022.
- Interview #84 with community member, resident, and local historian [anonymous]. Recording transcript; 1:34:11. September 21, 2022.
- Interview #131 with local resident and planning researcher [anonymous]. Recording. 1:52:10. October 24, 2022.
- Interview #145 with planning scholar, academic, and local resident [anonymous]. Recording transcript; 1:07:45. November 3, 2022.
- Interview #150 with planning academic and former planner [anonymous]. Recording transcript. 2:23:50. November 14, 2022.
- Interview #175 with politician, local resident, and activist [anonymous]. Recording transcript; 2:50:53. December 6, 2022.
- Personal communication #89 with academic and historian [anonymous]. Event and discussion notes; 1:15:00. September 22, 2022.
- Personal communication #182 with local resident, youth activist, and scholar [anonymous]. Unrecorded WhatsApp, Instagram, and in-person conversations, and field notes; 30:00. December 9, 2022.

Archival Documents and Primary Materials

- "A Land Divided Against Itself: A Map of South Africa Showing the African Homelands and Some of the Mass Removals of People which have Taken Place." 1977. *Mission Basel* 21. Ref. number: KARVAR-31.135. Accessed 23 February 2022. Available online at: https://www.bmarchives.org/items/show/100204688#.
- A Nation on the March. 1987. Book published by Hans Strydom Publishers (Bophuthatswana) (Pty) Ltd. Accessed at the North West Provincial Archive. Accessed 11 August, 2022.
- "An Afrikaner..." 1952. *The Crisis*. Accessed 12 November 2019. https://books.google.com/books?id=E1wEAAAAMBAJ&pg=PA112&dq=J.D.L+Kruger &hl=en&sa=X&ved=2ahUKEwjDkKr_kurlAhWPxVkKHcqUDAsQ6AEwAXoECAEQ Ag#v=onepage&q=J.D.L%20Kruger&f=false.
- "Bophuthatswana Streek (REGION) 5, Volume 2, Mallows, Louw, Hoffe, and Partners, and the Institut Vir Stads en Streekbeplanning PU Vir CHO – 1975 [Institute for City and Regional Planning]." 1975. Historical Papers Research Archive, University of the Witwatersrand, South Africa. Uncatalogued document. Accessed 28 October 2022.
- Geldenhuys, Deon. 1981. "South Africa's Black Homelands: Past Objectives, Present Realities and Future Developments." *The South African Institute of International Affairs*. August. Made available through the archive of interviewee #204. Accessed 27 June 2023.
- "High Commissioner's Notice No. 1." 1963. The Official Gazette Extraordinary of the High Commissioner for Basutoland, the Bechuanaland Protectorate, and Swaziland. Vol. 1, no. 1: Mafeking. Accessed through the Mahikeng Museum Archives. January 1. Accessed 21 September 2022.
- Laurence, Patrick. 1980. "Idea to Draw Homelands to Economic Hub." Rand Daily Mail. 20 August. The South African History Archive (SAHA): Neil Coleman Collection (AL2184 I). Accessed 31 October 2022.

- "Mahikeng Local Municipality Spatial Development Framework." 2019. Mahikeng Local Municipality and Maxim Planning Solutions. Accessed 22 September 2022. Available at: https://www.mahikeng.gov.za/download/mahikeng-spatial-development-framework-2019/.
- Mallows, Louw, Hoffe and Partners (MLH) Architects and Planners. 1981. "Final Summary Report: Five Year Plan 1981–1985." Accessed at the North West University (NWU) Library Archive, Ref. 81/506. Accessed 5 December 2022.
- "Mmabatho Out of Nothingness." 1989. *Visit Bophuthatswana*. Accessed at the National Library of South Africa (NLSA), AF.1989-41, pp. 87–1043. Accessed 16 November 2022.
- Regulation No. R293 of 1962 (R293). 1962. Republic of South African Government Gazette. Accessed at the National Library of South Africa (NLSA) Cape Town. Accessed November 15, 2022.
- Seiler, 1988. "Photographic Collection by John Seiler." Accessed at the Historical Papers Research Archive, University of the Witwatersrand, South Africa. John Seiler Photographs ZA HPRA A3217-9-9.1-5. Photos featured are 9.1.1 to 9.1.8 and 9.3. Photos 9.1.7 and 9.1.8 are from March 10, 1994. Accessed 28 October 2022.
- Seiler, John and Brendan Seery. 1995. "The Skweyiya Commission: Lessons for a Democratic South Africa." *Indicator SA*. 13(1): Summer. Accessed at the Historical Papers Research Archive, University of the Witwatersrand, South Africa. John Seiler Papers ZA HPRA A3217-Box 2–2.3. Accessed 3 November 2022.
- "South Africa's Black Homelands: A Handbook." 1982. Central Intelligence Agency (CIA) Directorate of Intelligence. 1 December. Sanitized Copy Approved for Release 2011/01/19. CIA document: RDP84S00552R000100020002-6. Accessed 27 June 2023.
- "Table 4 Total expenditure of the government sector and certain public enterprises by purpose." 1982. Reproduced from: Republic of Bophuthatswana Department of Economic Affairs: Statistical Report No. 2. National Accounts" 1971-1975. Review at the National Library of South Africa. ISBN: 0 86849 002 4. Received March 30,. Accessed November 18, 2022.
- "Table 5 Gross Fixed Investment by the public by purpose." 1982. Reproduced from: Republic of Bophuthatswana Department of Economic Affairs: Statistical Report No. 2. National Accounts." 1971-1975. Reviewed at the National Library of South Africa. ISBN: 0 86849 002 4. Received March 30. Accessed November 18, 2022.
- "Time Running Out for Mangope." 1991. *City Press*. March 31. Accessed at the Historical Papers Research Archive, University of the Witwatersrand, South Africa. ZA HPRA AG2543-C-Box D32. Accessed 21 October 2022.

Secondary References

- Adebayo, Pauline W. 2011. "Post-apartheid Housing Policy and a Somewhat Altered State Role: Does Incremental Housing Still Have a Place in South Africa?" *The Built & Human Environment Review*. 4(2): 3–16.
- Allen, Natalie and Mark Davey. 2018. "The Value of Constructivist Grounded Theory for Built Environment Researchers." *Journal of Planning Education and Research*. 38(2): 222– 232.

- Ally, Shireen. 2011. "Peaceful Memories: Remembering and Forgetting Political Violence in Kangwane, South Africa." *Africa*. 81(3): 351–372.
- Ally, Shireen and Arianna Lissoni. 2017. New Histories of South Africa's Apartheid-Era Bantustans. New York: Routledge.
- Ballard, Richard, Ngaka Mosiane, and Christian Hamman. 2021. "Spatial trends in Gauteng." Gauteng City Region Observatory. Occasion Paper No. 19. December. Accessed April 19 2023. Available at: https://wiredspace.wits.ac.za/handle/10539/33004.
- Bank, Leslie. 2015. "City Slums, Rural Homesteads: Migrant Culture, Displaced Urbanism and the Citizenship of the Serviced House." *Journal of Southern African Studies*. 41(5): 1067–1081.
- Bénit-Gbaffou, Claire, and Sophie Oldfield. 2011. "Accessing the State: Everyday Practices and Politics in Cities of the South." *Journal of African and Asian Studies*. 46(5): 445–452.
- Bickford-Smith, Vivian. 2008. "Urban History in the New South Africa: Continuity and Innovation Since the End of Apartheid." *Urban History*. 35(2): 288–315.
- Boden, Roger. 1992. "The Influence of Traditional Values and Historic Symbolism on Urban Design." *Journal of Architectural and Planning Research*. 9(4): 287–300.
- Bradford, Helen. 1987. A Taste of Freedom: The ICU in Rural South Africa, 1924–1930. New Haven: Yale University Press.
- Brenner, Neil. New Urban Spaces: Urban Theory and the Scale Question. Oxford, U.K.: Oxford University Press.
- ———. 2004. *New State Spaces: Urban Governance and the Rescaling of Statehood.* Oxford, U.K.: Oxford University Press.
- Brenner, Neil and Nikos Katsikis. 2020. "Operational Landscapes: Hinterlands of the Capitalocene." *Architectural Digest*. 90(1): 1–136.
- Brenner, Neil and Christian Schmid. 2015. "Towards a New Epistemology of the Urban?" *City*. 19(2–3): 151–182.
- Caldeira, Teresa PR. 2017. "Peripheral Urbanization: Autoconstruction, Transversal Logics, and Politics in Cities of the Global South." *Environment and Planning D: Society and Space*. 35(1): 3–20.
- Campion, Harvey. 1977. *Bophuthatswana Where the Tswanas Meet*. Sandton, South Africa: Valient. Republished by De Gruyter.
- Cante, Fabien, et al. 2023. "On Urban Re-Arrangements: A Suite in Five Movements. *International Journal of Urban and Regional Research*. 47(3): 325–521.
- Capps, Gavin J. 2010. "Tribal-Landed Property: The Political Economy of the BaFokeng Chieftaincy, South Africa, 1837-1994." A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy (PhD) at the Development Studies Institute of The London School of Economics and Political Science.
- "Chief Lucas Mangope, Bophuthatswana Homeland President, about the Thirty Two Million Rand Government Buildings Which Will be Built in Mmabatho, the Capital of Bophuthartswana." 1990. Motsweding FM. Speech in the PODI YA TSELA Segment. Accessed through the SABC Media Library Archives, CATNO: T (TSW/90)380, RECORDBC No. 19900615, Acc. No. 152418. June 15. 2:58. Accessed 19 October 2022.
- Christopher, A.J. 2001. The Atlas of Changing South Africa. London and New York: Routledge.

Cirolia, Liza R., Ngwenya, N., Christianson, B. and Scheba, S. 2021. "Retrofitting, Repurposing and Re-placing: A Multi-media Exploration of Occupation in Cape Town, South Africa." *plaNext – Next Generation Planning*. 11: 144–165. DOI: 10.24306/plnxt/69.

- Creswell, John and Cheryl N. Poth. 2018. *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*, 4th edition, Los Angeles: SAGE Publications.
- De Boeck, Filip. 2021. "Displaced Urbanism, Urbanism of Displacement." In: *Death and the City: Necrological Notes from Kinshasa.* London: Routledge.
- Dlamini, Jacob. 2009. *Native Nostalgia*. Aukland Park, Johannesburg, South Africa: Jacana Media.
- Drummond, James, Drummond, Fiona, and Christian M. Rogerson. 2021. "Latent Opportunities for Heritage Tourism in South Africa: Evidence from Mahikeng and Surrounds." *African Journal of Hospitality, Tourism and Leisure*. 10(6): 1591–1609.
- Drummond, James. 1991. "Reincorporating the Bantustans into South Africa: the Question of Bophuthatswana." *Geography*. 76(4): 369–373.
- Elden, Stewart. 2013. The Birth of Territory. Chicago, IL: University of Chicago Press.
- Evans, Laura. 2019. Survival in the "Dumping Grounds": A Social History of Apartheid Relocation. Leiden, Boston: Brill.
- Ewing, Kathryn. 2021. "Spaces of Transformative Practice: Co-producing, (Re)Making and Translating Fractional Urban Space in Gugulethu, Cape Town." *Urban Forum*. 32(4): 395–413.
- Gago, Verónica, and Liz Mason-Deese. 2017. *Neoliberalism from Below: Popular Pragmatics and Baroque Economies*. Durham, NC: Duke University Press.
- Gandy, Matthew. 2006. "Planning, Anti-planning and the Infrastructure Crisis Facing Metropolitan Lagos." *Urban Studies*. 43(2): 371–396.
- Götz, Graeme, Chris Wray, and Brian Mubiwa. 20134. "The 'Thin Oil of Urbanisation'? Spatial Change in Johannesburg and the Gauteng City-Region." In: *Changing Space, Changing City: Johannesburg after Apartheid.* Philip Harrison, Graeme Götz, Alison Todes and Chris Wray, eds. 42–62. Johannesburg: Wits University Press.

Gupta, Pamila, Sarah Nuttall, Esther Peeren, and Hanneke Stuit, eds. 2024. *Planetary Hinterlands: Extraction, Abandonment and Care*. London: Palgrave MacMillan.

- Halbach, Axel J. 1988. "The South African Homeland Policy and Its Consequences: An Evaluation of Separate Development." *Development Southern Africa*. 5(4): 508–526.
- Harrison, Phil. 2006. "On the Edge of Reason: Planning and Urban Futures in Africa." Urban Studies. 43(2): 319–335.
- Harrison, Phil, Edgar Pieterse, Suraya Scheba, and Margot Rubin. 2018. "Daily Practices of Informality amidst Urban Poverty." A report by the African Centre for Cities/University of Cape Town and University of Witwatersrand. December 1. Accessed 7 July 2023. Available at: https://www.africancentreforcities.net/wp-

content/uploads/2018/12/Informality-Project_05_11_lowres-singlepages-1.pdf.

- Hill, Christopher R. 1964. *Bantustans: the Fragmentation of South Africa*. Oxford and London: Oxford University Press and the Institute of Race Relations, London.
- Hindson, Douglas C. 1987. "Alternative Urbanisation Strategies in South Africa: A Critical Evaluation." *Third World Quarterly*. 9(2): 583–600.
- Hirsch, Alan. 1984. "Bantustan Industrialisation with Specific Reference to the Ciskei, 1973-

1981." Thesis submitted in partial fulfilment of the requirements of the degree of Master of Arts (MA) in the Department of Economic History, Faculty of Arts, University of Cape Town, May.

Hobbes, Thomas. 1968. Leviathan. New York: Penguin Books Limited.

- Huchzermeyer, Marie. 2006. "The New Instrument for Upgrading Informal Settlements in South Africa: Contributions and Constraints." In: *Informal Settlements: A Perpetual Challenge*. Marie Huchzermeyer and Aly Karam, (eds). 41–61. Cape Town: University of Cape Town Press.
- Huchzermeyer Marie and Philipp Misselwitz. 2016. "Coproducing Inclusive Cities? Addressing Knowledge Gaps and Conflicting Rationalities between Self-Provisioned Housing and State-Led Housing Programmes." *Current Opinion in Environmental Sustainability*. 20: 73–79.
- Hyslop, Jonathan. 2005. "Political Corruption: Before and After Apartheid." *Journal of Southern African Studies*. 31(4): 773–789.
- "Interview with BESTERECTA JOHANN BOTHA." 1980. The South African History Archive (SAHA). Accessed at the South African History Archive Trust (SAHA), Neil Coleman Collection, AL2184. Interviews and Questionnaires with the Construction Industry, Boxes F 1–2. Accessed 31 October 2022.
- Interview with Million Sambo," 1980. The South African History Archive (SAHA). Accessed at the South African History Archive Trust (SAHA), Neil Coleman Collection, AL2184. Interviews and Questionnaires with the Construction Industry, Boxes F 1–2. Accessed 31 October 2022.
- Izar, Priscila. 2022. "Meanings of Self-Building: Incrementality, Emplacement, and Erasure in Dar es Salaam's Traditional Swahili Neighborhoods." *Urban Planning*. 7(1): 305–320.
- Izar, Priscila et al. 2023. "What Lies Inbetween: Self-Built Housing and the Struggle to Remain in Place in Dar es Salaam." In *Housing in African Cities: A Lens on Urban Governance*. Margot Rubin, Sarah Charlton, and Neil Klug, eds. 105–123. Cham, Switzerland: Springer Nature, 2023.
- Jones, Peris. 2000. "'The Basic Assumptions as Regards the Nature and Requirements of a Capital City': Identity, Modernization and Urban Form at Mafikeng's Margins." *International Journal of Urban and Regional Research*. 24(1): 25–51.
- . 1997. "Mmabatho, 'Mother of the People': Identity and Development in an 'Independent' Bantustan, Bophuthatswana, 1975–1994." A doctoral thesis submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy (PhD), Loughborough University. Available online at: https://hdl.handle.net/2134/33161.
- Kerby, Edward M. 2016. "The Economics of Isolation, Trade, and Investment: Case Studies from Taiwan & Apartheid South Africa." A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy (PhD) in the Department of Economic History, London School of Economics.
- Khunou, Samuel F. 2017. "The Customary Anatomy of the Traditional Governance of the Bafokeng Traditional Community: The Implications of the Constitutional Recognition of Hereditary Headmanship." *The Potchefstroom Electronic Law Journal (PER)*. 20: 1–37.
 ——. 2013. "The Origin and Nature of Traditional Leadership in South Africa. A Precolonial Perspective." *Matatu.* 41(1): 293–320.
- Kruger, J.D.L. 1951. *Bantustan: A Study in Practical Apartheid*. Queenstown, CP: The Daily Representative.

Lalu, Premish. 2022. Undoing Apartheid. Hoboken, NJ: John Wiley and Sons Ltd.

Lange, Matthew. 2009. "Botswana: A Case of Development Despite Indirect Rule." In: *Lineages* of Despotism and Development: British Colonialism and State Power. 139–168. Chicago: University of Chicago Press.

- Levenson, Zachary and Marcel Paret. 2022. "The Three Dialectics of Racial Capitalism: From South Africa to the U.S. and Back Again." *Du Bois Review*. Advance online publication. https://doi.org/10.1017/S1742058X22000212.
- Levy, Ariel. 2019. "Who Owns South Africa?" *The New Yorker*. 13 May. Accessed 15 April 2020. https://www.newyorker.com/magazine/2019/05/13/who-owns-south-africa.
- Maape, Sechaba. 2023. "Interview: Dr Sechaba Maabe." *Johannesburg in Your Pocket*. 12 April. Accessed 17 April 2023. Available at:

https://www.inyourpocket.com/johannesburg/interview-dr-sechaba-maape-curator-for-the-sa 79234f.

- ------. 2023. "Tyre House." *Afreetekture*. Accessed 12 June 2023. Available at: https://www.afreetekture.com/tyre-house.
- Mabin, Alan. 1989. *Organisation and Economic Change*. Johannesburg and Berkeley: Raven Press and the University of California Press.
- ——. 1988. "Households, History and Black Urbanisation: Response to Graaff." *Development South Africa*. 5(3): 393–402.
- Mamdani, Mahmood. 1996. "The Other Face of Tribalism: Peasant Movements in Equatorial Africa." In: *Citizen and Subject: Contemporary Africa and the Legacy of Late Colonialism.* 183–217. Princeton: Princeton University Press.
- Mangashe, Patrick. 2018. "Operation Zikomo: The Armed Struggle, the Underground and Mass Mobilisation in South Africa's Border Region, 1986-1990, through the Experiences of MK Cadres." South African Historical Journal. 70(1): 42–55.
- Manson, Andy, and Mbenga, Bernard. K. 2014. Land, Chiefs, Mining: South Africa's North West Province since 1840. Johannesburg: Wits University Press.
- Mbao, Wamuwi. 2018. "On Bop and the Legacy of Nostalgia." *The Mail & Guardian*. 25 January. Accessed 20 March 2022. Available at: <u>https://mg.co.za/article/2018-01-25-on-</u> bop-and-the-legacy-of-nostalgia/.
- Meth, Paula, Thomas Goodfellow, Alison Todes, and Sarah Charlton. 2021. "Conceptualizing African Urban Peripheries." *International Journal of Urban and Regional Research*. 45(6): 985–1007.
- Meyer, Miranda and Stefan Norgaard. 2022. "Mnemonic Land War: Memory Constellations through Lebanon and South Africa." *Memory Studies*. 15(6): 1393–1405.
- Moore, Margaret. 2015. A Political Theory of Territory. Oxford, U.K.: Oxford University Press.
- ——. 2012. "Natural Resources, Territorial Right, and Global Distributive Justice." *Political Theory*. 40(1): 84–107.
- Mosiane, Ngaka, and Götz, Graeme. 2022. "Displaced Urbanisation or Displaced Urbanism? Rethinking Development in the Peripheries of the GCR." GCRO Provocation #08, Gauteng City-Region Observatory, April. DOI: 10.36634/SVRW2580.
- Mosiane, Ngaka, and Mamokete Modiba et al. 2018. "Landscapes of Peripheral and Displaced Urbanisms." *Gauteng City-Region Observatory*. July. Accessed 6 June 2023. Available at: https://www.gcro.ac.za/research/project/detail/landscapes-of-peripheral-and-displaced-urbanisms/.

- Motlhamne, Mojuta. 2023. "Mojuta Motlhamme on Lucas Mangope and Setstwana Natonalism, 1961–1994." *NWU History Seminar Series 2023*. Accessed 28 August 2023. Available at: https://www.youtube.com/watch?v=PiPeTAnu0zs.
- Murray, Colin. 1988. "Displaced Urbanisation: South Africa's Rural Slums." *African Affairs*. 86(344): 311–329.
- Ngwane, Trevor. 2021. Amakomiti: Grassroots Democracy in South African Shack Settlements. London: Pluto Press.
- Ngwenya, Nobukhosi. 2023. "Decolonisation of Praxis through Occupation?" Presentation at the Conference "Decolonisation of Planning in Praxis, Africa." Association of European Schools of Planning (AESOP). Online, 31 October 2023.
- Nkosi, Z. 1964. "New Books on South Africa." October. 86–92. Made available through the archive of interviewee #204. Accessed 27 June 2023. https://disa.ukzn.ac.za/sites/default/files/pdf_files/Acn1964.0001.9976.000.019.Oct1964. 12.pdf
- Oldfield, Sophie. 2004. Urban Networks, Community Organising and Race: an Analysis of Racial Integration in a Desegregated South African Neighbourhood." *Geoforum*. Vol. 35: 189–201.
- ———. 2000. "The Centrality of Community Capacity in State Low-Income Housing Provision in Cape Town, South Africa." International Journal of Urban and Regional Research 24(4): 858–872.
- Osborne, Peter. 2004. "Art as Displaced Urbanism: Notes on a New Constructivism of the Exhibition Form." In: *With all Due Intent: Manifesta 5: European Biennial of Contemporary Art.* Kuzma, Marta and Gioni, Massimiliano, (eds.). 64–77. Madrid, Spain: Actar.
- Parnell, Sue. 1986. "From Mafeking to Mafikeng: The Transformation of a South African Town." *GeoJournal*. 12(2): 203–210.
- Phillips, Laura. 2020. "The Making of the Lebowa Civil Service: Class Formation and Bantustan Administration." Lecture at the Wits Institute for Social and Economic Research (WISER). 6 April. Available at: https://wiser.wits.ac.za/content/making-lebowa-civilservice-class-formation-and-bantustan-administration-13375.
- Pieterse, Edgar. 2006. "Building with Ruins and Dreams: Some Thoughts on Realising Integrated Urban Development in South Africa through Crisis." Urban Studies. 43(2): 285–304.
- Rao, Anupama. 2015. "Value, Visibility and the Demand for Justice." *Economic and Political Weekly*. 50(36): 37–42.
- Redding, Sean. 1993. "Legal Minors and Social Children: Rural African Women and Taxation in the Transkei, South Africa." *African Studies Review*. 36(3): 49–74.
- Robinson, Jennifer. 2006. "Inventions and Interventions: Transforming Cities—An Introduction." *Urban Studies*. 43(2): 251–258.
- ——. 2002. "Global and World Cities: A View from off the Map." *International Journal of Urban and Regional Research*. 26(3): 531–554.
- ———. 1997. "The Geopolitics of South African Cities: States, Citizens, Territory." *Political Geography*. 16(5): 356–386.
- Rubin, Margot, and Philip Harrison. 2015. "Land, Settlement and Space: Conflict within the Western Limb of South Africa's Platinum Belt." *Labour, Capital and Society / Travail, Capital et Société*. 48(1–2): 120–155.

- Sack, Ruth D. 1986. *Human Territoriality: Its Theory and History*. Cambridge: Cambridge University Press.
- Sacks, Ruth. 2022. The Remaindering. Johannesburg, South Africa: Garamond Press.
- Scheba, Suraya and Nate Millington. 2023. "Occupations as Reparative Urban Infrastructure: Thinking with Cissie Gool House." *City*. OnlineFirst, 0(0). DOI: 10.1080/13604813.2023.2266192.
- Simkins, Charles. 1983 [2011]. "The evolution of the South African Population in the Twentieth Century." In *The Cambridge History of South Africa*. Volume 2: 1885–1994 (1st ed.), 492–517. Cambridge, U.K.: Cambridge University Press
- Simone, AbdouMaliq. 2022. *The Surrounds: Urban Life within and beyond Capture*. Durham, NC: Duke University Press.
- ———. "Pirate Towns: Reworking Social and Symbolic Infrastructures in Johannesburg and Douala." *Urban Studies*. 43(2): 357–370.
- Slater, Tom. 2021. Shaking Up The City: Ignorance, Inequality, and the Urban Question. Oakland, CA: University of California Press.
- Smith, David M. 1982. "Urbanization in the Homelands: The Case of Bophuthatswana." In: Living Under Apartheid. David M. Smith, ed. Pp. 38–44. London: George, Allen, and Unwin.
- "South Africa's Black Homelands: A Handbook." 1982. Central Intelligence Agency (CIA) Directorate of Intelligence. 1 December. Sanitized Copy Approved for Release 2011/01/19. CIA document: RDP84S00552R000100020002-6. Accessed 27 June 2023.
- "The Neil Coleman Collection," 2009. The South African History Archive (SAHA). Accessed at the South African History Archive Trust (SAHA), Neil Coleman Collection, AL2184. Accessed 31 October 2022.
- Tilly, Charles. 1985. "War Making and State Making as Organized Crime." In: *Bringing the State Back In*, edited by Peter Evans, Dietrich Rueschemeyer, and Theda Skocpol. 169– 187. Cambridge, U.K.: Cambridge University Press, 1985.
- Urson, Ruth, Shose Kessi, and Shari Daya. 2022. "Towards Alternative Spatial Imaginaries: The Case of 'Reclaim the City." In S. Kessi et al. (eds.), *Decolonial Enactments in Community Psychology*. 167–190. Cham, Switzerland: Springer Nature.

Wacquant, Loïc. 2022. Bourdieu in the City: Challenging Urban Theory. Hoboken, NJ: Wiley.

- Wellings, Paul and Anthony Black. 1986. "Industrial The Decentralization under Apartheid: Relocation of Industry to the South African Periphery." *World Development*. 14(1): 1–38.
- Wolpe, Harold. 1975. "The Theory of Internal Colonization: The South African Case." Collected Seminar Papers. Institute of Commonwealth Studies: 105–120.
- ——. 1972. "Captialism and Cheap Labour-Power in South Africa: From Segregation to Apartheid." *Economy and Society*. 1(4): 425–456.
- Wotshela, Luvuyo. 2021. "From Afflicted Black Local Authorities to Integrated and Contested Municipal System: Two Decades of Civic Action and Governance Realignment in the Border Kei's Eastern Cape, South Africa, 1985-2005." Presentation at the Wits History Workshop. 13 October.



We teach aspiring citymakers the holistic design principles of resilient, beautiful, and prosperous places.

Who We Are

We're a collective of professional urbanists, architects, professors, and planners who believe in building beautiful, sustainable places where we all can come alive and thrive.

Our Programs

Along with ongoing workshops, our first full program is Summer School 2025 - a three-week program led by world-class professionals. Through a mixture of hands-on education, engaging lectures, and city walks students will learn the first principles of urban planning, <u>architecture</u>, and the building arts.

Who's a Citymaker?

If you are fascinated by cities and how we can make them more liveable, you are a citymaker!

Reasons for Being

- 1. We have lost the vision of what a great place is and can be.
- 2. We have lost the technical knowledge to design-build into that vision.
- 3. Together we can change the tide in the way in which we build our communities and live together.

About Us

Citymakers Collective is a 501(c)3 nonprofit organization based in Atlanta, GA. Our Executive Board spans several states across the US, with an international Advisory Board offering diverse perspectives from across the field.

Contact Us

will@citymakerscollective.org www.citymakerscollective.org

Follow along with our journey on @citymakerscollective and sign up for our newsletter.



2025 Summer Studio

Urban Form and Civic Beauty

PURPOSE

This course will be an exploration of the mechanics and artistry behind the urban forms that shape our lives, with a particular focus on beauty in human-scaled city building. We will examine the spatial strategies of cities that have resulted in centuries of flourishing communities and apply these lessons to current development opportunities around the city of Savannah.

FORMAT

This course will meet 8 hours each Monday through Saturday for three consecutive weeks. We will utilize a combination of guest lectures, drawing analyses, and an intensive design studio throughout the course, with a heavy emphasis on drawing by hand. The course will culminate with a final presentation of design work to a select group of industry leaders.

TYPICAL DAILY SCHEDULE

| 08:30 - 10:00 | On-site drawing analysis |
|---------------|--------------------------|
| | |

10:00 - 11:00 Guest lecture

11:00 - 12:00 Guest lecture

12:00 - 13:00 Lunch break

13:00 - 17:00 Design studio

LEARNING OBJECTIVES

At the conclusion of this course, students will demonstrate:

- command of the practice of active sketching and be able to examine, record, and analyze urban environments of all scales
- comprehensive understanding of historic settlement typologies, their resulting urban forms, and how these types can be applied within the context of American urbanism
- thorough understanding of traditional architectural aesthetic principles and how to compose historically-informed architectural designs
- familiarity with development processes and pressures within the real estate development industry and how these affect our cities

Through these objectives, students will build a personal strategy for how they can positively impact the creation of better places within their own communities.

TEXTS

There will be short readings assigned throughout the course to supplement information presented in class. Any required texts shall be provided by the program or available online at no cost.

Strongly Recommended Readings:

- The Death and Life of Great American Cities by Jane Jacobs
- A Pattern Language by Christopher Alexander

Climate of Hope: Cities Leading the Way

1

By John Hans Gilderbloom with Chris Nolan

Abstract

Our planet is facing catastrophic destruction in just seven or eight years according to the United Nations. The doomsday clock is ticking; it's minutes before midnight. We are talking about saving civilization. We are talking about not just trying to slow down climate change by three years but actually reversing it. We have the tools to reduce greenhouse gases by 80% but we need to educate the citizens and leaders about existing tools to save civilization. We have access to the best data once hidden and not accessible to scientists: EPA, CDC, Toxics Release Inventory, and advanced satellite technology like the Copernicus Sentinel that can zoom in on a city, neighborhood or a building to measure what kinds of toxins are being released. The omnipresent eye of the European Space Agency's Copernicus Sentinel program captures data and highlights the profound connection between climate, cities, and neighborhood communities.

Introduction

It's going to get worse. Look around and you'll see that no place is safe from the ravages of climate chaos. Every state has experienced the pain of climate chaos—Hawaii, Florida, New York, Arizona, California, and of course, Kentucky. East to West, North to South we are witnessing the slow destruction of the Earth as we once knew it. Or look around the world: North Pole, African, Middle East, China, Russia, Africa, South America. We have a climate crisis that is destroying our way of life with record high temperatures. We are facing a catastrophic crisis that will destroy the Earth as we know it in eight years, according to the United Nations.

One response to climate chaos is doing nothing followed by a rapid increase in millions of people immigrating to places of greater opportunity for food, water, health, and work. It's either migrate or die. Climate chaos, if it goes unchecked, will result in more wars and catastrophic environmental damage. This trajectory of worsening conditions can be reversed. We have the means to immediately reduce greenhouse gases by 80%; that's why we are changing the mainstream view of climate of doom to climate of hope.

Climate change is a life and death struggle. Studies show that 70% of people worldwide fear for the future, believing they are helpless to change or solve the climate crisis, and most are young people under the age of 40. Our book, Climate Chaos: Killing People, Places and Planet& What to Do About It shares a message of optimism that climate change can be reversed and highlights tested policies from around the world that will reduce greenhouse gases by 80%. We have the tools to reverse catastrophic climate crisis, not just slow it down by three to four years.

Why do so many books and documentaries have a hard time convincing people of the dangers present and ahead of us? Because the human mind struggles with the abstract, the chaotic, and large-scale concepts that don't directly touch upon our local daily experiences. Climate change, for many, feels distant, intangible, staggeringly random and complex. It's a collection of intricate datapoints, statistics, models that blur the communication for the general

populace. A documentary that features the research in this book is under development. It is called Climate of Hope: Cities Leading the Way:

.http://www.climateofhopefilm.org

Unlike any other film, this documentary will take a different approach to climate change by describing how cities, communities, and citizens around this world are leading the way to create more livable, healthier, and more prosperous life. This book and documentary delves deeper into the overall vision for the documentary and the storylines of families in Louisville, Portland, Amsterdam, Los Angeles, and other places where greenhouse gases are being reduced. We want to create a realistic international movement to roll back the destruction of climate chaos. We have put together an amazing team of successful and proven change makers to save the Earth from decimation. It started innocently enough. The roots of Sociology were discovering the impact of "social forces" shaping our lives and using large data sets. We are connected to neighborhood organizations worldwide, from Neighborhood Associates in Washington DC to the Andrew Young Foundation in Africa. Our mission is to inspire and inform more front-line neighborhood crusaders to advocate for city-driven climate change mitigation worldwide. We aim to create a powerful grassroots movement for change that will amplify the distribution and momentum of the film's message.

The film aims to inspire hope and catalyze change through stories of families, children, and neighborhoods taking bold, transformative actions. It champions the idea that with technology, will, and heart, our cities can not only survive but thrive. At its heart, the film is about urban transformation, challenges faced by cities/neighborhoods, and examples of cities leading the way with climate change action — ultimately highlighting the potential for other cities to transform into success stories. Filmmaker Chris Nolan is already in talks with PBS to ensure wide audience

awareness and garner engagement in the movement. There are also plans in place to feature videos from the film on social media platforms such as YouTube and TikTok with the intent of reaching millions of viewers to create momentum and advocacy for this mission critical pursuit (http://www.sunlouisville.org and http://www.climateofhopefilm.com).

Our best chance to reverse climate change is our cities. In 2050, 70% of the population will live in cities. Imagine our world in 2050, where seven out of ten people reside in cities. The world's population is projected to then be around 9.7 billion, which means an astonishing 6.6 billion people will be living in cities. The relentless urban migration is up 55% since 2018, which means the brunt of climate change will be experienced in metropolises. There have been best-selling books on how cities have taken control of climate crisis, such as *Climate of Hope, How Cities, Businesses, and Citizens Can Save the Planet* and *Solved: How the World's Great Cities Are Fixing the Climate Crisis*. They have chronicled the stories of progressive cities around the world—large cities like Los Angeles, Amsterdam, New York, Toronto, Oslo, Shenzhen, and Sydney, and small towns such as Georgetown, Texas. However, since *Climate of Hope* was written in 2017, artificial intelligence (AI), technology, and even more city initiatives are making an incredible difference in reducing global emissions and implementing sustainable solutions.

Seventy percent of people worldwide fear the future, believing we are helpless to change or solve the climate crisis. A significant portion of this group consists of young people under the age of 40 who feel the planet is doomed. This book will help change that narrative. It aims to inspire hope and catalyze change. It highlights the urgency and feasibility of urban transformation, championing the idea that with technology, will, and heart, our cities can not only survive but thrive.

We cannot wait for national governments to agree on how to reduce greenhouse gas emissions. We aim to inspire a new conversation that will spur more action by cities to increase the pace and scale of climate change solutions that will make the world healthier and more prosperous. Technology and AI can solve 80% of greenhouse gases issues. We possess the means to curb climate change. Every block, every neighborhood, and every family matters. Climate is about more than data; it's about human lives. Cities, at their core, are dynamic organisms. They evolve, adapt, and with the right nudge, can heal. Look at how these great cities have been rebuilt even stronger from earthquakes, fires, and war: San Francisco 1906, Chicago 1871, Tokyo 1923, Warsaw 1944, Dresden 1945, Beirut, Berlin 1945, Lisbon 1755, Hiroshima 1945, London 1940, and Rotterdam 1940. This book and the film will provide a road map for tackling the most complicated challenge the world has ever faced and inspire those who want to take positive action and make a significant impact on the world.

Louisville Environmental Justice: A Case Study of one of the 1,000 Sacrifice Zones in the United States. Environmental justice has been defined as the pursuit of equal justice and equal protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, and/or socioeconomic status. This concept applies to governmental actions at all levels—local, state, and federal—as well as private industry activities. Lower-income communities and minority populations have historically been the target of many sources of pollution. Air pollution from industrial sites, toxic contamination from incinerators and brownfields, contamination of ground and source water, and lead exposure from aged housing structures are just a few the environmental hazards that disproportionately affect low-income communities.

The EPA has had an effective impact in places where citizens, science, and

government demand healthy air, water, and soil. California environmental protections work to expand lifespan, improve quality of life, and preserve loveable places. But this is sporadic because we know that there are 1,000 places where the EPA turns a blind eye to environmental disasters creating great harm to all forms of life (humans, animals, fish, and vegetation) necessary for sustainable life that allow us to thrive, not just survive. (Shaw and Younes, 202). Local EPA offices are political bodies that answer first to powerful and deadly corporations that destroy the Earth.

Louisville is a primary example where corporations ask for exemptions to release more deadly pollution. How do they justify or claim the one pound of toxins landing on the bodies of 60,000 residents who are mostly poor and minority and have a lifespan twelve years shorter than folks outside the sacrifice zones? (Gilderbloom, 2023) In a study my research team conducted, this difference in lifespan was not explained away by the lifestyle of poor and minority residents since the comparable demographic group lived longer in nonsacrifice zones. We exposed the lifestyle explanation as disinformation and pseudo propaganda blaming the victim instead of industries that pollute. Fuzzy math from the EPA justifies increasing deadly pollution despite hearing where 99% of the testimony is coming from residents who live and work there. (Gilderbloom, 2023)

The call for greater racial equity means cleaning up the air, water, and soil. Poor people needlessly suffer more in Louisville than do low-income people in West Coast cites. If Louisville adopted the same tough environmental regulations as its West Coast counterparts, West Louisville would surely bloom instead of slowly die. The unfairness between black and white neighborhoods is stark and vivid. Science and public health officials can show Louisville how to

solve some of its most pressing problems and other cities can learn from its example. If Louisville would find the will to address the pollution of West Louisville, it could prove to be a case study in best practices on how cities can confront environmental and health injustice. Deadly pollution is Louisville's most urgent problem, making many Westside neighborhoods unlivable, unsustainable, unhealthy, and unprosperous. It is the number one cause of environmental racial injustice.

The powerful want others to believe that pollution is not a problem. In other words, if they cannot see it, it must not exist. Science, data, facts, and truth tell a much different story. But President Trump wanted the EPA to hide this data from scientists and the public (Gilderbloom et. al, 2020).. Indeed, pollution is largely invisible because the deadliest pollution, PM.2.5, is microscopic, about 1/16th of a human hair, and gets clogged up in a person's lungs, heart, brain, and liver. Louisville might be among the worst examples of the extreme negative impact of pollution in the city. Compared with 144 other mid-size cities, Louisville has some of the worst and deadliest pollution in the United States (Gilderbloom et. al, 2020).

This book adds a human dimension to how pollution impacts our brains, hearts, and lungs in a case study of Louisville. We challenge the mainstream corporate view that pollution is harmless to humans and that it just "dissipates into the air." It's hard to dismiss the impact of one pound of toxic pollution per resident or student entering the nose, ears, eyes, mouth, and skin. It shortens lifespan. But they do dismiss it. And few challenge that view, including taxpayer funded universities for fear of alarming donors. We hope this research will stimulate even more rigorous research as we try to obtain more research funds via Neighborhood Associates, a non-profit organization in Washington D.C. High levels of pollution reduce lifespan, reduce housing equity, damage the fragile atmosphere, and increase the chance of getting COVID-19.

The map below showing deaths per 100,000 attributable to pollution was published by the Lancet Commission, the leading medical journal in the world. Beelen et. al., 2014 Notice that North America, Australia, and Northern Europe get a "pass" for hardly any deaths being caused by pollution. Beelen et. al., 2014) As we have shown throughout this book, this claim is preposterous, lazy, and maddening.



Chetty et. al (2014) found that in some part of the U.S.A., some places have reduced lifespan, but he discounted pollution which is consistent with Lancet. We found otherwise in this book



ProPublica was able to identify 1,000 places around the United States that released dangerous toxins in the air, and this is what their map showed. The majority are in rust belt area and the unregulated South (Shaw and Younes. 2021). Below are two other maps done by Shaw and Younes, 2021 showing concentrations of chemical releases mostly concerntrated in the rust belt and sun belt but few along the East and West Coast.





11

Commented [ES1]: Identify where this map came from. Add description.

As we showed in Chapter 3, my research team discovered an error in air pollution measuring: two of the four EPA measures of pollution were missing. We looked at a sample of 144 semiisolated cities with air quality ranging from clean to toxic. We wanted to clean up the mistakes made by Lancet and ProPublica and develop a clean and unbiased representative map to understand how high levels of toxins have a devastating impact on communities.



KIESD (Kentucky Institute for the Environment and Sustainable Development) partnered with American Synthetic Rubber, which alone was responsible for the production of roughly 90% of a deadly cancerous causing chemical: 1,3-butidiene. Russ Barnett found that the chemical was mostly non-detectable in the air when American Synthetic Rubber shut down for two weeks during the summer. KIESD proposed a \$3 million-dollar anti-pollution device that would stop 1,3-butidiene from being released in the air, water, and soil. This deadly chemical is highly correlated with cancer. Russ made a "good neighbor" proposal to have American Synthetic Rubber to install a \$3 million-dollar device to forestall this dangerous pollutant from going in the air. Imagine the positive impact if the chemical companies that produce 75,000 pounds of chemical pollutants were equipped with such devices. Moreover, our research pushed the EPA to reduce the amount of pollution by at least 6,000 pound (Giffin, 2024; see also Gilderbloom, 2023) EPA officials tipped the hat to my

series of articles on pollution in the local newspapers and academic journals along with my research cited by the U.S. Department of Justice (2023; see also Gilderbloom, 2023; 2020a, 2020b, 2020c). Good measures of data help move officials to act.

How deadly are the toxins in Louisville? One accident, one angry employee, or one terrorist attack could wipe out thousands of lives in West Louisville with a chemical leak or explosion. This is a ticking time bomb. Given the relative density of West Louisville, roughly 60,000 residents could die instantly according to former officials from the Commonwealth of Kentucky Energy and Environmental Cabinet, the recently closed Kentucky Institute for the Environment and Sustainable Development, and Center for Sustainable Urban Neighborhoods.

Heavy pollution not only affects health and housing in industrial neighborhoods, it also creates an even bigger hole in the fragile atmosphere, making Louisville one of the highest emitters of greenhouse gases per capita. High levels of industrial pollution explain why Kentucky has a disproportionate number of man-made disasters: flooding in Eastern Appalachia and dangerous tornados in the South. For example, in their 2021 article in the Courier Journal, environmental writer James Bruggers and his colleague Phil McKenna estimate that just one chemical plant out of the 45 in Louisville emits enough dangerous greenhouse gases to equal the pollution of 671,000 cars (McKenna and Bruggers, 2021a). Several weeks later they amended the article to read it was now 750,000 cars with two vicious greenhouse gases (McKenna and Bruggers, 2021b).::

Chemours most harmful climate super pollutant is the byproduct, dydroflurocarbon-23 (HFC-23), a potent greenhouse gas that produces 12,400 times more warming than carbon dioxide, the main chemical compound responsible for climate change.... In addition to being a

climate super pollutant that is 1,720 times more effective at warming the atmosphere than carbon dioxide, HCFC-22 also destroys atmospheric ozone that helps protect the Earth from harmful ultraviolet rays. (McKenna and Bruggers, 2021b).

In the previous chapters we talked about the correlation between the pollution and its impact on humans: proficiency scores, lifespan, and rates of COVID-19, as well as neighborhood impacts such as abandoned housing, housing equity, and crime. Deadly toxic pollution occurs in over 1,000 places around the United States according to Pro-Publica. It's a problem that has not been well documented due to significant push back from chemical companies, corrupt local governments, chambers of commerce, and even universities joining in on the deceit.

Reducing Greenhouse Gases and the Need for Renewable Energies

Many of our cities have evolved to become "post-industrial" and are unlike anything that our forbearers might have imagined. Cities in Brazil, Mexico, China, and India are reeling from population growth, poor development choices and environmental damage. Access to energy is a key to sustainability. Hope for solutions can be found in policies, programs, and technologies. Governments are creating policies, corporations are reconstructing strategic plans, and institutions are redefining their missions. Agendas are in flux and new programs are being launched and implemented. There is an evolving consensus on the horizon, one that will change how we prioritize our efforts to become more sustainable.

Historic Preservation as a Sustainability Strategy to Foster Pro-Environmental Cultures

This chapter examines the impacts of historic preservation on jobs, property values, and reducing fossil fuel consumption. Louisville, Kentucky is a national leader in preservation,

ranking first in the White House's Preserve America initiative with 73 recognized communities. Tax incentive programs have been an effective tool for creating positive changes in historic areas. Historic preservation results in more job creation than most other public investments. In the presence of escalating gas prices and assorted environmental practices, we show that neighborhoods containing historic districts exhibit higher increases in median neighborhood housing values than undesignated neighborhoods. This chapter also shows that environmentalism and historic preservation are linked together and complement one other. Residents of historic urban neighborhoods exhibit more environmentally friendly behavior, particularly those living in single-family homes. But more importantly, they recycle materials that reduce energy consumption with imbedded energy.

How to Make Our Schools Perform Better

The transition from energy-intensive schools to green schools can result in enormous energy savings; higher grades and test scores, less violence, and happier students (because of daylighting in classrooms); lower building costs; and reduced water costs (from water conservation techniques and rainwater collection systems). Plus, students' proficiency scores will rise in a clean air solar environment coupled with nearby chemical and liquor distillery companies shutting down the deadly toxins.

Will Planting Eight Billion More Trees Solve Climate Chaos? No!

Trees have the ability not only to filter our air but also add beauty to our cities. As a result of the many benefits associated with trees and their ability to improve urban areas, it is imperative that city officials and planners start incorporating trees into cities and urban areas on a much larger scale. They help cool the streets and houses, they make walking more pleasant and

enjoyable, and they create beauty which leads to make a more loveable and sustainable neighborhood. They help reduce the threat of flooding and reduce energy cost as well. But they don't do much to clean up toxic pollution.

Just one tree can make a difference, but it is not a miracle cure to address the issue of heavy chemical pollution. But too often, planting eight billion trees will not significantly lower the warming of the Earth or clean up the pollution. It's a corporate decoy designed to take the focus away from pollution and dodge having to focus on pollution regulation.

Does Walkability Matter? Yes, it Reduces Foreclosure, Improves Health, and Reduces Greenhouse Gases

The ideal neighborhood is one that is walkable. The more people walk or bike or use buses/trains the less pollution in the air. In general, inner-city neighborhoods built before the mass production of cars are more walkable than sprawling "residential only" suburban neighborhoods that are isolated from the basic necessities of everyday life. We find that walkability is statistically significant in predicting an increase in neighborhood housing values and has a significant negative correlation with foreclosures in the neighborhoods of Louisville. Finally, walkability is also associated with reduced crime in several measures.

Biking is the Best Choice for Health, Safety, and Zero Emissions

Biking is one of the most viable transportation choices for healing a broken Earth. Compared to cars, it releases none of the dangerous greenhouse gases that wreak havoc on the environment. Choosing a bike over a car means better health for bikers, longer life spans, decreased medical expenditures, and an average of \$8,000 to \$12,000 per year in savings. A bike-friendly neighborhood also increases community and housing values. The local economic

benefits are significant in shifting car-centered transportation toward a more bike-friendly culture in urban neighborhoods. Fewer cars and more bikes and bike-oriented infrastructure could translate into higher property values, more jobs, decreased traffic congestion, and, ultimately, more money in the consumer's pocket. This spending on housing repairs, installation of community gardens, and locally operated grocery stores and restaurants (expected results of the cost savings created by the reduction or discontinuance of car-based commuting) represents the potential green dividend of investments in urban bicycling. Another important finding is that people who ride bikes will be healthier due to increased physical activity and improved air quality. But, most importantly, the net zero impact of carbon emissions from bicycles means a reduction of greenhouses gases and, hopefully, a way to heal the Earth back to normalcy. But the primary problem is the lack of safe bicycling infrastructure in most cities today, requiring major public investment before a significant number of people will choose this option.

Portland, The Best Green City in America: Equity, Health, and Safety

Portland is a model for one of the most livable and sustainable mid-sized cities in the United States and is different from most other U.S. cities in one crucial way: it has reduced its per capita carbon emissions. Portland has not only become a city with a steadily shrinking environmental footprint, but one that is experiencing an economic boom based on the "green" economy, a massive influx of young and college educated residents, and steadily rising rates of walking, bicycling, and transit use. How has the city accomplished all of this? The answer is: by embracing new urbanism. Over the last 40 years, the city of Portland has instituted policies that incentivized the construction of dense, mixed-use development. Combined with generous investments in streetcars, light rail, and bicycling infrastructure, Portland has created a dense,

walkable urban environment that has been attracting new residents and new investment ever since. Portland's charm is that it is a weird, unconventional, and exciting place to live, and the city is living proof that investing in the "green" lifestyle pays off in a big way. In addition, they have banned new single family housing construction and mandate new housing must at a minimum have an accessory unit. Single family housing is just too expensive in terms of tax payer infrastructure cost and moreover, they tend to be more concentrated in the outlining areas which means longer commute times.

Amsterdam: Planning and Policy in the World's Most Livable City

Amsterdam includes many components that make it an ideal city: dense and compact neighborhoods near work and school, biking and walking for over half the population, light and hard rail access, minimal personal usage of cars, historic preservation, personal freedom, and support for the arts to attract young people. Many of the social, economic, and environmental problems facing Amsterdam are considerably fewer than in cities in the United States, and in most cases, Western Europe. Amsterdam, at this moment in history, might be the world's greatest city because of its ability to ensure necessities, freedom, and creativity. The data show that Amsterdam has lower rates of crime, murder, rape, drug usage (cocaine and marijuana), teenage pregnancy, diabetes, obesity, suicide, abortion, infant mortality, dependence on fossil fuels, and homelessness. There is also considerably less racial segregation. People live longer because of Amsterdam 's walkability, bike usage and access to parks. People living in Amsterdam seem more tolerant, secure, happier, and healthier compared to citizens in the United States. Amsterdam is by no means perfect, but in comparison to many other democratic industrial cities, it is a far better place for citizens of all races, religions, and incomes. There is much to learn from

the Dutch about important solutions to policy and planning and Amsterdam provides us with valuable lessons.

Academic Freedom and Science Under Attack

Throughout history there has been an attack on science. Who stands up for science? Not the cowardly university administration that bows down to the wishes of those who donate millions of dollars to the university and uses the same tactics that were used to attack Rachel Carson, author of the award-winning book, *Silent Spring*. Other scientists have been silenced; Galileo, the greatest scientist of all time, was put in home incarceration for 12 years. When he argued that the Earth circled the sun and conflicted with the teaching of the Catholic Church, his microscope and telescope were taken from him, and he was told that he could not write for the last 12 years of his life. Despite being a gunshot survivor and having my life threatened, I remain a fearless truth teller who informs people that we are not being good stewards of the Earth.

How are 3,000 plus places of higher education seemingly silent about environmental crimes against humanity and reducing greenhouse gases? There are only a few academic universities willing to speak out without interference from the polluters: Arizona State, University of California Santa Barbara, and Harvard are some of the best environmental scholars/activists. The rest are afraid to speak out and be good stewards of the Earth. Even the federal EPA under the Democrats is too timid.

Conclusion

Climate change is not just a scientific phenomenon; it's an intimate dance of survival, adaptation, and hope. Every block, every neighborhood, and every city add a note to our global symphony. The stakes are high and the challenges profound, but woven within are tales of resilience, transformation, foresight, and progress. We feel the weight of why this matters and
we've seen how our fight is down to individual city blocks. We've glimpsed the future of super cities and the next fifty years. Our children are the inheritors of dire world challenges, but they are also the heartbeat of promise for a more abundant, brighter, better future.

End toxic pollution and watch a magical transformation happen in the 1,000 toxic neighborhoods in the U.S.A: a jump in elementary school student proficiency scores, higher home values, longer lifespan, reduced greenhouse gases, fewer COVID-19 cases, and more business startups. We need to stop the unnecessary loss of life. We need to fight for clean air, water, and soil without compromise. Universities have millions of dollars to identify the problem and the solutions to solve it. The University should be a fearless defender of science and free speech, and an unassailable beacon of truth. Universities need get on the side of science instead of climate denialism. We need to have honest and uncomfortable debates. We can solve this problem before it's too late.

Our talk today is about hope, a climate of hope. It gives people workable tools to reverse climate change. We have put out examples of what might work and empowering citizens to not accept defeat. As President Biden said at The White House on November 14, 2023:

Anyone who willfully denies the impact of climate change is condemning the American people to a very dangerous future. The impacts we are going to see are going to get worse, more frequent, more ferocious, and more costly. Last year alone natural disasters in America cost us \$178 billion dollars in damages. And it is the ultimate threat to humanity.

References

Beelen, R. and Ole Raaschou-Nielsen, Massimo Stafoggia, Zorana Jovanovic Andersen, Gudrun Weinmayr, Prof Barbara Hoffmann, Kathrin Wolf, Evangelia Samoli, Paul Fischer, Mark Nieuwenhuijsen, Paolo Vineis, Wei W Xun, Prof Klea Katsouyanni, Konstantina Dimakopoulou, Anna Oudin, Bertil Forsberg, Lars Modig, Aki S Havulinna, Timo Lanki, Anu Turunen, Bente Oftedal, Wenche Nystad, Per Nafstad, Ulf De Faire, Nancy L Pedersen, Claes-Göran Östenson, Laura Fratiglioni, Johanna Penell, Michal Korek, Göran Pershagen,, Kirsten Thorup Eriksen, Kim Overvad, Thomas Ellermann, Marloes Eeftens, P. Petra, H. Peeters, Kees Meliefste, Meng Wang, Bas Bueno-de-Mesquita, Dorothea Sugiri, Ursula Krämer, Joachim Heinrich, Kees de Hoogh, Prof Timothy Key, Annette Peters ,Regina Hampel, Hans Concin, Gabriele Nagel, Alex Ineichen, Emmanuel Schaffner Prof Nicole Probst-Hensch, Nino Künzli, Christian Schindler, Tamara Schikowski, Martin Adam, Harish Phuleria, Alice Vilier, Françoise Clavel-Chapelon, Christophe Declercq, Sara Grioni, Vittorio Krogh, Ming-Yi Tsai, Fulvio Ricceri, Carlotta Sacerdote, Claudia Galassi ,Enrica Migliore, Andrea Ranzi, Giulia Cesaroni, Chiara Badaloni, Francesco Forastiere, Ibon Tamayo, Pilar Amiano, Miren Dorronsoro, Michail Katsoulis, Antonia Trichopoulou, Bert Brunekreef, & Gerard Hoek. (2014). Effects of long-term exposure to air pollution on natural-cause mortality: an analysis of 22 European cohorts within the multicentre ESCAPE project. The Lancet Vol. 383 No. 9919: 785-795. DOI: 10.1016/S0140-6736(13)62158-3.

Chetty, R., Cutler, D., Stepner, M., & Abraham, S. (2016). The Association Between Income and Life Expectancy in the United States; 2001-2014. *Journal of the American Medical* Association, 315 (16) pages 1, 750-1, 7666.

Giffin, C. (2023) "New EPA Rule EPA Rule Would Effect these Four Chemical Plants, provide Air Monitoring in West Louisville"

Gilderbloom, J. H. (2023) Where is the Public Outrage? The Reckless Decision to Keep Polluting West Louisville. Courier Journal op-ed April 3, 2023

- Gilderbloom, J. H., Washington, C. B., Quenichet, K., Manella, C., Dwenger, C., Slaten, E., Sarr,
 S., Altaf, S., & Frederick, C. (2020). What Cities are the Most Dangerous to Your Health?
 Ranking the Most Polluted Mid-Size Cities in the United States. Pre-prints with *The Lancet*. January 9, 2020
- Gilderbloom, J. H., Meares, W. L., & Squires, G. D. (2020b). Pollution, place, and premature death: evidence from a mid-sized city. *Local Environment: The International Journal of Justice and Sustainability*. 25(6), 419-432.

https://doi.org/10.1080/13549839.2020.1754776

Gilderbloom, J., Gregory Squires, G., & Meares, W. (2020c). Mama I Can't Breathe: Louisville's Dirty Air has Steep Medical Costs. *Local Environment: The International Journal of Justice and Sustainability*, 25(8), 619-626.

https://doi.org/10.1080/13549839.2020.1789570

- Gilderbloom, J. I. H., Kingsberry, I., & Squires, G. D. (2021). How Many More Children Must Be Hurt by Pollution? HARVARD MEDICAL SCHOOL PRIMARY CARE REVIEW. https://info.primarycare.hms.harvard.edu/review/children-hurt-pollution
- Gilderbloom, John Hans William Riggs, Chad Frederick, Gregory Squires, and Karrie Quenichet (2022) The Missing link of Air Pollution: A Closer Look at the Association Between Place

and Life Expectancy in 146 Mid-Sized Cities." International Journal of Strategic Energy and Environmental Planning.V4.4 July 2022

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3506217

- Gilderbloom, J. H. & Squires, G. (2022). Put a Mask on Pollution: Connect the Dots Between COVID-19 and Unhealthy Air." *Social Policy*.
- McKenna, P. and Bruggers, J. (2021a). Louisville chemical plant emits super-pollutant equal to emissions from 671,000 vehicles. Courier Journal, March 10, 2021. <u>https://www.courier-journal.com/story/news/2021/03/10/global-warming-louisville-plant-emits-super-pollutant-contributors/6932934002/</u>
- McKenna, P. & Bruggers, J. (2021b). Louisville's Super-Polluting Chemical Plant Emits Not 1, but 2 Potent Greenhouse Gases. *Courier Journal*, April 5, 2021. <u>https://www.courier-journal.com/story/news/2021/04/05/super-polluting-louisville-chemical-plant-emits-more-greenhouse-gases-than-thought/7075408002/</u>
- Meares, W., Gilderbloom, J., H., Squires, G., & Jones, A. (2021). "Pollution and the Pandemic: Explaining the Differences in COVID-19 Rates Across 146 U.S. Communities. *International Journal of Strategic Energy and Environmental Planning*, 4(2).
- Shaw, A., & Younes, L. (2021). The Most Detailed Map of Cancer-Causing Industrial Air Pollution in the US. *ProPublica, November, 2*.
- U.S. Department of Justice, 2023,Investigation of the Louisville Metro Police Department and Louisville Metro Government. United States Department of Justice Civil Rights Division and the United States Attorney Office Western District of Kentucky Civil Division March 3, 2023

file:///C:/Users/jigild01/Downloads/2023.3.8_lmpd_findings_report_0-1.pdf

Authors: John Hans Gilderbloom is a Professor at the University of Louisville and Fellow at the Neighborhood Associates in Washington D.C. <u>http://www.sunlouisville.org</u> and Chris Nolan is a three time Emmy Award documentary winner based in Santa Monica and is the genius behind Climate of Hope: Cities Leading the Way to Save the Earth http://www.climateofhopefilm.org



How can we change the "operating system for growth" to create more livable cities and towns for all?

Updated: Apr 7

The answer is an evolving set of tools and strategies employed by municipal governments, non-profits, practitioners and citizens - ones we will explore, and help advance through research, at the 60th IMCL conference, April 26-28



Orenco Station in Hillsboro, Oregon, an example of a new neighborhood that scores very well on livability metrics, as well as other metrics of ecology, health, and social well-being -- but many barriers remain to making more livable places.

EDITOR'S NOTE: This is another in a series of posts featuring topics to be discussed at the <u>60th International Making Cities</u> <u>Livable</u> (IMCL) conference, in the beautiful livability case study of Newport, Rhode Island USA, April 26-28, 2024.

In 1965, the architect Christopher Alexander wrote these lines:

"The non-art-loving public at large, instead of being grateful to architects for what they do, regards the onset of modern buildings and modern cities everywhere as an inevitable, rather sad piece of the larger fact that the world is going to the dogs.... Their growing reluctance to accept the modern city evidently expresses a longing for some real thing, something which for the moment escapes our grasp." Alexander devoted the rest of his career seeking to grasp this real but elusive thing. For him, it was the quality of a livable neighborhood, which he later said was "not very complicated"... "a balance of privacy and contact... safety from traffic and noise... from crime and violence... beauty... intimacy.... streets and public places where everyone feels at home...."

Yet the modern "operating system for growth" too often seems to deliver something very different: urban structures that are too dangerous, too ugly, too unwelcoming -- even exclusionary -- and just too costly, in many more ways than one.

This is the opposite of a livable city -- or a sustainable one.

Yet we can see hopeful examples of livable cities, towns and suburbs, that are still being built today, including many of the inspiring case studies presented at conferences of the <u>International Making Cities Livable conference series</u>, begun in 1985. Among others, they include the successful suburban retrofit of <u>Carmel, Indiana</u>, the remarkable regenerated city of <u>Le Plessis-Robinson</u>, in the Paris region of France, and the celebrated urban extension of <u>Poundbury, UK</u>, as well as the widely-studied transit-oriented suburb of <u>Orenco Station</u>, in Oregon, illustrated at the top of the page.

The problem is, these places are too often the exception rather than the rule. Their builders consistently report that there are still too many barriers, too many entrenched obsolete standards, and too many perverse incentives and disincentives, making it all too difficult and rare for them to be able to build livable places. What we need, they say, are effective tools and strategies to overcome the barriers, reform the standards, and change the incentive structures. In a sense, we need to reform the "operating system for growth" that has locked us in to the current unsustainable course -- in city-making, and perhaps too, in our world as a whole.

This is the critical topic of implementation -- a main focus of <u>our upcoming conference in Newport, Rhode Island</u>, April 26-28, and of other conferences in the <u>IMCL series begun in 1985</u>.

So what are the tools and strategies that we must employ to change this urban state of affairs? One vitally important area is the emerging research and best practice in transportation planning reforms toward greater walkability and bikability, reduced car dependency, and more meaningful transportation choice. The University of Colorado researcher <u>Wes Marshall</u> will discuss this emerging research, and its translation into implementation of a new generation of walkable, bikable streets, featuring better street networks and street design. <u>Alex Krumdieck</u>, Director of the Urban Design Studio of Auburn University, will explore the disruptive influence of parking standards, and alternative strategies to mitigate the heavy impact of parking areas on urban livability while maintaining mobility.

Research shows that what is needed is not only the functional infrastructure of walking, biking and other modes, but an improved quality of the user experience, including aesthetics. If we are going to expect people to walk, bike and take transit, they themselves will have to find those attractive choices, including aesthetic attraction and enjoyment. Researcher <u>Akosa</u> <u>Wambalaba</u> of the United States International University-Africa in Nairobi, Kenya, will provide an international perspective on this issue, using case study data from Nairobi.

The conference will also include other researchers exploring user experience and livability. Among others, <u>Justin Hollander</u>, Professor at Tufts University, and <u>Ann Sussman</u>, President of the Human Architecture and Planning Institute, will discuss research on "cognitive architecture" and the results of eye-tracking research to provide useful guidance for the design of more walkable, livable urban features. <u>Marjo Uotila</u>, City Council Member of Kaarina, Finland, and Chair of INTBAU-Finland (a partner of the IMCL), will present new research on user preferences in architecture toward more livable cities. We will also explore urban resilience, including economic resilience. Too often, cities chase after seemingly attractive development models that carry hidden "externality" costs, and city leaders fail to recognize the very real cultural and economic wealth they have in their own back yards, with opportunities for infill and regeneration. <u>Chris Allen</u>, Sponsorships and Partnerships Coordinator at <u>Strong Towns</u>, will share an update on their widely recognized work to make cities and towns more resilient and livable, with a focus on municipal finance.

Another vital subject for livable cities is the need for more climate-friendly development, in an age when this issue has come to pose an existential threat to humanity and to the biosphere. <u>Research has shown</u> the importance of walkable, diverse, mixeduse urbanism, especially in comparison to sprawl, in slowing the emissions that drive climate change. What's more, mitigation strategies (i.e. reducing emissions) often overlap with adaptation strategies (i.e. coping with a changing climate). For example, planting trees, reducing paved areas, and using "cool surfaces" (reflective of solar radiation) serve both goals of adaptation and mitigation -- and provide many other benefits for livable cities besides.

Several speakers will address issues of climate and resilience, including John Hans Gilderbloom, Professor of Sociology at the University of Louisville. His work focuses on the disproportionate impacts of environmental damage, including climate change, on vulnerable populations -- and what can be done about it. His most recent work looks at positive steps to be taken to deal with climate change, with case studies of families in Rome, Mumbai, Louisville, Georgetown, TX, Los Angeles, Amsterdam, and Nairobi. The work is documented in an upcoming film titled *Climate of Hope*, and he will show a trailer at the conference. Other conference researchers will present work on Urban Heat Island (UHI) effects on health, including <u>Veronica Westendorff</u> of UNC Charlotte, and urban alternatives to adapt to sea level rise by <u>William Kenworthey</u>, Regional Leader of Planning for HOK, and a national leader in resilient urban design.



One of the barriers to better development is the stakeholders' fear of the potential negative impacts of new development. History shows that they may not be wrong -- and moreover, it's *their* neighborhood that is impacted, and they have a right to participate in the public decision-making process about its future. On the other hand, they don't have the right to exclude others unjustly, or prevent the development of resources (including housing) that the community needs. So it's entirely proper to challenge them to step up and be proactive rather than reactive (an approach we have referred to as <u>"QUIMBY"</u> <u>urbanism</u>, for "Quality In My Back Yard."

One way to do that is to work <u>with</u> the community to adopt pre-approved plans in order to expedite urgently needed housing, including more diverse and more affordable housing. <u>Allison Quinlan</u> of <u>Flintlock</u>. <u>LAB</u> will discuss this emerging practice across the USA, including the development of townhouses and other "middle housing" and infill types. Instead of reacting to infill development they don't like, neighbors are challenged to identify development they <u>will</u> support. Regulatory authorities and financial institutions are also challenged to adopt streamlined and pre-approved processes, and overcome the barriers to getting the diverse and affordable housing we need.

We will also explore other ways to deliver more diverse and affordable housing -- not only in quantity, but in quality, and properly located. <u>David Woltering</u> of Woltering Community Planning will explore effective strategies to deliver "Not Just More, But Truly Livable, Housing for Generations to Come." <u>Kent Watkins</u> of the National Academy of Housing and Sustainable Communities, will discuss the importance of location-efficient housing, and new methods to deliver it more equitably --including fascinating (but also questionable) new AI technologies. Another way to overcome stakeholders' fears, and thereby ease approvals as well as outcomes, is to build temporary and incremental versions of proposed changes, such as narrowed or pedestrianized streets, pocket parks, street improvements, and other features of more walkable and livable neighborhoods. Sometimes residents imagine the worst, and temporary changes can provide a non-threatening way of letting them see the reality and its benefits ("seeing is believing"). <u>Krista</u> <u>Nightengale</u>, Executive Director of the <u>Better Block Foundation</u>, will describe their remarkable tools and strategies that employ this approach.

Another crucial need is for zoning reform to end exclusionary zoning by use and housing type, and allow greater diversity and mixing of activities. <u>Rachelle Alterman</u>, Professor of Urban Planning and Law at The Technion, IIT, will discuss the emerging research on planning law and its new reform tools and strategies, as well as the <u>problematic impacts of tall buildings</u>, and strategies to add more "middle housing" as an alternative. (As the research and many examples show, it's possible to achieve quite high numbers of units <u>without</u> tall buildings and their negative impacts.)

Affordability is a related and critical issue for many cities, and University of British Columbia Professor <u>Patrick Condon</u> will explore the evidence for land valuation as a major driver of housing cost, as well as the limits of density alone -- and tall buildings -- in achieving affordability. That's essential if we're going to have livable cities for <u>all</u> -- as is a fairer distribution of resources and amenities. We will be joined by <u>Senchel Matthews</u>, Associate Director for the Built Environment for the Full Frame Initiative, a Massachusetts-based social change organization that works to create a country where everyone has a fair chance at wellbeing. FFI partners with communities, nonprofits, and public systems to change structures and beliefs to improve wellbeing for all. We will also be joined by Professor <u>Edgar Adams</u> of Roger Williams University, exploring how we can achieve a just city through "reclamation and repair."

One of the major developments in urban research is a clearer picture of the importance of public space as a fundamental urban arena, bringing all citizens together to enjoy, create and prosper. Indeed, it seems increasingly clear that public space plays a role in creating all of the benefits that cities give us -- and its decline in many places plays a role in the negative impacts of urban growth, including car dependency and emissions, high-consumption lifestyles, declining health, social isolation, and other high "externality costs".

Research documents the importance of key characteristics that public space must have in order to function properly (including access, affordance of activities, visibility, and other elements). <u>Setha Low</u>, Professor of Anthropology and Environmental Psychology with the Public Space Research Group at City University of New York, will discuss the findings of her new book, <u>Why Public Space Matters</u>. She will be joined by sociologist <u>David Brain</u> of New College of Florida, <u>Kristie Daniel</u>, Program Director of Livable Cities at HealthBridge, <u>Andrew Rudd</u>, Human Settlements Officer at UN-Habitat, and others who have been working on public space implementation projects around the world.



The 60th IMCL will also include prominent leaders in the international placemaking movement, which is effectively using tactical approaches for improving public space. The legendary <u>Fred Kent</u> (at left), early collaborator of public space pioneer William H. Whyte, will describe the work of his "Social Life Project." <u>Ethan Kent</u> will describe the work of PlacemakingX in supporting a growing international network of local placemaking innovators. <u>Madeleine Spencer</u> of PlacemakingUS will lead a workshop on new placemaking tools and strategies.

The Kents and others acknowledge a debt of gratitude to Christopher Alexander, whose "pattern language" methodology encapsulates a wide range of tools and strategies for making livable cities and buildings. Alexander's method continues to bear fruit through the work of IMCL colleagues, including the most recent <u>A New Pattern Language for Growing Regions: Places,</u> <u>Networks, Processes</u>. That volume is squarely focused on implementation, and on new developments including new technologies, techniques of sustainable building, and methods to manage rapid urbanization in the Global South. It also includes a companion wiki, <u>npl.wiki</u> (developed by wiki inventor Ward Cunningham, also a pioneer of pattern languages in software leading directly to wiki and Wikipedia).

Also working in the Global South is <u>Ben Bolgar</u>, Executive Director of the Projects Team at the King's Foundation in London. The Foundation works with the Commonwealth Association of Planners, which includes senior planning officials of India, Pakistan, Malaysia, Canada, Australia, and many African and Caribbean countries. Ben will give a report on this important work and how research is driving urgently-needed reforms to practice and policy -- but more needs to be done.

Other partners in the conference will discuss the state of implementation for livable cities, and the role that research can play to drive more effective change. <u>Mallory Baches</u>, President of the Congress for the New Urbanism, will give a report on the strategic plan of that organization, and its work to drive reforms to professional and educational standards. <u>Christy Milliken</u> will describe work by Seaside Institute to share knowledge about project successes and lessons, both in the US and internationally.

We will also be fortunate to hear from leading practitioners to share their front-line expertise from the field. This year, we will be joined by <u>Steve Mouzon</u>, a nationally prominent urban designer of many noted projects, founder of the <u>Urban Guild</u> (a partner of the IMCL), and author of the landmark book <u>The Original Green</u>. We will also be joined by <u>Christine Storry</u> of Utopia Architects in New South Wales, Australia, and <u>Nir Buras</u>, principal of the <u>Classic Planning Institute</u> in the USA. Also joining us will be <u>Daniel Morales</u> of Morales Architects, speaking on user preferences, beauty and neuroscience, and <u>David Dixon</u>, Vice President and Urban Places Fellow at the global design firm <u>Stantec</u>.

Other prominent researchers, practitioners and city leaders include <u>Sallie Hambright-Belue</u>, Associate Professor at Clemson University, speaking on educational reforms; <u>William Batson</u>, Professor and Director of the Community Urban Rural Enhancement Service (CURES) Center of Prairie View A&M University, speaking on suburban retrofit; <u>Robert Knapp</u>, Professor Emeritus of Physics and Sustainable Development at The Evergreen State College, speaking on the qualitative aspects of sustainability and the work of Christopher Alexander; and <u>Anirban Adhya</u>, Associate Professor at Lawrence Technical University, exploring morphological typologies and their impacts on livability.

<u>Stefan Norgaard of</u> Columbia University will also discuss hopeful examples of incremental "bottom-up growth" in post-Apartheid South Africa, and the lessons for other parts of the world. <u>Ryan Sandwick</u> of CalPoly San Luis Obispo will share strategies to better translate academic research into community actions to revitalize downtowns.

We at the IMCL believe it is particularly important to learn from projects and their post-occupancy successes and lessons learned. That is a key reason that the IMCL hosts its conferences in key case study locales, encouraging research and communication about them. We often hear from the visionary leaders who worked on these places, like <u>Jim Brainard</u>, former long-time mayor of Carmel, Indiana, a remarkable success story of suburban retrofit. We will hear from other government officials too, on the tools and strategies they have employed effectively and the barriers remaining, including <u>Rory Nisan</u>, Deputy Mayor of the City of Burlington, Ontario, and <u>Mary Gardill</u>, Project Manager for Large-Scale Private Public Projects for the State of Massachusetts.

We will also have the opportunity to tour inspiring downtown Providence projects, including affordable and beautiful housing, by Cornish Associates Managing Director <u>Buff Chace</u>, <u>Brent Runyon</u> of Runyon Heritage Associates, and <u>Don Powers</u> of Union

Studio Architects. We will also have the opportunity to see transportation innovations in Newport by Bike Newport, on a bike tour led by President <u>Bari Freeman</u>. (For attendees and guests who want to sign up for the tours, the link is here: https://www.imcl.online/newport-tours)

The above-mentioned Orenco Station in Oregon (explored in several past IMCL tours) scores remarkably high on metrics of ecology, health, and social well-being, as well as community satisfaction. <u>A study by sociologist Bruce Podobnik</u> reported that Orenco Station achieves much higher rates of walking as well as higher indicators of social capital and resident satisfaction. <u>A study by Professor of Planning Reid Ewing and colleagues</u> found that "parking demand was less than one half the parking supply guideline in the ITE Parking Generation manual; vehicle trip generation rates were about half or less of what is predicted in the ITE Trip Generation Manual; and automobile mode shares were as low as one quarter of all trips, with the remainder being mostly transit and walk trips." Orenco Station is also much more compact than the vast majority of suburban neighborhoods, yet it's very popular and livable -- and it features abundant outdoor amenities supporting a healthy and low-carbon lifestyle, as well as "not so big houses," many of which sport solar systems and other green technologies.

Orenco Station and many other examples demonstrate that we <u>can</u> build (and rebuild) a new generation of more walkable, ecological, equitable, <u>livable</u> cities, towns and suburbs. But to do so, we must commit to learning from our successes and failures through research, and to deploying (and sharing, and further developing) proven effective tools and strategies for implementation. There is much more work to be done, as we will learn about in Newport -- but also many hopeful and inspiring examples to celebrate.

Please join us for a fascinating, productive and, we think, very important gathering in Newport. More information is here: https://www.imcl.online/2024-newport

| | DRAFT | DRAFT | DRAFT |
|--------------|-------|-------|-------|
| July 20 2019 | | | |

White Paper

on

TALL BUILDINGS RECONSIDERED The Growing Evidence of a Looming Urban Crisis

Michael Mehaffy and Rachelle Alterman

Ax:son Johnson Foundation Centre for the Future of Places – Stockholm

And

Neaman Institute for National Policy Research at Technion - Israel Institute of Technology







<u>TALL BUILDINGS RECONSIDERED:</u> The Growing Evidence for a Looming Urban Crisis

EXECUTIVE SUMMARY

At a time of unprecedented speed of construction of tall buildings around the world, evidence-based evaluations of their drawbacks as well as claimed advantages are remarkably infrequent (Ng, 2017). Given the potential for long-term impacts of unknown magnitude, this situation seems to warrant urgent remedy. As a contribution to that goal, this research summary looks specifically at negative impacts, which we find are under-reported. Specifically, we find significant negative impacts in the following categories:

Economic externalities. There is evidence that tall residential buildings with for-sale units
are significantly more likely to fail economically over time. A hardly addressed but
important issue is the built-in market failure in meeting the maintenance costs of towers –
especially residential towers – with condominium type ownership. Contrary to intuition,
the maintenance costs broadly rise with height, reaching prohibitive sums that many
households will at some point not be able to afford. Towers are thus destined to faster
deterioration, greater difficulties in upgrading to newly expected standards, and major,
unaddressed economic and urban challenges when the time comes to replace these
towers.There is also evidence that the higher cost of tall residential for-sale buildings can
fuel gentrification and make surrounding housing less affordable (Lehrer and Wieditz 2009).

There is also some evidence that tall buildings tend to suppress small-scale entrepreneurial activity by replacing older, smaller, more affordable commercial spaces with larger more expensive ones.

- 2. *Social impacts.* There is abundant cautionary research on the negative social impacts of residential tall buildings and their associated urban typologies, both for residentsand for adjacent communities. These include greater isolation and loneliness for some populations, greater rates of depression and even suicide, and suppression of street-based social interaction (particularly for tall buildings with garages for private automobiles).
- 3. *Impacts on the natural environment.* There is evidence that tall buildings do not contribute significantly to urban sustainability, and that arguments to that end are often greatly exaggerated. Evidence shows that many tall buildings with claims to sustainability have performed poorly on environmental criteria in actual post-occupancy evaluations. Tall buildings also have higher embodied energy and resources than lower building typologies, greater exposure to energy heat and loss, and higher negative impacts on access to natural daylight and passive heating by adjacent buildings.
- 4. *Impacts on the human environment.* There is ample research indicating that tall buildings have many negative impacts on the livability of their adjacent public and private spaces. These include shading effects, wind effects, loss of sky view, canyon effects (concentration

of pollutants at street level), and aesthetic effects for larger numbers of residents, which, when judged by residents to be negative, affect more residents negatively for taller buildings. This problem is compounded by evidence of a significant divergence between what professionals and non-professionals judge to be a proper and pleasing building design, which becomes more consequential for more residents when buildings are taller, and thus more conspicuous. There is also an inherent cognitive bias in any profession, which in the case of architecture and development, can have negative ramifications for laypersons' quality of life.

Background

In the last several decades, the number and height of tall buildings has greatly increased in many cities around the world. The benefits of these new buildings are widely discussed: symbols of civic identity, profitable engines of economic development, new homes and offices affording beautiful views, and accommodations for new urban growth in a more compact and (it is alleged) sustainable form.

Indeed, it has become a truism among many sustainability advocates that tall buildings are, by sheer virtue of the higher volume of building they provide per given footprint, paragons of sustainability. Some architects and other boosters now offer highly exuberant prescriptions for the building of many more "sustainable skyscrapers," often with fanciful designs and technological features. Some proponents advocate a wholesale move to super-dense "skyscraper cities," while others simply tout the green credentials of particular tall buildings, like London's Gherkin or Manhattan's New York Times Building.

These are strong claims, which should require strong evidence. In fact, troubling evidence points to many problems with tall buildings, on social, economic and even ecological grounds. Far from being paragons of sustainability, evidence indicates on the contrary that they are a highly problematic urban typology. At the very least, in light of this evidence, the burden should be on those who (for often understandable reasons of self-interest) are exuberant boosters of the type, to show that their negative impacts have been mitigated, and claims for their positive contributions have been fully substantiated. In particular, this should be a minimum prerequisite for any move to deregulate building height rules – which is indeed under way in a number of cities.

We must certainly acknowledge the numerous advantages and appealing qualities of tall buildings for their own residents (and to the developers' profit margin). They can afford wonderful views to residents, or at least they can when not blocked by other similar tall buildings. However, it seems clear that, given the pace of growth of tall buildings – in both number and height – a sober assessment of the evidence is long overdue.

Looking at the evidence

To be clear, the research does show that places like Manhattan and Vancouver, BC, perform well on ecological criteria: They conserve farmland and natural areas, they have relatively low energy use and emissions per person, and they have relatively efficient use of resources per person (notably in

things like buildings, pavement, etc.).

But how much of this is due to the presence of tall buildings? Is it possible that tall buildings are not a significant contributor in and of themselves?

More pointedly, does the research show that there significant negative impacts that we, as responsible practitioners, must bear in mind?

In a word, yes -- on both counts. One problem is that the current knowledge about the impacts of tower buildings is still rudimentary, especially regarding residential towers, and it is replete with unsupported assumptions about the ostensible benefits of tower buildings.

To be sure, there is a small but growing body of research on the benefits and drawbacks of tall buildings, and this research gives a decidedly mixed picture. This research shows that there are significant negative ecological and even economic impacts of tall buildings, as well as other negative factors, and the ecological benefits are not as great as is often assumed. We summarize some of this research below, and offer a sampling of citations.

Definition

First, for the purposes of this paper, we define a "tall" building as any building more than fifteen storeys. This is a somewhat arbitrary definition, since both positive and negative impacts of taller buildings increase with height, and there are many complex factors at play, including materials, engineering requirements, local building codes, view sheds, and other variable factors. Nor are the impacts continuous by height, but rather, they are influenced by a series of "tipping points" above which different materials, structural designs, lift and egress designs, and other changes are required. Nonetheless, there is a significant difference between a ten-storey building and a twenty-storey one, sufficient to draw a line of definition between them.

Three common types

Where tall buildings do exist in these cities, they often fall disproportionately into two categories. They are usually either single-use or limited mixed-use office buildings, or they are residential towers inhabited primarily by upper-income families. A third type of building is the public housing project created by government. Since these structures are rarely above fifteen storeys, we will not focus on that type in this paper.

However, it is worth noting that many of the taller (but below fifteen storeys) buildings that house the poor have an unhappy history. There is extensive research on their dysfunctions, calling into question their social suitability for families, their impact on children, their psychological impacts, their relation to their open spaces and propensity for crime, and other social issues. Moreover, in most cases these are not simply correctable design defects, but inherent problems stemming from isolation from the ground, lack of eyes on the street, and other attributes of taller buildings. These problems are clearly present and even exacerbated when residential buildings are above fifteen storeys. Office buildings, a common type of tall building within city centres, by definition don't by themselves increase residential density, but depend for many of their claimed benefits on their location and the pattern of commuting. If they are confined to largely single-use office districts whose employees empty out in the evening, decamping to remote residential enclaves, then this is clearly not much of an ecological benefit.

A. Economic and legal impacts

1. The illusion of internal economic efficiency masks the real cost of long-term maintenance of towers.

Contrary to conventional wisdom, tall buildings often entail *higher* rather than lower maintenance costs per unit, despite the large number of owners; the taller, the more complex, although not quite in a linear relationship (for details see Alterman 2010). A further problem is related to the structural attributes of tower buildings, which operate like complex, closed machines that are not amenable to structural changes. Unlike regular buildings, in towers it will not be possible to grant additional development rights in the future (incentive zoning) to finance the necessary updating costs. Tower buildings are less amenable to structural modifications, so there is a greater danger that their relative value will eventually diminish, causing them to lose their position in the housing market, and thus to deteriorate faster than smaller apartment buildings. In addition to current expenditures for routine maintenance, comparatively larger investments are required for periodic repair and replacement of expensive machinery, large scale upgrading and renovation of the whole building and so on, than applies to regular buildings.

The problem of financing maintenance is much more severe in residential towers (almost always in condominium ownership) than in office towers. These edifices have built-in susceptibility to market failure in their decision structure. The large number of households in a tower along with the high absolute costs of maintenance are breeding ground for "free riders". This means, that even if the monthly payment is not met by a few households, the elevator is likely to continue to run and the stairs cleaned for many months before the "free rider" effect leads to organizational or economic collapse. Especially challenging would be the higher periodic investments needed for upgrading the technologies, or Any initial socially based understanding among the original owners is likely to erode over time, as apartments change hands or are rented out, and as the costs rise due to building deterioration. As the time range expands, and higher investments are needed for renovation, it becomes increasingly likely that many of the original owners will have moved out. An 'intergenerational' problem then arises, whereby upon sale, each owner has an interest in passing on the onus of financing maintenance to the new purchasers. When this happens on the large scale of a residential tower, the effect on deterioration is inevitable.

2. The legal frameworks differ across countries, but their impacts are barely researched.

Since residential towers are almost always in condominium ownership (called strata in Pacific countries), there is a special legal structure that determines or guides decision making and the mutual obligations of the apartment ownership; However, the differences in the legal structures are

not socio-economically neutral. The decision-making rules may have direct or indirect implications for participation, social inclusion or exclusions. Furthermore: various legal requirements in the law to prevent payment defaults along with the legal powers of the condominium association could have major impacts on the costs of maintenance and thus on the future of the buildings' good functioning. The different legal formats can also impact the socio-economic composition of the ownership and reinforce the inherent exclusionary attributes of towers.

Condominium laws differ from country to country. There is no published large-scale comparative research on a wide span of countries' laws and practices and their urban impacts in practice. There are however a few published papers on one or a few countries. Harris (2011) analyzes British Columbia. Alterman's 2010 paper compares Florida and Israel, and Garfunkel's paper (2017) presents part of the findings of a larger research project in-progress by Alterman and Garfunkel encompassing four countries.

Alterman's comparison of Florida and Israel reports on two legal regimes which may represent the two extremes on the range of condominiums laws: In Florida the law is very sophisticated in its attempt to assure funding for long-term maintenance of condominiums. It grants the condominium association a draconic legal right - to take over any apartments if the owner has not paid the monthly fees for more than a month! The Association can then sell the apartment, deduct what is owed, and give the rest to the owner. In addition, the law requires that apartment buyers put aside a heft fund for future repairs, to be managed by the association. These drastic rules come hand in hand with scores of pagers of legal caveats and rules placed both on the developer and on the buyers. To meet these legal and financial requirements, buyers would need to hire a slate of legal and economic experts, thus raising the costs of apartment purchase. These are exclusionary factors built into the legal requirements. (Despite all these protections many condominiums did not survive the 2008-9 crisis when the condo associations found themselves with too many defaulted apartments and a weak market).

At the other extreme is the Israeli "thin "law, which is typical of many other countries as well. It has the minimal elements necessary to run a condominium, and has served the country well for 70 years – a country where the vast majority of urban residents live in condominiums (spanning most price levels). However, the simply condo laws are not geared to assure the long-term maintenance of tower buildings. With scores and hundreds of owners the social fabric that could work with 10-20 owner is silenced. The absolute maintenance costs, as noted, are also much higher. Although the law does not require hiring of building-management corporations, towers have not practical choice but to do so. The entrance of maintenance companies changes the entire decision-making structure, adding third players in the game, with many unanticipated repercussions. Research on these repercussions is still embryonic. The Israel Ministry of Justice is currently considering legal changes, but these are not likely to tackle the inherent costs of maintenance – probably even exacerbating the problem.

3. The claims that tall buildings provide a stimulus for economic development are weak.

Another issue that should be considered is the relation of real estate development, and tall building development specifically, to the economic development strategy of a city. Indeed, tall buildings are

often linked to economic development and the growth of jobs by many proponents. Some advocates of tall buildings, like Harvard economist Edward Glaeser, favor a kind of "supply-side" development strategy using real estate development to create jobs, and to lure wealthy people into the city to generate additional economic opportunities for others.

To be sure, there is strong evidence that real estate development can serve as a spur to economic growth. Cities like Phoenix, Las Vegas and Atlanta have explicitly used suburban real estate development in exactly that way. Arguably the economic development of the American middle class was fueled in part by suburban real estate development, along with the growth in automobiles and household goods. The question now is what is the quality of this economic growth, and how sustainable is the model?

There is some evidence that real estate development per se is a short-lived contributor to a regional economy, and that it can also produce unintended negative consequences. Vancouver, for example, experienced explosive growth of tall buildings beginning in the 1990s, and the surging wealth in the city also contributed to its high cost of living. The city is now in the midst of a broad civic debate about the wisdom of tall buildings, with many people expressing misgivings – a debate that is not typically acknowledged in proponents' arguments.

There is a strong alternative argument about the dynamics of cities, most famously articulated by the urbanist Jane Jacobs. She argued for a diverse city, with diverse uses, and diverse building ages and costs. In such a city, she argued, there are opportunities for entrepreneurship at a range of economc price points and "rungs of the ladder." The problem with the supply-side model may be that it focuses too much on one end of the economic spectrum, and it thereby exacerbates inequality and the under-performance of some sectors of the economy. Jacobs' "slow burn" approach, while it may not produce the quantity of riches for some sectors that the urban supply-side model does, nonetheless produces a steadier, more sustainable form of urban growth – and one most likely to preserve a city's livability, which is also a key economic asset.

B. Resource and ecological impacts

1. The claims for benefits from density are not supported by the evidence.

One of the most common arguments for the benefits of tall buildings is that they create dense settlement patterns that are inherently beneficial in reducing energy, resource consumption and emissions. A related argument is that the denser form of tall buildings reduces sprawl.

But as a recent UK House of Commons report concluded, "The proposition that tall buildings are necessary to prevent suburban sprawl is impossible to sustain. They do not necessarily achieve higher densities than mid or low-rise development and in some cases are a less-efficient use of space than alternatives."

Often cities like New York and Vancouver are cited as stellar examples of dense ecologically superior cities with tall buildings. It's usually assumed that it's the tall buildings in these cities that give them the edge.

As noted earlier, these cities are indeed very positive when it comes to carbon and other ecological metrics. But it's often overlooked that tall buildings are only a fraction of all structures in these places, with the bulk of neighborhoods consisting of rowhouses, low-rise apartment buildings, and other much lower structures. They get their low-carbon advantages not only from density per se, but from an optimum distribution of daily amenities, walkability and access to transit, and other efficiencies of urban form.

Figure One. Density and tall buildings are not synonymous. A drawing by Sir Richard Rogers shows the same density in three completely different urban typologies. From the Urban Task Force, 1999.



From an urban sustainability perspective, it is not just density, but the efficient placement of people and their activities, that is important. A dense downtown, far away from a dense bedroom community, may actually be worse, from a carbon point of view, than a less dense mix of the two.

Furthermore, research shows that the benefits of density are not linear, but taper off as density increases. In other words, there is an optimum density, above which the negative effects of density start to increase over the positive ones. That "sweet spot" seems to be in the neighborhood of about

50 people per acre. Many cities around the world achieve this density without tall buildings, while creating a very appealing, livable environment (e.g., Paris and London, as well as the aforementioned parts of New York, Vancouver et al.).

2. There is other cautionary evidence about the negative ecological consequences of tall buildings.

Research literature documents the following problems:

- 1. Increasingly high embodied energy of steel and concrete per floor area, with increasing height, requiring more resources and energy per unit of useable floor space.
- 2. Relatively inefficient floorplates due to additional egress requirements (e.g. multiple stairs).
- 3. Less efficient ratios of common walls and ceilings to exposed walls/ceilings (compared to a more low-rise, "boxier" multi-family form as in, say, central Paris).
- 4. Significantly higher exterior exposure to wind and sun, with higher resulting heat gain/loss.
- 5. Challenges of operable windows and ventilation effects above about 30 stories.
- 6. Diseconomies of vertical construction systems, resulting in higher cost per usable area (not necessarily offset by other economies these must be examined carefully).
- 7. Limitations in insulation and solar gain of typical lightweight curtain wall assemblies (there are efforts to address this, but many are unproven).
- 8. Challenge of maintenance and repair (in some cases these require high energy and cost).

3. Evidence from post-occupancy research on environmental performance is not encouraging.

When actually measured in post-occupancy assessments, many tall buildings have proven far less sustainable than their proponents have claimed. In some notorious cases they've actually performed worse than much older buildings with no such claims. A 2009 New York Times article, "Some buildings not living up to green label," documented the extensive problems with several noted sustainability icons. Among other reasons for this failing, the Times pointed to the widespread use of expansive curtain-wall glass assemblies and a failure to account for increased user consumption of energy.

Partly in response to the bad press, the City of New York instituted a new law requiring disclosure of actual performance for many buildings. That led to reports of even more poor-performing sustainability icons. Another Times article, "City's Law Tracking Energy Use Yields Some Surprises," noted that the gleaming new 7 World Trade Center, LEED Gold-certified, scored just 74 on the Energy Star rating — one point below the minimum 75 for "high-efficiency buildings" under the national rating system. That modest rating doesn't even factor in the significant embodied

energy in the new materials of 7 World Trade Center.

Things got even worse in 2010 with a lawsuit ["\$100 Million Class Action Filed Against LEED and USGBC"] against the US Green Building Council, developers of the LEED certification system (Leadership in Energy and Environmental Design). The plaintiffs in the lawsuit alleged that the USGBC engaged in "deceptive trade practices, false advertising and anti-trust" by promoting the LEED system, and argued that because the LEED system does not live up to predicted and advertised energy savings, the USGBC actually defrauded municipalities and private entities. The suit was ultimately dismissed, but in its wake the website Treehugger and others predicted, based on the evidence uncovered, that "there will be more of this kind of litigation."

This is a paradoxical outcome. How can the desire to increase sustainability actually result in its opposite? One problem with many sustainability approaches is that they don't question the underlying building type. Instead they only add new "greener" components, such as more efficient mechanical systems and better wall insulation. But this "bolt-on" conception of sustainability, even when partially successful, has the drawback of leaving underlying forms, and the structural system that generates them, intact. The result is too often the familiar "law of unintended consequences." What's gained in one area is lost elsewhere as the result of other unanticipated interactions.

For example, adding more efficient active energy systems tends to reduce the amount of energy used, and therefore lowers its overall cost. But, in turn, that lower cost tends to make tenants less careful with their energy use — a phenomenon known as "Jevons' Paradox." Increasing efficiency lowers cost, and increases demand — in turn increasing the rate of consumption, and wiping out the initial savings. The lesson is that we can't deal with energy consumption in isolation. We have to look at the concept of energy more broadly, including embodied energy and other factors.

There are often other unintended consequences. A notable case is London's sustainability-hyped "Gherkin" (Foster & Partners, 2003), where the building's open-floor ventilation system was compromised when security-conscious tenants created glass separations. Operable windows whose required specifications had been lowered because of the natural ventilation feature actually began to fall from the building, and had to be permanently closed. The ambitious goal of a more sophisticated natural ventilation system paradoxically resulted in even worse ventilation. (See also Capeluto et al 2003).

4. Life-cycle costs and energy retrofitting affect towers' role in emissions

The life-cycle costs of constructing towers in various specific geographic contexts are also not factored into the cost calculations by developers or consumers. These too are worthy of more research.

Because most older buildings are low or mid-rise, there is little research on environmental retrofitting of towers, especially not on residential towers. The global agenda is increasingly focusing on zero-energy consumption and on installing renewable energies in building, and standards and technologies are in flux. For example, new solar energy technologies to paste on windows and walls, will soon be economically viable . Tower buildings consume much energy, but

also offer a lot of potential window and wall surface areas . But towers, especially condominium towers, are likely to prove recalcitrant. The legal framework and the already high costs of maintenance (without counting in energy) are likely to make such retrofitting difficult. Towers might not be good friends of the climate-change agenda.

5. No building is an island

Another major problem with green building programs happens when they treat buildings in isolation from their urban contexts. In one infamous example ["Driving to Green Buildings"], the Chesapeake Bay Foundation moved its headquarters to the world's first certified LEED-Platinum building — but the move took them from an older building in the city of Annapolis, Maryland to a new building in the suburbs, requiring new embodied energy and resources. The added employee travel alone — what's known as "transportation energy intensity" — more than erased the energy gains of the new building.

The theory of resilience points to the nature of the problem. Systems may appear to be well engineered within their original defined parameters — but they will inevitably interact with many other systems, often in an unpredictable and non-linear way. We look towards a more "robust" design methodology, combining redundant ("network") and diverse approaches, working across many scales, and ensuring fine-grained adaptivity of design elements. Though these criteria may sound abstract, they're exactly the sorts of characteristics achieved with so-called "passive" design approaches.

Passive buildings allow the users to adjust and adapt to climactic conditions — say, by opening or closing windows or blinds, and getting natural light and air. (Capeluto and Shaviv 2001). These designs can be far more accurate in adjusting to circumstances at a much finer grain of structure. They feature diverse systems that do more than one thing — like the walls that hold up the building and also accumulate heat through thermal mass. They have networks of spaces that can be reconfigured easily, even converted to entirely new uses, with relatively inexpensive modifications (unlike the "open-plan" typology, which has never delivered on expectations). They are all-around, multi-purpose buildings that aren't narrowly designed to one fashionable look or specialized user. And perhaps most crucially, they don't stand apart from context and urban fabric, but work together with other scales of the city, to achieve benefits at both larger and smaller scales.

6. Older, shorter buildings often perform surprisingly well.

Many older buildings (prior to the age of cheap energy) took exactly this "passive" approach, simply because they had no alternative. In an era when energy was relatively expensive (or simply not available) and transportation was difficult, buildings were naturally more clustered together in urban centers. Their shape and orientation exploited natural daylight, and typically featured smaller, well-positioned windows and load-bearing walls with higher thermal mass. The simple, robust shapes of these buildings allowed almost endless configurations. In fact, many of the most indemand urban buildings today are actually adaptive reuse projects of much older buildings.

The results of this passive approach are reflected in good energy performance. While New York's 7

World Trade Center actually scored below the city's minimum rating of 75 out of 100, older buildings in the city that had been retrofitted with the same efficient heating, cooling, and lighting technologies fared much better: the Empire State Building scored a rating of 80, the Chrysler Building scored 84.

But age alone is clearly not a criterion of success. The 1963 MetLife/PanAm building (Walter Gropius & Pietro Belluschi), now a half-century old, scored a dismal 39. Another mid-century icon, the Lever House (Skidmore, Owings & Merrill, 1952), scored 20. The worst performer of all was Ludwig Mies Van der Rohe's iconic Seagram building, built in 1958. Its score was an astonishingly low 3.

What's the problem with these buildings? As the earlier New York Times article noted, they have extensive curtain-wall assemblies, large window areas and other limitations. On a fundamental level, as we can now begin to see from resilience theory, they lack many crucial resilient advantages of older building types. There may be something inherent in the building type itself that is non-resilient. The form language itself could be an innate problem — something that, according to systems thinking, no mere bolt-on "green" additions can fix.

7. Perhaps it's time to re-assess "Oil-interval" architecture?

Architectural critic Peter Buchanan, writing recently in the UK magazine, The Architectural Review, placed the blame for these failures squarely at the feet of the Modernist design model itself, and called for a "big rethink" about many of its unquestioned assumptions ["The Big Rethink: Farewell To Modernism — And Modernity Too"]. Modernism is inherently unsustainable, he argued, because it evolved in the beginning of the era of abundant and cheap fossil fuels. This cheap energy powered the weekend commute to the early Modernist villas, and kept their large open spaces warm, in spite of large expanses of glass and thin wall sections. Petrochemicals created their complex sealants and fueled the production of their exotic extrusions. "Modern architecture is thus an energy-profligate, petrochemical architecture, only possible when fossil fuels are abundant and affordable", he said. "Like the sprawling cities it spawned, it belongs to that waning era historians are already calling 'the oil interval'."

C. Social and health impacts

1. In addition to ecological and economic impacts, the research literature also paints a rather damning picture of social impacts, for both residents and those around them.

- 1. Psychological effects on residents, especially children. After surveying the literature, Gifford (2007) concludes that "the literature suggests that high-rises are less satisfactory than other housing forms for most people, that they are not optimal for children, that social relations are more impersonal and helping behavior is less than in other housing forms, that crime and fear of crime are greater, and that they may independently account for some suicides."
- 2. Social effects, particularly at the street. Tall buildings can function in effect as "vertical

gated communities," failing to activate longer stretches of streets with ground-level doors and windows. (We discuss this problem in more detail below.) This problem is exacerbated with tall buildings that have their own internal garages, through which residents may enter and depart without ever setting foot in the public realm.

- 3. Shading of other buildings and public spaces. This has obvious impacts on degree of sunlight and skyview, and impacts on those who are using the public realm.
- 4. Ground wind effects. Some of these effects can become quite strong (e.g the so-called "Venturi effect") which can make public spaces unpleasant. The proverbial "windswept tower plaza" seems to be more than a stereotype.
- 5. Heat island effects. Tall buildings clustered together are known to trap air and heat it, placing increased demand on cooling equipment in warm climates, and making adjacent public spaces less habitable.
- 6. "Canyon effects". Similarly to heat island effects, canyon effects can trap pollutants, reducing air quality at the street and in public spaces.
- 7. Psychological impacts for pedestrians and nearby residents. This is a more difficult area to evaluate and depends greatly on the aesthetics of a particular building. However, there is research to show that a design that is (or comes to be) experienced as ugly by adjoining residents can significantly degrade their experience of the public realm and quality of place.

2. Vertical gated communities?

Residential towers – almost inevitably in condominium ownership - have a built-in capacity to take on aspects of gated communities, whether intentionally or not. Towers must be self-contained in controlling vertical traffic. They have expensive machinery that must be maintained and thus, as noted, must charge significant maintenance costs. Towers have many housing units, and therefore must have an effective decision-making mechanism that is unlikely to be in a "town meeting" format. The inevitable anonymity and the physical inability to see who comes in and out, increased issues of security. Gated communities thrive on the perception of need for security (Atkinson & Blandy, 2005; Blandy 2011). Tower condominiums invest sizable resources in technologies such as key fobs, CCTV and reception desks. This, in turn, serves to support claims that tower condominiums, as urban enclaves, act as a source for urban fragmentation (Warner, 2011; Webster and Glastz, 2006)

Thus, even if tower condominiums don't exercise overt selection of owners based on income, lifestyle, number of children etc., they do become "vertical gated communities" to some extent. Gatedness limits interaction and social capital across socio-economic groups (Margalit 2009). Moreover, like horizontal gated communities, they bottle up the activity of residents that might otherwise help to enliven the public realm. Lastly, there is the simple and rather embarrassing fact that when it comes to residential density, you can't count people more than once: if wealthy tower residents have two or three homes, then their residential population count has to be divided between

these. This fact alone reduces the conventional density count of some higher-end residential tower neighborhoods (like those in Vancouver) significantly.

2. Additional evidence from research on the divergence between architects' and laypersons' aesthetic judgments

A basic question about any building is its contribution to the public realm, and to the aesthetic qualities that are most valued by citizens. This comes down to the even deeper question, "for whom do we build?" Do we build only for our own buyers, or for our own professional community? Or do we need to take into account, in a democracy, the preferences of others whose experience of our buildings in within the public realm? If so, what are those preferences, and how do they align, or diverge, from those of professionals?

In the case of tall buildings, this question takes on much greater importance. A six-story building that is disliked by non-architect residents might be a problem for the neighborhood, but a sixty-story building that is disdained by non-architect residents (and possibly visitors too) becomes a problem for the entire city.

Here the research is also quite cautionary (see Appendix II for citations). In a widely cited survey of other research, psychologist Robert Gifford and his colleagues reported that "architects did not merely disagree with laypersons about the aesthetic qualities of buildings, they were unable to predict how laypersons would assess buildings, even when they were explicitly asked to do so." The researchers pointed to previous studies showing cognitive differences in the two populations: "Evidence that certain cognitive properties are related to building preference has already been found."

The researchers stressed that architects did not simply disagree aesthetically with non-architects: they literally *could not see* the difference between their own aesthetic preferences and those of non-architects. "It would seem that many architects do not know, from a lay viewpoint, what a delightful building looks like. If we are ever to have more delightful buildings in the eyes of the vast majority of the population who are not architects, this conundrum needs study and solutions."

Of course, every profession has its own biases and cognitive limitations, and it's unfair to suggest that architects are unique. Every profession is a bit like the proverbial "carpenter with a hammer, for whom every problem looks like a nail." We see the world through the lens of our own training and experience, and sometimes our specialized concerns become detached from the concerns – perhaps even the common sense – of our own clientele.

In social psychology, this well-known problem is described by what is known as "Construal Level Theory." The more removed we are from the concrete experience of, say, how buildings affect real people in ordinary life, the more we must construe our work and its goals in abstraction – and the more remote those "construals" can become from human beings and their needs. Of course the same is true for planners, developers, business owners or anyone else working in the built environment.

But in the case of architects, the research is helping to explain a particularly consequential way of seeing the world. It seems that, where most people see objects in context, architects as a group (and, we should add, their art-connoisseurs and media boosters) tend to focus on objects in isolation from their contexts. Where most people look for characteristics that help buildings to fit in and to increase the overall appeal of their surroundings, architects seem to focus narrowly on the attributes of buildings that make them stand out: their novelty, their abstract artistic properties, their dramatic (even sometimes bizarre) contrast.

Some researchers have concluded that this peculiar way of seeing comes from architects' unique studio education. Students must stand out in a highly competitive environment, and they do so by winning praise for the clever novelty of the art-objects they produce. In the abstracted world of studio culture, those objects are usually very far removed indeed from their real-world contexts – as anyone who has taught studio, like me, can readily observe.

But of course, this training turns out to be useful preparation for the role that architects must too often play in the modern development process: they must "brand" their buildings, their clients and themselves as attention-getting novelties, the better to compete as commodities with others. This focus on the design of novel art-objects is a historically exceptional development. Up to the 20th century, architecture was by necessity a close adaptive response to its human and natural context. On that concrete foundation, architecture explored its more abstract expressions.

As the urbanist Jane Jacobs pointed out, this is a healthy relationship between life and art: namely, life serves as the foundation upon which the art is an enrichment of meanings. But as Jacobs warned, when this relationship is confused – when abstract art seeks to supplant concrete life – the results are very bad for life, and probably bad for art too.

But as Jacobs also observed, this is precisely what professionals allowed to happen – even encouraged to happen – in the 20th century. The marketing allure of their fine art was used to rationalize, even glamorize, a toxic industrialization of the built environment. The results of this malpractice are evident today in ugly, dysfunctional cities and towns all around the globe.

Of course many architects blame others for this degradation of settlements: developers, engineers, or the non-architects who design a large percentage of structures. But architects occupy a singular leadership position, whether by action or inaction. It is architects whose influential ideas about cities and buildings profoundly shape what others can do in the built environment – perhaps by deeming certain kinds of designs "fashionable" or "edgy" – or conversely, "reactionary" or "inauthentic."

Historically, it was also architects who helped to shape the most beautiful, enduring, well-loved cities, towns and buildings of human history. As we enter a time of unprecedented urbanization – on track to produce more urban fabric in the next five decades than in the previous 10,000 years – it is architects who now have an urgent responsibility to lead a humane, sustainable form of settlement for the future.

But the new research findings make it clear that this will require some major soul-searching.

Outmoded ideologies and practices must be fundamentally reassessed. The distorted conception of architecture as fine-art novelty, in dramatic contrast with its context – with its environment, and with its history – must be reformed. In its place we require an architecture of life – one responsive to human need, and to the patterns of nature and history.

REFERENCES

Ali, M. M., & Al-Kodmany, K. (2012). Tall buildings and urban habitat of the 21st century: A global perspective. *Buildings*, 2(4), 384-423.

Alterman, Rachelle. 2009. *Failed Towers: The condominium maintenance conundrum*. Center for Urban and Regional Studies, Technion – Israel Institute of Technology. IN HEBREW.

Alterman, Rachelle. 2010. "The Maintenance of Residential Towers in Condominium Tenure: A Comparative Analysis of Two Extremes - Israel and Florida". In *Multi-Owned Housing Law, Power and Practice*. Ed. Blandy Sarah, Dupuis Ann and Dixon Jennifer, 73-90. Ashgate.

Blandy S (2013) Collective Property: Owning and Sharing Residential Space. *Modern Studies in Property Law* (pp. 152-172).

Blandy S (2011) Gating as governance: the boundaries spectrum In Crawford A (Ed.), *Social and Situational Crime Prevention: International and Comparative Criminal Justice and Urban Governance* (pp. 519-544). CUP

Bowker, G. E., D. Heist, S. G. Perry, L. Brixey, R. S. Thompson and R. W. Wiener (2006). *The Influence of a Tall Building on Street-Canyon Flow in an Urban Neighborhood*. U.S. EPA Office of Research and Development, National Exposure Research Lab. Presented at 28th NATO/CCMS International Technical Meeting, Leipzig, Germany, May, 2006.

Brown, G., & Gifford, R. (2001). Architects predict lay evaluations of large contemporary buildings: whose conceptual properties? *Journal of Environmental Psychology*, 21(1), 93-99.

Buchanan, P. (2007). "The Tower: An Anachronism Awaiting Rebirth?" In Harvard Design Magazine 26, Spring/Summer 2007

Capeluto I.G., Shaviv E. (2001). "On the Use of Solar Volume for Determining the Urban Fabric." *Solar Energy Journal*, *70*(3), Elsevier Science Ltd., pp. 275-280.

Capeluto, I.G., Yezioro, A., Gat, D. and Shaviv, E. (2003). "Energy, Economics and Architecture." In *Proceedings of the Eighth International IBPSA Conference*, Eindhoven, NL August 11-14, 2003.

Garfunkel, Dorit (2017). High rise residential condominiums and the transformation of private property governance. *UBC Law Review 50*:4, 891

Gat D. (1995). "Optimal Development of a Building Site." *Journal of Real Estate Finance and Economics*, 11 (pp. 77-84).

Gifford, Robert (2007). "The Consequences of Living in High-Rise Buildings." *Architectural Science Review* 50(1):2-17. DOI: 10.3763/asre.2007.5002

Ghomeshi, M., Nikpour, M., & Jusan, M. M. (2012). Evaluation of Conceptual Properties by Layperson in Residential Façade Designs. *Arts and Design Studies*, *3*, 13-17.

Harris, Douglas, 2011. Condominium and the City: The Rise of Property in Vancouver. *Law & Social Inquiry*, *36*(3), 694-726.

House of Commons, UK (2001). "Tall buildings: Report and Proceedings of the House of Commons Transport, Local Government and the Regions Committee." In *Sixteenth report of Session 2001-02* London, UK Stationery Office, 4 September 2002, HC 482-I

Hubbard, P. (1984). Diverging evaluations of the built environment: Planners versus the public. IN *The Urban Experience: A People–Environment Perspective*, PUBLISHER? CITY? 125-133.

Hubbard, P. (1996). Conflicting interpretations of architecture: an empirical investigation. *Journal of Environmental Psychology*, 16(2), 75-92.

Kunze, J. (2005) *The Revival of High-rise Living in the UK and Issues of Cost and Revenue in Relation to Height*. Masters Thesis. London: University College London.

Lehrer, Ute and Thorben Wieditz (2009). Condominium Development and Gentrification: The Relationship Between Policies, Building Activities and Socio-economic Development in Toronto *Canadian Journal of Urban Research 18*(1):82-103

Mead, M. N. (2008). "Canyons Up the Pollution Ante" *Environmental Health Perspectives*, July 2008; Vol. 116, No. 7, p. A28.

Margalit, Talia. 2009. Public Assets vs. Public Interest: High-rise Building in Tel Aviv-Jaffa. *Geography Research Forum, 29* 48-82.

Ng, C. F. (2017). Living and working in tall buildings: satisfaction and perceived benefits and concerns of occupants. *Frontiers in Built Environment*, *3*(70).

Shaviv, Yezioro and Capeluto. (1999) *The Influence of High-Rise Buildings on their Energy Consumption and Urban Shading. Tel* Aviv: HELIOS Ltd., 1999.

Tan W. (1999). "Construction Costs and Building Height." Construction Management and Economics, 17, pp. 129-132.

Treloar, G.J., Fay,R., Ilozor, B., P.E.D. Love, P.F.D. (2001). "An Analysis of the Embodied Energy of Office Buildings by Height." *Facilities*, 2001 Volume: 19 Issue: 5/6 Page: 204 - 214 ISSN: 0263-2772 DOI: 10.1108/02632770110387797 Publisher: MCB UP Ltd

Trope, Y., Liberman, N., & Wakslak, C. (2007). "Construal levels and psychological distance: Effects on representation, prediction, evaluation, and behavior." *Journal of Consumer Psychology: 17*(2), 83.

Warner E. Mildred, 2011. Club Goods and Local Government, *Journal of the American Planning Association*, 77:2, 155-166

Webster Chris, Glastz George. 2006. "Dynamic urban order and the rise of residential clubs". In *Private Cities*. Ed. Glasze Georg, Webster Chris, Frantz Klaus. 218-231. London: Routledge

APPENDIX I: RELEVANT EXAMPLES FROM RESEARCH ON TALL BUILDING IMPACTS

Guedi Capeluto, Abraham Yezioro, Daniel Gat and Edna Shaviv (2003). "Energy, Economics and Architecture." Proceedings of the Eighth International IBPSA Conference, Eindhoven, NL August 11-14, 2003.

Excerpt:

"Very often, high rise buildings are proposed as a means of achieving high urban density. However, tall buildings may cause environmental problems like high wind velocities in open spaces around them, as well as extended shadows over nearby houses and open spaces (HELIOS, 1999, 2000). Moreover, the construction cost of high-rise buildings is steep (Tan, 1999, Gat, 1995). When all these factors are taken into account it is not a priori clear that the desired high urban density can be achieved by tall buildings along with an acceptable solution to the above mentioned environmental problems. Recent studies have shown that a reasonable density may be achieved with six stories high buildings while preserving the solar rights of neighboring buildings, as well as open spaces among them (Capeluto and Shaviv, 2001)."

Citations given above:

Shaviv, Yezioro and Capeluto. (1999) The Influence of High-Rise Buildings on their Energy Consumption and Urban Shading. HELIOS Ltd., 1999.

Tan W. (1999). "Construction Costs and Building Height." Construction Management and Economics, Vol. 17, pp. 129-132.

Gat D. (1995). "Optimal Development of a Building Site." Journal of Real Estate Finance and Economics, Vol. 11, pp. 77-84.

Capeluto I.G., Shaviv E. (2001). "On the Use of Solar Volume for Determining the Urban Fabric." Solar Energy Journal, Vol. 70, No. 3, Elsevier Science Ltd., pp. 275-280.

G.J. Treloar, R. Fay, B. Ilozor, P.E.D. Love (2001). "An Analysis of the Embodied Energy of Office Buildings by Height." *Facilities*, 2001 Volume: 19 Issue: 5/6 Page: 204 - 214 ISSN: 0263-2772 DOI: 10.1108/02632770110387797 Publisher: MCB UP Ltd

Abstract:

"Aims to compare the energy embodied in office buildings varying in height from a few storeys to over 50 storeys. The energy embodied in substructure, superstructure and finishes elements was investigated for five Melbourne office buildings of the following heights: 3, 7, 15, 42 and 52 storeys. The two high-rise buildings have approximately 60 percent more energy embodied per unit gross floor area (GFA) in their materials than the low-rise buildings. While building height was found to dictate the amount of energy embodied in the "structure group" elements (upper floors, columns, internal walls, external walls and staircases), other elements such as substructure, roof, windows and finishes seemed uninfluenced."

Excerpt from conclusion:

"Alternatives to tall buildings should be sought, but where unavoidable, measures to reduce the size of the building, reduce the intensity of material usage (especially energy intensive and

nonrenewable materials) and to minimise wastage should be fully explored."

Gifford, Robert (2007). "The Consequences of Living in High-Rise Buildings." Architectural Science Review 02/2007; 50(1):2-17. DOI: 10.3763/asre.2007.5002

Abstract:

A full account of architectural science must include empirical findings about the social and psychological influences that buildings have on their occupants. Tall residential buildings can have a myriad of such effects. This review summarizes the results of research on the influences of high-rise buildings on residents' experiences of the building, satisfaction, preferences, social behavior, crime and fear of crime, children, mental health and suicide. Most conclusions are tempered by moderating factors, including residential socioeconomic status, neighborhood quality, parenting, gender, stage of life, indoor density, and the ability to choose a housing form. However, moderators aside, the literature suggests that high-rises are less satisfactory than other housing forms for most people, that they are not optimal for children, that social relations are more impersonal and helping behavior is less than in other housing forms, that crime and fear of crime are greater, and that they may independently account for some suicides.

Kunze, J. (2005) "The Revival of High-rise Living in the UK and Issues of Cost and Revenue in Relation to Height." Masters thesis, UCL (University College London).

Abstract:

"The following report explores the recent revival of tall residential buildings in the UK as well as issues of costs and revenues for such projects. The first part of the paper focuses on the background and the preconditions of the revival. The history of tall residential buildings and its impact on the image of highrise living is explored as well as some of the debate that surrounds the topic. However, the vast amount of related social, urban design and environmental issues are not part of the analysis. The phenomenon of the revival is described in numbers of completed buildings and with examples of built and proposed projects. Characteristics like the new type of occupiers and the provision of affordable housing are highlighted. The second part of the report and the main part of the research focus on the economic drivers behind tall residential developments. The issues of building costs and sales prices in relation to height are explored and values are gathered in several interviews with professionals. The findings are analysed and applied in a series of model calculations for developments with heights from 5-50 storeys. It seems that the disadvantages of building high are not balanced out by a premium in sales prices for height. The evidence found suggests that the economics of tall residential buildings change dramatically above 20 storeys. This corresponds with the height of structures that were built in recent years. However, the paper concludes that the data available was not sufficient to establish robust quantitative relationships between residential developments of different heights and that it is necessary for the benefit of all that more research on this topic is made publicly available."

Buchanan Peter (2007). "The Tower: An Anachronism Awaiting Rebirth?" Harvard Design Magazine: "New Skyscrapers in Megacities on a Warming Globe" Number 26, Spring/Summer 2007

Excerpt:

"Is the tall building an anachronism? Does it, like sprawling suburbia and out-of-town shopping malls, seem doomed to belong only to what is increasingly referred to as "the oil interval," that now fading and historically brief moment when easily extracted oil was abundant and cheap? The answer is probably "Yes"....

" ... What kind of city nurtures [today's] very different workforce that is in touch with and wants to live in accord with its deeper values? Ask people how they believe they should really live; the clearer they become about this, the more obvious it is that such a lifestyle is very difficult in the contemporary city. Do we want to live in a city of glistening towers, of spectacle and the restless excitement that fuels and is fuelled by excessive consumption? Or would we prefer a mid-rise city with a more finely grained, more intricately rich and varied urban fabric offering choice, contrast, respite, and surprise - a convivial city where community has a chance of being reestablished? **Sustainability requires not only that we lessen our ecological impacts, but also that we create the urban and cultural frameworks in which we can attain full humanity, in contact with self, others, and nature. This might be the real reason that the tower seems an anachronism. There may be a few clusters of green towers here and there, but their presence might be limited in the compact and convivial cities of the future."**

Bowker, G. E., D. Heist, S. G. Perry, L. Brixey, R. S. Thompson and R. W. Wiener (2006). "The Influence of a Tall Building on Street-Canyon Flow in an Urban Neighborhood. U.S. EPA Office of Research and Development, National Exposure Research Lab. Presented at 28th NATO/CCMS International Technical Meeting, Leipzig, Germany, May, 2006.

Mead, M. Nathaniel (2008). "Canyons Up the Pollution Ante" Environmental Health Perspectives, July 2008; Vol. 116, No. 7, p. A28.

Excerpt:

"... a new study focuses on how traffic emissions are dispersed within urban street canyons -streets that are lined with tall buildings on both sides. Within these domains, large quantities of pollutants are released near the ground from motor vehicle exhaust, then trapped and concentrated within the canyon walls. Urban street canyons also tend to contain a lot of people, potentially making these areas high-risk zones for big cities. ... population exposure to traffic pollutants in New York's urban street canyons can be up to 1,000 times higher than exposure to a similar amount of emissions in other urban settings."

House of Commons (2001). "Tall buildings: Report and Proceedings of the House of Commons Transport, Local Government and the Regions Committee." Sixteenth report of Session 2001-02. London, UK Stationery Office, 4 September 2002, HC 482-I

Excerpt:

"The main reason that the Committee held an inquiry into tall buildings was to identify the contribution which they can make to the urban renaissance. We found that contribution to be very limited. The proposition that tall buildings are necessary to prevent suburban sprawl is impossible to sustain. They do not necessarily achieve higher densities than mid or low-rise development and in some cases are a less-efficient use of space than alternatives. They have, for the most part, the advantages and disadvantages of other high density buildings. They can be energy-efficient, they can be part of mixed-use schemes and they can encourage the use of public

transport where there is spare capacity, but so can other types of high density developments. Tall buildings are more often about power, prestige, status and aesthetics than efficient development."

APPENDIX II:

RELEVANT EXAMPLES FROM RESEARCH ON DIVERGENCE OF ARCHITECTS' AND LAYPERSONS' AESTHETIC JUDGMENT

Brown, G., & Gifford, R. (2001). Architects predict lay evaluations of large contemporary buildings: whose conceptual properties?. Journal of Environmental Psychology, 21(1), 93-99.

Abstract

Evidence suggests that architects as a group cannot predict the public's aesthetic evaluations of architecture. In this study, practicing architects predicted laypersons' responses to large contemporary building, and again these predictions were poorly correlated with ratings by laypersons, although some architects' predictions were better than others, and architects were able to predict accurately that lay ratings in general would be more favourable than their own. To understand why most architects are unable to predict reactions to particular buildings, the architects' predictions were analysed in relation to their own and lay ratings of the buildings' conceptual properties. **The results suggest that architects are unable to exchange their own criteria for conceptual properties for those of laypersons when they predict public evaluations, which leads to self-anchored, inaccurate predictions. This was supported by showing that the best-predicting architects related their evaluations to buildings' conceptual properties in a manner similar to that of the laypersons. Implications for design are suggested.**

Ghomeshi, M., Nikpour, M., & Jusan, M. M. (2012). Evaluation of Conceptual Properties by Layperson in Residential Façade Designs. Arts and Design Studies, 3, 13-17.

Abstract

When it comes to aesthetic evaluation of a design, architects and non-architects differ from each other. This study demonstrates how aesthetic evaluation of buildings could be predicted. These predictions are important for architects as they can be used to find the users preferences and expectations of the design. Preference is considered to involve conceptual evaluation about whether the design is liked or disliked. In environmental preference, this type of conceptual evaluation might be conscious or unconscious. The aim of this study is to identify the essential conceptual properties that are related to aesthetic evaluation of façade designs using qualitative methodology. As a result it can be concluded that not all the conceptual properties are related to aesthetic evaluation of the design. Some conceptual properties are not important from the eye of non-architects and some are highly important. Findings of this research could help architects to understand the perception of non-architects.

Hubbard, P. (1984). Diverging evaluations of the built environment: Planners versus the public. The urban experience: A people–environment perspective, 125-133.

Hubbard, P. (1996). Conflicting interpretations of architecture: an empirical investigation. Journal of Environmental Psychology, 16(2), 75-92.

Abstract

The idea that environmental preferences are not solely determined by the characteristics of individuals, but instead are socially constituted, has fundamentally challenged many traditional

psychological analyses of landscape preference and meaning. In this paper, an attempt is made to suggest that the two interpretations are by no means incompatible, and that there is a growing need for an environmental psychology that recognizes the importance of both individual and social factors. Drawing on traditions within European social psychology, this paper demonstrates how the quantitative analysis of social representations can be used to identify both differences and commonalities in peoples' interpretations of architecture. Specifically, **this study reports on one segment of a larger empirical study investigating differences in architectural interpretation between planners, planning students and public respondents.** These interpretations were examined using multiple sorting techniques, with respondents asked to sort 15 examples of contemporary architecture according to their own criteria. INDSCAL analysis of this data facilitated the recognition of a shared conceptualization of these architectural stimuli, but also demonstrated a number of important inter-group and inter-individual differences in architectural interpretation, which were evident as variations from this common conceptualization. The paper concludes by discussing the implications of this study for research in environmental psychology, particularly stressing the need to consider notions of power and ideology.

Trope, Y., Liberman, N., & Wakslak, C. (2007). "Construal levels and psychological distance: Effects on representation, prediction, evaluation, and behavior." *Journal of Consumer Psychology:* the official journal of the Society for Consumer Psychology, 17(2), 83.

APPENDIX III

RELEVANT EXMPLES FROM RESEARCH ON ECONOMIC DEVELOPMENT, REAL ESTATE AND URBAN FORM

Jacobs, J. (1961). The Death and Life of Great American Cities. New York: Random House.

Jacobs, J. (1970) The Economy of Cities. New York: Vintage Press.

Glaeser, E. L., Kallal, H. D., Scheinkman, J. A., & Shleifer, A. (1991). *Growth in Cities* (No. w3787). National Bureau of Economic Research.

Glaeser, Ed. (2011). "How Skyscrapers Can Save the City." The Atlantic, February, 2011. Available on line at http://www.theatlantic.com/magazine/archive/2011/03/how-skyscrapers-can-save-the- city/308387/

(TBC)


The Surprisingly Important Role of Symmetry in Healthy Places

New research suggests there might be a "symmetry deficit disorder" in today's built environments, with significant impacts on health, well-being, and even sustainability.

14 Minute Read March 8, 2021, 5:00 AM PST By <u>Michael Mehaffy, Nikos A. Salingaros</u>

🎔 🖬 in 🕝 🖂 🔗



Two environments in London. Left: Seven Dials, dating from the 17th century. Right: a typical office complex from the 20th century. These environments can be better understood as geometric structures manifesting different degrees and kinds of symmetry. | Left: John Sutton via Wikimedia Commons. Right: Michael Mehaffy

Among the many factors influencing health and well-being, the environment might be the least appreciated —but in many ways, it's one of the most important. Intriguing new research is indicating that, within human environments, the mathematical property of symmetry plays an outsized role.

The relationship between mathematics and architecture is an ancient one, and the topic of symmetry has long been central to both. But the "symmetry" described by classical writers like Vitruvius and Alberti was not limited to the idea of mirroring two sides, as is commonly thought. Rather, symmetry was a much deeper concept, covering many other complex kinds of geometrical relationships. What was important was that there was some kind of measurable correspondence, some *sym* + *metros*, or "same measurement," among the parts as they formed a whole.

Symmetry continues to be a central concept in the sciences today, with important applications to the built environment—as <u>our own recent research has documented</u>. Exciting new developments in mathematics, environmental psychology, neuroscience, and other fields are transforming the scientific understanding of the essential role of symmetry in human experience, and where it goes wrong (and right too). Perhaps surprising—and most important—is an emerging understanding of the key role these characteristics seem to play in human health and well-being.

The field of architecture, for all its aspirations to cutting-edge modernity, has so far been notably backward in applying these insights. Instead, the applications of symmetry, where they exist at all, are mostly confined to superficial explorations of ever more extravagant new aesthetic packaging over what are still relatively primitive object-buildings. The lessons for public space networks, and for healthier human environments more broadly, are largely ignored.

One of the fundamental questions lost in this fashionable mix of art and technology is the ancient topic of beauty, one of Vitruvius' famous triad of essential architectural components (which he termed "venustas"). Few people today deny the great beauty of many historic and traditional buildings. We often marvel at the incredible diversity of these beautiful structures across innumerable geographic locations, cultures, and periods. Indeed, some wonder why so many buildings of our time seem so inferior—let's face it, so much uglier—by comparison.

It's common to assume that this loss is just the price of progress. Perhaps the "beauty" of the built environment nowadays (if we can even agree on what that is) exists only in the powerful, machine-like logic of buildings, their daring structural innovations, or the clever abstract expressions of their designers. Perhaps the current era pays for its modern conveniences by relegating the experience of "beauty" to the status of a dispensable consumer good. 107 L Q

This is a common view of things—but new research shows that it's simply not true. Semir Zeki, a neurobiologist at University College London, has surveyed neurological research, including his own team's, and concluded that the experience of beauty in the environment "is not a luxury, but an essential ingredient in nourishing the emotional brain." Research in other fields reveals that experiencing places that are perceived as beautiful (including "biophilic" places with natural vegetation, for example) actually lowers stress in the body, improves health and well-being, and even (as one famous study showed) shortens recovery times from surgery!



Common types of symmetry that are widely perceived as beautiful, in (left) a child's kaleidoscope (using pieces of shell that also include subsymmetries), a "fractal" pattern generated mathematically on a computer (center), and the natural environment of Bryce Canyon in Utah (right). These beautiful structures typically combine different forms of symmetry, such as reflectional, rotational, translational, and scaling symmetries (including fractals). Image credits: Left, Pixabay (public domain); center, Pixabay (public domain); right, Michael Mehaffy.

These and other studies unveil a surprisingly strong relationship between aesthetics, well-being, and health. Findings in environmental psychology, neuroscience, medical science, and related fields are pointing to a profound (if under-appreciated) effect of environmental structures-including their aesthetic properties-upon our health and quality of life, along with other more obvious factors. These findings seem all the more important for those who are already more vulnerable, including children, the elderly, and the poor.

The research also disproves the simplistic modern assumption that the experience of beauty is just a subjective phenomenon—merely "in the eye of the beholder." While there can be great variation among people as to *some* of what they find beautiful, there are also broad areas of commonality. For example, many geometric characteristics of natural environments and of the human body (<u>like the symmetry of faces</u>) are almost universally considered beautiful. This universality is anchored in shared biological roots, and in the shared ways that we react to certain kinds of structures, according to Zeki: "mathematical principles of symmetry, harmony, and proportion...are part of the cognitive apparatus of all brains."

This is true not only of natural environments and <u>beautiful "biophilic" vegetation</u>, as Zeki notes, but built structures too: "What universality architectural beauty may possess probably lies in satisfying inherited brain concepts of proportion, harmony and geometric relationships that are more formally expressed in mathematical terms." In other words, there are discernible geometric properties in surroundings that most people unconsciously find beautiful, and those properties are also conducive to physical well-being and quality of life. That's a finding with potentially momentous implications.

Environmental designers surely have a professional responsibility to avoid harm to users, and indeed, to actively promote their well-being. The question is not whether there is a place for artistic creativity, novelty, and individual expression—surely there is—but rather, how designers can anchor this creativity within a common framework of sharable characteristics that are most likely to produce physiological benefits for users. It is the business of science to provide exactly that kind of knowledge for built environment professions-just as the practice of medicine relies on the health sciences, for example.

What science reveals is that nature has shaped unconscious preferences so that humans are instinctively drawn toward conditions most beneficial to health and well-being. When we are forced into "ugly" or stressful environments (as revealed by medical measurements), it creates much more than superficial annoyance. The task for designers, then, is to start with those documented factors that will best promote the health and well-being of users, and then explore the infinite possible varieties of expression using those factors.

When it comes to identifying these "salutogenic" (health-giving) factors, our own work on environmental symmetry has yielded fruitful results. Once again, we are referring here to "symmetry" in the broader mathematician's sense, as a kind of structural correspondence between parts. In addition to the familiar mirror symmetry, we can add translational symmetry (where patterns are replicated), scaling symmetry (where patterns recur at different scales, as in fractals), rotational symmetry (as in the iris of an eye), and other combinations. **108**



Examples of different kinds of symmetry in nature, and in human architectures. Top row: reflectional or mirror (tiger), rotational (Sun), translational (ducklings), and scaling (fern). Bottom row: reflectional (Classical building), rotational (stained glass), translational (Islamic tilework) and scaling (Alhambra). Image credits: Top row, left: S Taheri via Wikimedia Commons; center left: public domain (via Pixabay); center right, public domain (via Maxpixel); right, public domain (via Free Nature Stock). Bottom row, left: Ryan Kaldari via Wikimedia Commons; center left, Thomas Ledi via Wikimedia Commons; center right, public domain (via Pixabay); right, public domain (via Pixabay).

In most natural environments, the different forms of symmetry occur together and in combinations with others. Our work and others' has found that this compound symmetry has a particularly strong association with the experience of beauty. When these compound symmetries contain high levels of interrelatedness, as is evident in many natural structures, we refer to this as "deep symmetry." (One could say that there is a "symmetry of symmetries" in these structures.) Such structures (including built environments) have many layers of symmetrical sub-structures built up into a very complex interrelated whole.

"Deep symmetry" also interrelates specific objects with their surroundings, and to us as viewers too. This deep symmetry extends mathematically to the larger scale of urban spaces, neighborhoods, and city regions (and ultimately to the Earth, and even the Cosmos). This new understanding of the symmetrical relatedness of buildings and cities rejoins the sadly separated disciplines of architecture, urban design, and planning, within a larger natural framework.

The human body as a whole incorporates such "deep symmetry"—especially so in bodies universally regarded as particularly beautiful—as do many natural environments. This kind of structure can be contrasted with what we might think of as "shallow symmetries"—merely pasted together symmetrical structures that do not interrelate. By contrast, many contemporary designs exhibit shallow symmetries (like the endlessly repeated window units in the example at the top right of this article).



Some examples of "deep symmetry," in the human body (left), in a natural environment (center) and in human architectures (right). In each case, multiple symmetries and distinct kinds of symmetries are combined and interrelated through further symmetries. In the sculpture of Michelangelo's David, the irises have rotational symmetry, the face has reflectional symmetry, the hair has scaling symmetry, and so on. The rotational symmetry of the sun in the middle is combined with the reflectional symmetry of the water and the translational symmetry of the repeating birds, and the scaling symmetry of the water patterns. Taktsang Monastery in Bhutan repeats translational groups with reflectional symmetry, all in translational symmetry as they adjust to their positions over the rocks. Image credits: Left, George M. Groutas via Flickr; center, @Chiaralily via Flickr; Right: Douglas J. McLaughlin via Wikimedia Commons.

It's important to note that the mathematics of symmetry is not some mysterious occult realm of knowledge, or mystical set of secret formulas. In fact, it is widely comprehensible, and widely useful in practice (as Vitruvius, Alberti and other pioneers demonstrated). Indeed, as the cognitive scientists George Lakoff and Rafael Nuñez <u>pointed out</u>, mathematics itself is simply the symbolic manifestation of the human process of cognitively ordering the environment—that is, of modeling the symmetries of experience. (What we call a "formula" is nothing other than a mathematical symmetry between the simple of an "equation" and

the other.) The ability to model these symmetries of experience was the key to the evolutionary survival of humans, and, more recently in history, to the development of advanced language, mathematics, and science.

This symmetry-modeling is an example of our inherent order-seeking, meaning-seeking behavior. We are constantly striving to find "meaning" in the world—that is, to relate ourselves to experienced structures, to find patterns of coherence and consistency, and to replace informational disorder with a coherent understanding of our surroundings and ourselves within them. (We might call this view of things a "symmetric structuralism.") We evolved to instinctively seek this kind of meaning in environments, and it is reassuring and satisfying when we find it—whether in a formal and symbolic sense, or a more tacit and perceptual sense. Justifiably, we refer to this experience as "beautiful." (In a similar sense, mathematicians often describe certain formulas as "beautiful.") The unsurprising corollary is that environments in which we do not find this meaning—commonly called "ugly"—are stressful, and potentially harmful to well-being.

It turns out that the built environments that most people find most beautiful, including historic and traditional ones, possess this meaning-rich structure that we refer to as "deep symmetry." Importantly, there is also a strong (and not coincidental) correspondence with those environments that produce the most positive measurable effects upon well-being.

The architect Christopher Alexander set out to catalog the forms of this deep symmetry, referring to "fundamental properties" that we observe repeatedly in things that we experience as beautiful or full of life. He found that he could do it empirically with just 15 geometrical categories (Figure Four). Many of them correspond directly to forms of symmetry (e.g., "local symmetry," "levels of scale," "echoes", and so on). Others are more complex mixtures. Nonetheless, Alexander's work shows that it is possible to empirically map the geometric characteristics of deep symmetry – and moreover, to find a surprisingly close congruence to the vast and diverse array of natural and historic human environments that possess it.



Alexander's "Fifteen Properties," found repeatedly in common natural structures, and human structures that we experience as beautiful and full of life. Image credit: Michael Mehaffy, from open sources under fair use.

What about the many contemporary environments that do not display this deep symmetry? They may have a very shallow or learned, cerebral form of symmetry, or a mere veneer of symmetry (like a thin product packaging). Research is beginning to reveal that this shallow symmetry is associated with environments that produce stress, and may contribute to illness, depression, and other disorders.

For example, Penacchio and Wilkins (2014) show that visual scenes that lack the scaling and other multiple symmetries found in natural environments "<u>provoke discomfort, and even headaches and seizures in susceptible individuals</u>." Le et al. (2016) confirm that "<u>patterns with unnatural statistical properties are uncomfortable to look at ... with consequences for brain metabolism, and possibly also for health</u>."

The journalist Richard Louv coined the term "nature deficit disorder" to highlight research evidence he found documenting the negative impacts from lack of contact with natural environments and forms, especially for children. Now we can see an even broader phenomenon, and one that is closely related: we'll call it "symmetry deficit disorder." The deficit in the experience of deep symmetry in modern environments causes an actual disorder in human beings—that is, we identify a geometrical condition that can impair the function of the body and mind. The cause of both disorders is ultimately the same: people seem to have an innate need to connect with the biological structures, and their symmetries, that drove the evolution of humans.

How did this "symmetry deficit disorder" come to be so pervasive in contemporary times? Was something as serious as this accidental? After all, we noted earlier that places and periods throughout history produced beautiful buildings and environments with deep symmetry as a matter of routine—in spite of many other problems those societies faced.

As also noted earlier, some people think that society simply made a calculated trade in the modern era, sacrificing this ordinary—and older—environmental beauty based on deep symmetry for sanitation, medicine, technology, and the like. Very well, they say, we got more sterile, machine-like buildings, but they were orderly and functional, and occasionally costumed with imaginative artworks. What's wrong with that?

Too much, actually. It's not only that these environments are taking a documented toll on human health and well-being (by the evidence of data regularly emerging from the medical professions). They are, like the resource-guzzling technologies that made them, profoundly unsustainable (by the evidence of data coming from energy and resource use).

Once again, history offers important and humbling lessons. Consider the Pantheon in Rome, say, which has lasted 18 centuries, in large part because it has been treasured as beautiful by each of the 80 or so generations that kept and sustained it. Yet today we pat ourselves on the back for calling a building with a lifespan of 60 years "sustainable," and very many new buildings are demolished or fall into disuse after only 40 years or so.



On the left is the Pantheon in Rome, built 18 centuries ago, and exhibiting many forms of compound symmetry. On the right is a new "green" skyscraper, whose symmetries derive mostly from its veneer of plants. The underlying structure is a fairly ordinary stripped-down objectbuilding, of the kind that has been fashionable since the early 20th century. It is common for such buildings to be demolished within a halfcentury or so. Image credits: Left, Evan Qu via Unsplash. Right, Victor Garcia via Unsplash.

A deeper level of unsustainability is caused by the disordered processes that disrupt ecologies, resource bases, and, no less, the human quality of life. In that sense, the mathematical ugliness of the built environment is a manifestation (and a warning indicator) of deeper dysfunctions, and deeper asymmetries. This problem cannot be dismissed as "merely" an aesthetic one. The remedies, therefore, must be more than aesthetic—they must dig at the core of the processes that generate these ugly places, as well as the ugly products themselves. Process and product are inseparable.

Chief among these processes are the economic and cultural valuations of consumption, disposability, and novelty. Most people already recognize (or suspect) that our cultural and technological systems do not rest on a durable footing. As we have written about <u>before</u>, one way to address that shortcoming is to reform the runaway economies of scale and standardization, which are proving so destructive. While there is a useful role for these economies—in nature and in human systems too—there is also an essential, and largely missing, need to temper them with economies of *place* and *differentiation*. Rebalancing systems in this way is essential to the transition from an unsustainable "depletion economy," to a more sustainable, regenerative, "repletion economy."

Similarly, while we can welcome visual novelty and excitement in human environments, durability, profoundness, and deep symmetry play a much more essential role. The latter qualities maintain the human race on a viable evolutionary trajectory, whereas their neglect or suppression could trigger catastrophic consequences. Unfortunately, contemporary systems of production over-value the shallow appeal of the new and exciting, with the consequence that there is a "race to the bottom" to build ever cheaper, ever more disposable, but ever more superficially exciting, environments lacking deep symmetry altogether.

Architects have become complicit in this auto-destructive system, for fateful reasons. At the turn of the 20th century, architects signed up to support the unbridled industrialization of the human environment (and its unsustainable development, and ultimately its dehumanization). Fatefully, they became essentially a marketing arm for this unsustainable economic transformation. Rhapsodic theorists from great universities legitimized the cachet of a novel type of fine art, by eulogizing its allure, thus providing compelling packaging for this new—and toxic—industrial product.

Ironically, it is not altogether easy for architects themselves to see this. (We say this as researchers and teachers of architecture ourselves.) Through a process we have previously called "<u>architectural myopia</u>," architects—like other professionals—have their own lenses through which they see the world and their work. For example, the research literature repeatedly documents that architects have fundamentally different judgments from common people as to what constitutes a beautiful building.

For architects, a "good" building is more likely to be stripped down, dramatic, unadorned—an example of what we have previously termed "<u>geometrical fundamentalism</u>." From their cognitive perspective, this geometry seems most appropriate for contemporary times, with its focus on machinery and power. At the same time, they have a prevalent aversion for the ornate patterns of nature, and of historical design forms. Instead, trained architectural taste is consistent with an early 20th century fantasy of a "modern" future defined by that bygone era's stripped-down futuristic images.

The new research coming from social psychology, environmental psychology, and other fields, is helping us to understand what is going on—how those individuals who are removed from the flesh-and-blood reality of a situation must substitute their own "construals" for that reality, often with negative impacts on others. The lesson is that all of us see the world through our own cognitive biases, and with our own "bounded rationality."—sometimes with unintended consequences.

Architects (and other futurists) do experience beauty, just like everyone else. But as research shows, the beauty they experience largely ignores key attributes of the natural and physical world that all of us share —the *structura naturalis* as we refer to it (Latin for "natural structure"). Rather, they are much more focused upon the beauty of their own mental constructions (shared mostly among other architects)—what we refer to as *structura mentis*.

There is an essential place for both kinds of structure. After all, the beauty of literature and of other arts comes largely from the mental symmetries of *structura mentis*. This is the important domain of symbol, allegory, metaphor, and all the other rich capacities of literature and the arts.

But when it comes to the impacts of the actual physical environments where humans live their lives, specific geometries do matter, as the research shows. The health and well-being of users (and of the natural environments upon which we depend) must take priority over the individual prerogatives of artistic expression.

The new insights on symmetry in the built environment offer fertile ground for further development of practical tools and approaches. They cut through the meaningless "style wars," and transcend considerations of which kind of object-building we might like or dislike, or whether or not we are "modern" and "with it." Instead, they simply provide a growing body of evidence about why certain environmental characteristics are beneficial, and how we can create more of those beneficial environments.

This comes at a particularly urgent time when the world is urbanizing at a historically unprecedented rate, with profound impacts upon future resource use, ecologies, and quality of life. Clearly, we cannot afford to remain mired in the same old "business as usual" patterns. Professional responsibility and good citizenship demand that we recover the methods for enriching the symmetries of our human environments. As the new research shows, these places do have profound impacts upon us — and increasingly, it appears, upon our future.



A few more buildings that exhibit high degrees of compound and deep symmetry. Left, Santa Caterina del Sasso Monastery, Lake Maggiore, Italy; Center, Central Market, Valencia, Spain; right, Byodo-in Temple, Hawaii. Image credits: left, public domain (via Pixabay); center, @nosoylasonia via Photohere; right, @little_plant via Unsplash.

Michael W. Mehaffy, Ph.D., is a researcher in architecture based at KTH Royal Institute of Technology in Stockholm, and director of the <u>International Making Cities Livable</u> conference series.

Copyright Planetizen, Inc. © 2000 - 2024. All rights reserved.

The Place of Beauty: Neuroscience, Health, and Sustainability

By Daniel Morales

4-23-24

I'd like to talk about the place of beauty in architecture and how it can make our cities more livable given the challenges we face. Beauty is a subject as old as antiquity, yet largely absent from academia. This goes back to the 1930's, when architecture schools replaced their Beaux Arts curriculums for Modernism by abandoning the study of historic precedent and composition in the pursuit of beauty. Modernists believed that human nature had evolved in tandem with technology and that traditional notions of beauty were obsolete, but today we know better. Recent advances in neurology have shown that human nature is thousands of years old and that our aesthetic impulse is instinctual. These findings are key to understanding the role beauty plays in the built environment and how it can help us mitigate the effects of climate change.

Our planet is sick and getting sicker, as evidenced by the increasing number of extreme weather events. These are the direct result of development patterns which are disrupting how ecosystems work. To allow nature to heal, we must reduce our foot-print by abandoning some places while building up others to be more dense, sustainable, and beautiful. But what does beauty have to do with sustainability? People save the things they love, so to reduce waste we must build places worth preserving, which means building places people love.

The problem is that people are suspicious of density, especially in established neighborhoods. Too often, modern buildings ignore their context, leading to resistance from residents who block new development. This is why the Preservation movement came up in the 1960s, when whole neighborhoods were being demolished in the name of urban renewal. To build the kind of density needed, we will have to get the public's support, which requires asking what people like about their own cities. This is exactly what a study by the Knight Foundation did in 2010 when it surveyed 46,000 people from 23 different cities. The majority said it wasn't their jobs or a healthy economy, but rather their city's beauty and sense of community.

So how do we get the study of composition back into architecture schools? By articulating a vision of beauty based on human nature rather than ideology. The first thing to understand is that beauty is an expression of how something make us feel. Neurologists have established that emotions are a short hand for determining if something is good or bad for our survival. When Modernism dismissed the importance of beauty, they also dismissed the way buildings make us feel. What Modernists failed to understand is that people experience the built environment instinctually rather than intellectually. No matter how elegant a theory, if it can't be seen, then it doesn't affect the passerby. New Urbanists were the first to understand this by working with home builders. Being accountable to the marketplace, builders had never stopped using historic styles. This is why my first job out of school was in the Town Architect's office of Kentlands,

Maryland. After seeing some drawings by Duany Plater Zyberk, I thought it was the only place I could get a job designing the kind of buildings people liked. This isn't to say that Modernism as a style is bad - far from it - but when schools threw out the study of historic buildings as a tool of design, they also threw out the lessons of composition embedded in their facades. This is why many developments rely on aesthetic regulations, because architects no longer design buildings to work well with each other.

The pedestrian city is a city of facades, the quality of which affects how we feel walking down a street. When confronted with blank or incoherent facades, the mind is alienated, but when harmoniously designed, the mind is engaged. This is why the authors of a book on the Victorian houses of San Francisco entitled it "A Gift to the Street". A recent study published in the New York Times found that people who experienced beauty on a regular basis were more open to strangers. It showed that the areas of the brain which were activated when looking at beautiful faces were the same as those which responded to other pleasurable stimuli. Therefore, the more we design buildings to work together, the more people will be inclined to linger in the public realm and form the social bonds of community.

Architecture schools continue to deny the legitimacy of traditional styles in contemporary practice. Imagine doing this in any other art form. The reality is that people don't think about styles the way Modernists do. Take an Italianate Brownstone in Brooklyn or a Romanesque loft building in Soho which were designed by builders with no architectural training. Today, they are some of the most desirable buildings in the City. Why would buildings that used to be torn down as a matter of course become identified with New York's identity? I believe this has to do with how their facades create pleasing patterns of light and shadow, especially when in an overall streetscape. Evolutionary biologists have shown that the mind evolved to read patterns as part of our survival instinct, the quicker we could process visual information, the better. This ability evolved into various art forms as a way to enjoy and practice what the mind does instinctively. Whether in a song, story, or streetscape, the more harmonious a composition, the more beauty we feel, even when we have no cultural connection to it. In neurological terms this is called our Superior Pattern Processing, something which is considered a defining feature of human intelligence and an essential part of creativity. Because of the limited size of our working memory, the brain forms neural networks which enable us to store and recall large amounts of information. This pattern making process allows us to quickly construct virtual models of the real world as we accumulate a repertoire of similar objects. The same thing happens when we hum along with a song we've never heard before if it contains compositional motifs we're familiar with. This is why the study of historic precedent was considered an essential part of developing one's eye for composition, something Michelangelo called the raggione dell'occhio.

Recent studies have shown that the brain is most aroused by patterns which have a 20 percent redundancy of elements, the same as those found in many traditional styles. Too much repetition results in monotony while too much variety causes confusion. Nature uses the same geometric patterns and compositional principles to propagate life, what scientists call fractals. One can see this in trees, whose branches relate to the trunk the way its leaves relate to their stems. This is why Aristotle said that art imitates nature and why our attraction to traditional styles is akin to biophilia. When these principles are applied to a building's facade, the mind finds a unity within variety that aligns with how we process visual information. The truth is that styles work as pre-harmonized kit of parts which allow an architect to more easily compose an attractive facade.

Take a typical building with a tripartite facade. The bottom, middle, and top were often treated like a pedestal, column, and entablature, with each of these in turn divided into three parts as well. At the ground floor, one might find a base, window, and belt course, while the middle section might be expressed as a column with its own base, shaft, and capital. Finally, the attic floor was often treated as a giant entablature with an architrave, frieze of windows, and cornice scaled to the overall facade. Each of these sections could then be further subdivided through the use of moldings, ornaments, and plane changes. Taken together, these elements create a unified whole through principles of composition such as rhythm, scale, and proportion. The fractal nature of traditional styles help pedestrians relate to buildings which might otherwise dwarf the passerby. Even without ornament, a building's openings can be arranged into groupings which have a similar effect. When several buildings in a street or neighborhood share a similar pattern language, one gets a symphony of delight, as evidenced by cities whose identity is associated with their aesthetic appeal. These principles were well known before the advent of Modernism when architects were expected to be fluent in many styles. They also account for the timeless quality of some buildings which continue to delight the public long after they were built.

While beauty is in the eye of the beholder, it turns out that those eyes have more in common than previously thought. Despite our differences in taste, it's clear that most people find certain places more attractive than others. Why else would millions of tourists flock to historic towns and cities just to be immersed in their beauty? We often agree when something looks out of balance or too crowded, and when we don't, it often adds to the variety which harmony requires. In the past, it was taken for granted that a building should form part of the larger streetscape as a form of civic manners, similar to the role social etiquette plays. This approach to design allowed buildings of different periods and styles to coexist because architects understood that the beauty of a street was more important than the sum of its parts. Today we have to rely on form codes and design regulations to maintain a common pattern language of details, materials, and composition motifs. When architects complain that this limits their creative freedom, it's often because they aren't familiar with historic styles or the principles of composition that were used to create buildings which work together.

Another reason for the popularity of traditional styles is because of their visual logic. Having grown out of building practices which grew out of structural requirements, they are intuitively reassuring even when purely ornamental. This is because humans have mirror neurons that respond to actions we see in others. In the case of architecture, if a building looks unstable, they makes us feel uneasy, while those that look stable are reassuring. Take the Gothic style, whose pointed arch and buttresses were the result of carrying roof loads, or a Classical column, whose entasis expresses its load bearing function. The same is true of an entablature, whose cornice is an elaboration of a roof's function while the triglyphs and dentils are an expression of structural beams. Over time, these details were embellished to please the eye even while their functional origin had disappeared. This doesn't mean that people will read buildings in this way, but when they do, their structural origins are quietly reassuring.

To illustrate the disconnect between academia and the public, take the demolition of Penn Station which prompted the passage of the National Historic Preservation Act in 1966. Despite public outcry, the head of Harvard's Graduate School of Design, Walter Gropius, dismissed the efforts to save it, writing, "Why do we dissipate our strength by fighting battles for the resurrection or preservation of structures which were monuments to a particularly insignificant period in American architectural history, a period which, still unsure of its own mission, threw on the Roman toga around its lungs to appease its nagging doubts." Compare this to what Austin Lord, the Dean of Columbia's School of Architecture said about Penn Station in the 1920's. "I entered it some two years ago, a dark winter morning, at seven o'clock, and there was a light such as it exists in the Pantheon, that blue, purple dawn, scattering itself in those colors. I forgot myself. I forgot I was in this prosaic America, and, standing before the man that was going to sell me my ticket, I exclaimed, 'Oh! This is wonderful.' Then I hesitated, somewhat confused, but I was agreeably surprised. The man said, "My dear man, I am the night ticket man, and that is what I sit up waiting for. Isn't it beautiful?"

In the coming years, the demand for multi-family housing will only grow. Not only do we need more dense and walkable places, we also need to alleviate the crisis of affordable housing due to a lack of supply. This is as true of new developments as it is of historic districts. There's no reason why these neighborhoods should not be able to grow as they have historically. The easiest way to get more housing built is to work with common building types. Fortunately the five-over-one podium building is the same height as some of our most popular cities. Take Paris for example, a 4-7 story city whose density rivals New York. Not only is it humanely scaled and attractive, but most of its buildings don't require elevators, should we run into energy shortages. The beauty of Paris is that it is mostly the product of form codes imposed by Baron Hausmann, the official tasked with rebuilding the city. Using pattern books, developers lined the famous boulevards with buildings that are considered some of the most beautiful in the world.

This demonstrates that one doesn't need great design to create great urbanism, as long as there are good models to emulate, which brings us back to the fear of new development. I experienced this first hand when working in the Colonial town of Alexandria, Virginia. The firm I was working for at the time was tasked with designing a block long apartment building that required an approval by local residents. At the beginning of the job, my boss instructed me to design a glass building, which was promptly rejected. I was then told to clad it in brick, but the residents rejected that one as well, calling it Stalinist. At this point, the developer client was getting impatient, so I was told to design something that I thought would get approved. I decided to break up the block with various historic facades as if it had been built over time. This not only made for a better pedestrian streetscape, but also allowed the building to blend in with its surrounding context. Residents approved the new design and construction began soon thereafter.

The fact is that beauty sells, as evidenced by developments which employ design guidelines. Even when we can't afford fine materials and craftsmanship, good proportions are free, as long as one has been trained in the art of architecture. In a TND where I've done a lot of work, the town architect told me there was a huge demand for architects who could design 'authentic' buildings, by which he meant how architects used to design in the past. This method is what Vitruvius called symmetria and Alberti called concinnitas, but whatever the term, the way architects used to talk about beauty aligns with what science tells us about human nature.

It's clear that buildings which ignore our aesthetic impulse are less likely to be preserved. This doesn't mean that every building needs to be attractive, but for the fabric buildings which form the background of daily life, we would do well to study places people love. While we've made great strides in reviving pedestrian-oriented urbanism, we still have a long way to go towards designing pedestrian-oriented architecture. This is why it's important that we bring the study of composition and historic precedent back into architecture schools. Without the harmonious beauty that makes cities a pleasure to walk in, we will never build places worth preserving, but if we revive the art of architecture, not only are we more likely to get it, but what we build today will stand a better chance of being reused tomorrow.

Designing Parks Together: Generative Participatory Placemaking for Co-creating Parks, Case of Riyadh Parks

Lobna A. Mostafa, PhD

Senior Specialist, Community Development and Placemaking, ICON-LAB

Abstract:

Over the past decade of the dynamic realm of urban design and community development, the concept of placemaking has gained prominence based on its proven profound impact on the relationship between communities and their public spaces. However, moving beyond conventional traditional placemaking regenerative approaches, this research focuses on generative placemaking as a powerful new approach. Generative placemaking is a strategic framework that integrates the uniqueness of a community and the prospects of a space with participatory design principles, considering socio-spatial characteristics. In that context, this research demonstrates the *Generative Placemaking* strategy the author created, tested, and applied to engage all stakeholders in creating new parks in Riyadh City, Saudi Arabia. The research explores the intersection of urban planning, community engagement, and sustainability. The study focuses on the innovative approach of generative placemaking, a strategy that emphasizes community involvement and stakeholder engagement in the design and decision-making of urban parks.

Specifically, it demonstrates how to co-create new parks by actively involving stakeholders in the making process. The research shows the importance, feasibility, and applicability of placing people at the heart of the process and strengthening the connection between communities and their spaces. The research draws insights from interdisciplinary literature, case studies, and collaborative practices. It proposes actionable guidelines for the generative process of designing rich parks, where stakeholders co-create vibrant and inclusive environments. In conclusion, the research contributes to the growing body of literature on generative placemaking and urban sustainability. It underscores the importance of community engagement in urban park design and offers valuable insights for future park development projects.

Keywords: Generative Placemaking, participatory design, human-centered, Riyadh, Public Spaces, Parks Design, Stakeholders Engagement, QoL.

1. Introduction

Placemaking is a continuous process of shaping, experiencing, and contributing to 'place'. It is a multidimensional construct, referring to a locality and the relationships that occur within the locality, including socio-economic reality, ecological conditions, and political standpoints (Iderlina Mateo-Babiano, 2020). Placemaking is catching on as another way to improve the quality of various places in a neighborhood, and by extension, the community and region in which those places are located as well. However, the myriad uses of the term are sometimes confusing and contradictory, and this dilutes the value of the concept and undermines its utility in helping neighborhoods and communities imagine and create a better future. (Wyckoff, 2014)

The *Placemaking* strategy is built around two main concepts: Sense of Place and Community Participation, which are the main concepts at the heart of the placemaking movement. The idea of "making place" stems from a phenomenological tradition in geography where "place is space imbued with meaning." (Kalandides, 2018) However, the meaning may be quite different for diverse groups and individuals.

Meanwhile, various Placemaking strategies are adapted to suit the conditions of each specific case. These include adaptive reuse (repurposing of heritage structures), tactical urbanism (pop-up events, street furniture, colored asphalt), street and market revitalization (pedestrian-friendly, safer junctions), waterbody restoration (ecological rehabilitation, disaster mitigation), urban green open space (urban parks, community guerrilla garden), walking and cycling facilities (sidewalks, bike lanes) and transit-oriented development (public transport, mixed-use, last mile connectivity) (Kumar, 2023). These strategies aim to create spaces that are not only functional and aesthetically pleasing but also foster a sense of community and belonging (Kumar, 2023).

At the top of the Placemaking engaging strategies is *"Participatory Design"*. Participatory design is a methodology that allows real-world users to participate in the design process with professional designers. The goal of participatory design is to create a high-quality product, service, or system that suits the user's needs. Other names for participatory design are Cooperative design, Community design, Co-design, and Co-creation. Regardless of the name, the idea stays the same: Users and stakeholders participate in the design process. Participatory design isn't a new concept. It originated in Germany and became popular in Scandinavia back in the 1980s. It spread to other places, including North America.

In the 2000s, co-design became popular for technological products. Back then, a development method called Extreme Programming (XP) emerged. It implemented a collaborative approach to improve software quality. The group design methodology gained momentum among software developers. (Dovetail, 2023)

Community design can come in many shapes and sizes. Sometimes, it involves users in the entire project, allowing them to make significant changes and share responsibility. In other situations, the user's contribution is consultation only. This approach directly engages users in the design process. It is centered around the community and can foster community ownership and pride. In this strategy, the community designs the whole project, for the community. Each resident contributed to elements of the design, function, and management.

This research draws on various case studies of generative participatory placemaking, with a particular focus on the Riyadh 100 Parks Project, an ambitious initiative aimed at transforming the urban landscape of Riyadh, Saudi Arabia, into a greener and more sustainable environment. The project exemplifies the principles of generative placemaking, involving local communities in the planning and design process, thereby fostering a sense of ownership and connection to the parks.

2. Literature Review

2.1. The Design Process.

As for the attributes of design tools in participatory projects, it is necessary to understand what the design processes are about. Among others, Barton, H. et al. (2003) provided 7 steps for shaping neighborhoods, and Wates, N. (2000) suggested a scenario to reuse derelict areas. While Urban Action Network generalized the process of the Neighborhood Park Movement (2004). Their framework of the general processes of participatory design can be charted as follows. (Hyun-Chan Ahn, 2007)



Fig. 1 Processes of Participatory Design Source: (Hyun-Chan Ahn, 2007)

2-2 The Multiple Roles of Placemaking:

Historically, planners, community development groups, and other place-engaged organizations have worked to elevate the importance of place and placemaking in economically, socially, and environmentally responsible development (Ellery, 2020).

Placemaking places people at its core, either by employing a participatory process to public space design, gaining an understanding of residents' perceptions and aspirations, or responding through projects/programs, which generate positive relationships in/to/with the place. (Iderlina Mateo-Babiano, 2020)

The concept of placemaking has been presented professionally from different perspectives using a variety of definitions (Iderlina Mateo-Babiano, 2020). The theoretical model proposed in the work of Ellery, J. Ellery, & M. Borkowsky is offered for further examination, description, and testing and as a foundation for future research on the role placemaking plays in community development professional practice (Ellery, 2020).

2-3 Regenerative vs Generative Placemaking:

Regenerative and generative placemaking are two distinct concepts in urban planning and development. Regenerative development is an approach to supporting design for places to focus on the delivery of vital, viable, and resilient places, able to evolve to support all human and non-human life. (Dominique Hes C. H.-S., 2020)

Regenerative Placemaking is a development approach that protects existing neighborhoods by co-creating sustainable, eco-friendly, and inclusive projects, emphasizing participatory planning, cross-sector collaboration, and financial prosperity for the community (Tohme, 2023)1. It is defined as a strategic process of (re)igniting people's relationship to socioecological systems through place-specific activations (Dominique Hes B. R., 2021). This approach harnesses the key strengths of regenerative development and placemaking practices (Dominique Hes B. R., 2021). It emphasizes deep engagement with the community of an area, the use of relatively small projects to trigger long-term benefits and the aim of improving life quality by developing social cohesion and place attachment that contributes to the planning and investment in public places (Dominique Hes C. H.-S., 2020). On the other hand, "Generative Planning" is a method that focuses less on the specification of a final form through schematic planning and more on the stepwise process by which a form might emerge from the evolutionary actions of a group of collaborators. (Mehaffy, 2008)

2-4 The value of Participatory design:

The participatory approach in placemaking is a process that emphasizes the involvement of local communities in the design and management of public spaces. It's a method that places people at its core, either by employing a participatory process to public space design, gaining an understanding of residents' perceptions and aspirations, or responding through projects/programs, which generate positive relationships ships in/to/with the place (Iderlina Mateo-Babiano, 2020). The participatory approach is seen as a spatial process, producing interactions among people, creating emotional or material connections, exchanges, and inevitable conflict, re-configuring (public) space, and extending (urban) citizenship (Kalandides, Participatory placemaking: concepts, methods and practices, 2018).

The participatory design presents placemaking as a capacity-building strategy to harness the power of the community in shaping and transforming places in cities. The Placemaking employed participatory learning and interacting strategies to engage people across cultures

and ages through group collaboration in an intensive workshop. (Iderlina Mateo-Babiano, 2020).

Over the past 40 years, participatory design has evolved to minimize downsides and maximize the benefits. While it may not apply to all projects, many product designers, and urban designers take advantage of user consultations and participation for their concepts and designs.

In the context of designing and implementing neighborhood parks the participatory approach has proven to have several benefits:

- 1. **Community Engagement**: Participatory design fosters a sense of community ownership and connection to the parks. It allows for the integration of local knowledge and preferences, leading to designs that are more likely to be accepted and used by the community (Sanem Özen Turan, 2016).
- 2. Inclusive Design: It ensures that the needs and preferences of all community members, including underrepresented groups, are taken into account. This leads to more inclusive and accessible park designs (Dovetail, 2023).
- 3. **Sustainability**: Parks designed with community input are more likely to be maintained and preserved by the community in the long term (Sanem Özen Turan, 2016) (Dovetail, 2023).
- 4. **Innovation**: The process can lead to innovative design solutions that professionals might not have considered. Different perspectives can bring unique ideas and solutions to the table. (Mostafa, 2021)
- 5. **Improved Quality of Life**: Well-designed parks can enhance the quality of urban life, promote social cohesion, and contribute to environmental conservation (Sanem Özen Turan, 2016).
- 6. User Satisfaction: Participatory design can lead to higher user satisfaction as the end result is likely to meet the users' needs and expectations (Dovetail, 2023).
- 7. **Learning Opportunity**: It provides a platform for mutual learning between designers, stakeholders, and the community.
- 8. **Empowerment**: Participatory design empowers community members by involving them in decision-making processes that affect their environment (Dovetail, 2023).

3. Methodology

In this research, the two practices of "Generative planning" and "Participatory Placemaking" are integrated under the 'Generative Placemaking" model. This model harnesses the key strengths of both practices while providing ways to address their limitations. The case project was analyzed using demographic urban methods to identify potential synergies. The resulting model indicates that merging these two practices can deliver a place designed for human-centered urban development. Potentially shifting city-making from a largely planning-based practice. The combined approach supports the ability to look across history and its attributes to understand a place's potential while providing a method through which the community can actively participate in the city-making process. Placemaking can thus become a strategy to bring forward this potential, test, play, and evaluate generative initiatives, in the context of spatial, temporal, social, and ecological influences.

The research follows a mixed method; quantitative- quantitive approach. It studies and analyzes three Participatory Placemaking international projects. The methodology of Generative Participatory Placemaking of the case study of Riyadh Parks will be presented and analyzed.

In that context, this research demonstrates the Generative Placemaking strategy that was created, tested, and applied by the author to engage all stakeholders in the process of creating new parks in Riyadh City, Saudi Arabia. Specifically, it demonstrates how to co-create new parks by actively involving stakeholders in the making process.

The research shows case the importance, feasibility, and applicability of placing people at the heart of the process and strengthening the connection between communities and the spaces they inhabit. The research draws insights from interdisciplinary literature, case studies, and collaborative practices. It proposes actionable guidelines for the generative process of designing rich parks, where stakeholders co-create vibrant and inclusive environments. In conclusion, the research contributes to the growing body of literature on generative placemaking and urban sustainability.

4. Case Studies

The selection of the case studies was based on the parks and public spaces that have successfully implemented participatory strategies to design and implement neighborhood and community parks:

4.1. Case Study One:

- **Project Name**: NRIAG Eco-Park
- City: Helwan, Egypt, Year: 2020
- **Owner**: The National Research Institute of Astronomy and Geophysics (NRIAG)
- **Design Approach**: This project focused on integrating marginalized natural environments, such as Wadis (dry streams), with the urban fabric through ecolandscape design. The project used a participatory qualitative method along with other analytical and digital tools, such as modeling and Geographic Information Systems (GIS), to deduce scientific details and activities in the preliminary phases of zoning plans. (Okasha, 2021)
- **Participatory Approach**: The collaboration of multidisciplinary experts, the local community, and non-governmental organizations (NGOs) was recommended to join the design team, after the first brainstorming session. Due to the high cost of the study, a small grant was proposed to support the focus group workshop and some experts' technical reports. The study was part of an ongoing project, and this research is the first phase that aims to propose activities and zoning design.
- **Participatory Methods:** individual meetings, small group work, focus group workshops, and distributed work package tactics, can help in eco-landscape design, decision-making, and management.
- Learned Lessons: The researchers demonstrated the challenges facing the participatory approach related to transparency, and lack of experience at the decision-

maker level. It also brings to attention the importance of such practices to support sustainability.



Fig. 2 The Participatory Multi-Method Design Approach Source: (Okasha, 2021)

4.2. Case Study two:

- Project Name: Xicoténcatl Park
- City: Tijuana, Mexico, Year: 2021
- Owner: Taller Capital
- Design Approach: This informally urbanized area is characterized by cardboard and cinder block constructions, usually roofed with corrugated metal sheets or very simple concrete slabs, standing over steep slopes. This project was originally meant to address the construction of sidewalks and the cleaning of the ravine to guide water runoff. After visiting and understanding the community's pressing need for public and recreational spaces, the scope changed. (ArchDaily, 2023)
- **Community Participation**: The project team visited and understood the urgent need of the community for public and recreational spaces. They witnessed the enormous amount of debris that filled the canal and proposed a drastic change in the program:

to place the debris on platforms to create sports and recreational spaces that linked both sides of the stream. The community had already initiated actions where this material was used to create a simple soccer field. Through the use of a popular and vernacular construction system to build contention walls called llantimuro or tire-wall, this project takes advantage of the existing on-site debris and the millions of used tires uselessly piled in border cities such as Tijuana, to build a series of earth and concrete platforms, held by tire-wall contention walls.

• Leaned Lessons: The project demonstrated the potential of learning from the local community using local and vernacular construction systems that recycle materials, such as tires, to structure the intervention.



Fig. 3 The Xicoténcatl Park, Mexico Source: Rafael Gamo, (ArchDaily, 2023)

4.3. Case Study three:

- Project Name: Tapis Rouge public space
- City: Haiti, Year: 2016
- **Owner**: Emergent Vernacular Architecture (EVA Studio)
- **Design Approaches**: Tapis Rouge is one of several public spaces built under the program LAMIKA, whose acronym stands for "A Better Life in my neighborhood". The program, funded by the American Red Cross and implemented by Global Communities, aims to construct multifunctional spaces that facilitate and promote social cohesion through an inclusive approach. (ArchDaily, 2023)
- **Community Participation**: The design is inherently community-oriented and understands public space as an anthropological ground from which identity and social relations grow. Green Gym was created in response to the community's needs with simple low-cost equipment.
- Learned Lessons: The project aimed to give transformative power to a local community and to provide the residents with a sense of ownership, identity, and pride. The goal was to create a safer and cleaner environment, which would help reduce crime, violence, and anti-social behavior in the area.



Fig. 4 Tapis Rouge public space, Haiti Source: Gianluca Stefani, over (ArchDaily, 2023)

4.4. Learned Lessons Conclusion:

The case studies projects demonstrate the potential of participatory design to create parks that are not only aesthetically pleasing but also meet the needs and aspirations of the local community. Through a participatory approach and through placing community engagement at the core of the design process. The methods applied for the participatory approach varied from one project to another based on the nature of the project itself and the targeted community: whether common or specialists. All of the demonstrated cases were for generative placemaking, which focuses less on the specification of a final form through schematic planning or design and pays more attention to the participatory process by which the form emerges from the collective design of the group of collaborators.

5- Riyadh Park Generative Participatory Placemaking

This part of the research demonstrates the Generative Placemaking Participatory approach that the author planned and led the execution in the design of Al-Wadi Park, in Riyadh City, Saudi Arabia. The project took place in Riyadh in late 2022, and early 2023.

5.1 Background of The Riyadh 100 Parks Project

Riyadh City, the capital of Saudi Arabia, is the focus of major efforts to transform its physical urban fabric, economic potential, and cultural dynamics in direct response to the national goal for Riyadh City to become one of the ten top QoL cities worldwide by the year 2030. Moving to a new paradigm of collaboration with different stakeholders and supporting community engagement, this transformation can contribute to the targeted future of Riyadh. However, the humanization of Riyadh city gained official royal attention a long time ago. The Riyadh 20-year strategic plan titled "Riyadh: The Human Being and The Place" that the City Mayor launched in 2012 centered around livability and creating better public spaces and experience, which reviewed practices, identified challenges, and proposed a framework for action. The strategic plan was rooted in several initiatives launched by Riyadh's municipality. The Riyadh Municipality also pursued achieving the QoL Program goals related to the neighborhood's environment by upgrading public spaces and promoting residents' daily activities through conducting the upgrading public spaces as a part of the" humanization of residential districts" project. (Mostafa, 2021)

Riyadh Municipality launched the 100 Parks Project in 2023 in response to the objectives of the Quality-of-Life Program and The Humanization of Residential Districts Project. The project aims to construct 100 new parks distributed along the residential districts in the city of Riyadh to assure equity in accessibility for green services.

5.2 Project Governance and Limitation

The city is a contiguous residential neighborhood whose residents communicate through public spaces in the neighborhood. Thus, parks are the most important spaces for activity and social interaction in each residential neighborhood. Therefore, the Riyadh Municipality, represented in the Public Administration of Design and Execution of Services Projects in partnership with the Center of Local Governance at Prince Sultan University represented in the Public Spaces and Placemaking Program, launched a pioneering experimental project of Placemaking Participatory project to co-design the Al-Wadi neighborhood park to ensure that the needs and aspirations of the residents are met, and their activities are accommodated, which eventually would contribute to improving their quality of life. Meanwhile, since Placemaking is a community-based approach, each park is considered unique and has its methodology based on the demographic, social, and urban characteristics of each district. However, the municipality could use the design outcomes as solid evidence for guiding the design decisions in characteristically similar districts.

5.3 The Methodology of the Al-Wadi Placemaking Project

To provide better processes and products in participatory designs, communication among residents and experts is one of the most important matters. Existing studies point out that the development of public spaces contributes enormously to encouraging physical activities for neighborhood residents and presents an excellent opportunity for best practices if community feedback is put into concern. Moreover, enhancing user's comfort and satisfaction will encourage people to spend more time outdoors, with the potential to improve their physical health, enrich their social cohesion, and enhance their overall quality of life. (Alawi, 2019). According to (Mostafa, 2021) she recommended humanization projects to conduct a small-scale placemaking participatory project in each neighborhood to discuss the intended development and simulate community participation in co-design parks.

The methodology of Al-Wadi Placemaking project was structured around four main phases:

| 1 | Pre-design Studies | → Demographic study of the district, characteristics of the residents , → A detailed assessment for observation and users- Behaviour mapping that was conducted in a nearby park in Al-Wadi. → Surveys and analysis of the users' needs and preferences were conducted |
|---|---------------------------------------|---|
| 2 | Placemaking Participatory Workshop | → Conducted with Al-Wadi residents for the proposed design to assess, evaluate, and upgrade according to their needs and preferences. → Provide analytical research on the workshop outcomes |
| 3 | Design Development Workshop | → Conducted with Amanah and the design consultant. → The final conceptual design was created through a co-design process corresponding to the community's aspirations concluded for the Placemaking workshop. |
| 4 | Final Design & research | → Conducted with Amanah& the consultant → The final detailed design was discussed in regard to o the community's aspirations. → The final project research was prepared for LCG. → The final project presentation was prepared for presenting to the Mayor and team. |

Fig. 5 Al-Wadi Park Placemaking Participatory Methodology Source: Author

Phase 1: Pre-Design Studies

To plan the Placemaking Co-Design Project with the residents of Al-Wadi district it was crucial to have a deep understanding of both the community and the urban context. Thus, a series of studies were conducted by the team including:

- Studying the urban context of the district.
- Studying the demographic characteristics of the district.
- Conducting an observation study and user-behavioral mapping.

- Surveying Park users to investigate their needs and preferences in the park.
- Analytical study for the outcome of all previous studies.

By the end of this phase, it was possible to Conclude the design guidelines based on community practice.

The studies report was shared with the municipality and the design consultancy as a guide for the park design to produce the conceptual masterplan of the Al-Wadi Park.



Fig. 6. Phase one: Survey and Observation studies Source: Author

Phase 2: The Placemaking Co-Design Workshop

After the studies step, the park masterplan was ready to be used as a base point for discussion and co-design with the residents through the Placemaking workshop. The workshop preparation considered the need to hold preparatory meetings to reduce the gap between the scientific approach and the practical practice of placemaking according to the nature of the involved society, in addition to introducing the other stakeholders: the Municipality team, and the consultant to the Placemaking concept itself. That stage helped make the appropriate decisions regarding the limitations and the required facilitations and planning to achieve the community's needs and aspirations. Three meetings were held, in addition to continuous communication.



Fig. 6. Phase Two: The Placemaking Participatory Workshop Source: photo 2, Riyadh Municipality & photos 1, 3, 4 Author

Through the Placemaking participatory workshop, communication between experts and residents is most important. Traditionally, experts used to visualize their design ideas with technical drawings, such as plans, elevations, sections, and perspectives. However, it is difficult for non-expert, common participants to understand such traditional drawings. To overcome this obstacle and facilitate community participation, the methodology included two main visual mediums: a big-size, walk-on masterplan where participants were able to walk and feel the scale and distance and various parts of the park. In addition, a walk-through video that demonstrates the park design in a movie format is played on a big screen with an audio background of birds and a water soundtrack. Both elements successfully achieved their intended goals that were achieved through discussions with participants.

The organization team expected the co-design workshop to last for four hours and about 150 residents. However, it was a remarkable success for the efforts to stimulate residents' participation that the workshop lasted for seven hours and received 480 participants.

Phase 3: Design Development Workshop

In the participatory design, design developments must be attained by feedback, because participants` ideas cannot be reflected in the actual design at once. Through the development phase, communication among the Placemaking team, consultancy team, and the Municipality team is most important. During this workshop, all design issues were discussed. Not only designed form or space composition, but also hardscape and softscape

elements to suit activities and uses requested by the residents through the Placemaking workshop. By the end of this phase, the teams agreed on a developed masterplan that incubates all the needs and preferences concluded from the Placemaking workshop.

Phase 4: Final Park Design

The consultancy team transferred the development plan that was reviewed and approved by the placemaking experts regarding complying with the design program. Afterward, the consultancy team produced the blueprints and execution drawings that the municipality approved and handed to the contractor for execution.



Fig. 7. Left: The primary conceptual masterplan, right: the final developed design. Source: Riyadh Municipality

6. Discussion and Conclusion

From the case project of the Al-Wadi neighborhood park, this paper explained the characteristics of the four major phases that were conducted in the participatory design processes of the Placemaking Generative strategy. It also demonstrated the specific attributes of the design tools applied to each phase. The main purpose was to achieve better communication among residents and experts. The findings from the case project could be articulated as follows:

Placemaking Participatory Manifesto:

1. Understanding the population characteristics is a vital element to be able to plan a suitable participatory strategy for them.

2. Designing a Placemaking participatory workshop requires facilitating public information to activate communications among residents and experts. The participatory tools here contribute to enhancing the efficiency of the information transfer and the participation methods by making its contents more thorough, diverse, and interesting to visualize residents` ideas and values. When developing design tools for this step, experts need to decide the degree of participation that residents can comfortably handle; simplify the design process and provide more diverse and precise items.

3. Participants' feedback is important for stakeholders and experts to develop the design together. As the key communication methods, drawings are to be changed in themes and methods of visualization. Themes of visualization are extended to activities and uses. In the methods of visualization, it is helpful if specific properties are realistically expressed in the placemaking workshop. That includes providing samples of the furniture, softscape, and hardscape elements.

4. Designers and Placemaking experts are required to make design tools more suitable for specific residents by modifying design tools more appropriately in each step and testing them in practice continuously. Such design tools can play important roles in improving communication among residents and experts in participatory design. Better communication would eventually enhance the mobilization of community spirit among all residents.

5. Beyond the mere application of foreign cases, the localization of the participatory design was inevitably pursued as a focus of research and practices. The participatory design became a part of the social movements, in which grass-roots citizen/resident participation played bigger roles than before

In conclusion, generative placemaking is a critical process that creates the capacity for people to invent space with meaning rather than reshaping existing one. It plays a significant role in public spaces by shaping them before planning, design, and execution to deliver, create, invent, and produce vibrant and inclusive places that reflect the community's identity and aspirations, and minimize the cost of creating then enhancing public spaces.

The study also highlights the potential of generative placemaking to enhance the quality of urban life, promote social cohesion, and contribute to environmental conservation. The research underscores the importance of integrating community perspectives into urban planning processes, arguing that this can lead to more inclusive, sustainable, and successful outcomes.

7. Recommendations and Future Research Directions

The findings provide valuable insights into the benefits and challenges of generative placemaking, offering practical recommendations for policymakers, urban planners, and community leaders.

Future research needs to extend to investigating the impact of placemaking strategies on decision-making and policy-making at the municipality level.

It's also recommended to examine the broader implications of this approach for urban development and environmental sustainability.

Acknowledgment:

The author thanks the team of the Center for Local Governance at Prince Sultan University in Riyadh for their full cooperation and amazing efforts in executing the Al-Wadi Placemaking Workshop during her work there as a Senior Research Associate and the Leader of the Public Spaces And Placemaking Research Program.

She also extends her thanks to the Riyadh Municipality's Mayor and team, who without their full cooperation, this project wouldn't happen.

And for all those who believe in the value of Community Engagement.

References:

- Alawi, G., & Mostafa, L. (2019). Users' Satisfaction in City Waterfront: The Case of Jeddah Corniche. ARCHive-SR, 3(2), 90–105. <u>https://doi.org/10.21625/archive.v3i2.504</u>
- Alexandra J Tohme, Medium, (2023), Developing a Regenerative Placemaking Framework, <u>https://medium.com/@FOCities/developing-a-regenerative-placemaking-framework-part-2-1990e1768bde</u>
- ArchDaily Team, 2023, When Architects Design for Communities: 7 Parks and Squares, retrieved on May 1st from: <u>https://www.archdaily.com/1001033/when architects-</u> design-for-communities-7-parks-and-squares
- Dominique Hes, Bill Reed, Future of Cities. (2021). Introducing Regenerative Placemaking. <u>https://focities.com/intro-to-regenerative-placemaking/</u>
- Dovetail Editorial Team, 2023, Participatory design: Definition, methods, and implementation, retrieved on 15th April 2024, <u>https://dovetail.com/ux/participatorydesign/</u>
- Ellery, P.J., Ellery, J. & Borkowsky, M. Toward a Theoretical Understanding of Placemaking. Int. Journal of Com. WB 4, 55–76 (2021). https://doi.org/10.1007/s42413-020-00078-3
- Hes, D., Hernandez-Santin, C., Beer, T., Lo, L. (2020). A New Model for Place Development – Bringing Together Regenerative and Placemaking Processes. In: Roggema, R., Roggema, A. (eds) Smart and Sustainable Cities and Buildings. (pp. 53– 68). Springer, Cham. <u>https://doi.org/10.1007/978-3-030-37635-2_22</u>
- Hyun-Chan Ahn, So-Hyun Park, 2007, Design Tools and Three Steps in Participatory Design Processes: A Proposal for Better Communications among Residents and Experts, Proceedings of the 6th Conference of the Pacific Rim Community Design Network, Quanzhou, Fujian, China, June 18-21, 2007. retrieved on 15th April 2024. http://courses.washington.edu/quanzhou/pacrim/proceedings.html
- Journal of Urbanism: International Research on Placemaking and Urban Sustainability, V.1, 2008, <u>https://doi.org/10.1080/17549170801903678</u> (<u>https://www.sciencedirect.com/science/article/pii/S1877042815062229</u>)
- *Kalandides, Ares.,* 2018, Participatory placemaking: concepts, methods, and practices, *Place management Blog,* <u>Participatory placemaking: concepts, methods and practices</u>.

- Kumar, Chinnu S., and Pooja Nigam. 2023. "Placemaking and Sustainable Urbanism: Strategies for Creating Liveable and Resilient Cities" Engineering Proceedings 53, no. 1: 48. <u>https://doi.org/10.3390/IOCBD2023-15989</u>
- Mateo-Babiano, I., Lee, G. (2020). People in Place: Placemaking Fundamentals. In: Hes, D., Hernandez-Santin, C. (eds) Placemaking Fundamentals for the Built Environment. Palgrave Macmillan, Singapore. <u>https://doi.org/10.1007/978-981-32-9624-4_2</u>
- Michael W. Mehaffy, (2008), Generative methods in urban design: a progress assessment,
- Mohammed S. Al Surf, Lobna A. Mostafa, 2017, "Will the Saudi's 2030 Vision Raise the Public Awareness of Sustainable Practices?, Procedia Environmental Sciences, Volume 37, Pages 514-527, ISSN 1878-0296, <u>https://doi.org/10.1016/j.proenv.2017.03.026</u>. (<u>https://www.sciencedirect.com/science/article/pii/S1878029617300269</u>)
- Mostafa, L. (2021). Investigating the Impact of Saudi QoL Program on Public Spaces: Case of Riyadh Neighbourhoods. *Environment-Behaviour Proceedings Journal*, 6(18), 293–303. <u>https://doi.org/10.21834/ebpj.v6i18.3024</u>
- New Riyadh parks 2023: Exciting new green spaces in Saudi. <u>https://www.timeoutriyadh.com/news/new-riyadh-parks</u>.
- Okasha, A., Mekkawy, A., 2021, "A. Participatory eco-landscape design: the case of NRIAG eco-park in Helwan, Egypt". J. Eng. Appl. Sci. 68, 12 (2021). https://doi.org/10.1186/s44147-021-00012-0
- Think Wood. The Architecture of Community: How Participatory Design Builds Connection. *The Architecture of Community: How Participatory Design Builds Connection*.
- Sanem Özen Turan, Müberra Pulatkan, Dilek Beyazlı, Berna Sezen Özen, 2016, User Evaluation of the Urban Park Design Implementation with Participatory Approach Process, Procedia - Social and Behavioral Sciences, Volume 216, Pages 306-315, ISSN 1877-0428, <u>https://doi.org/10.1016/j.sbspro.2015.12.042</u>. (https://www.sciencedirect.com/science/article/pii/S1877042815062229)
- Wyckoff, Mark A., 2014, DEFINITION OF PLACEMAKING: Four Different Types, Planning & Zoning News (PZN).

CITY - MAKING An Introduction to A Periodic Table of Urban Restoration and the concept of Civic Morphology

"Only when it is understood that those who build and sustain urban life have a primary claim to that which they have produced and that one of their claims is to the unalienated right to make a city more after their own heart's desire, will we arrive at a politics of the urban that will make sense" Harvey, 2019, p. Xvi.

Cities exist, as Michel Foucault described, as heterotopic spaces of difference (1986, p. 25). Cities are spaces that seem wholly contradictory, continuously transforming, socially intense, culturally incompatible and discursively networked. Understanding this, my research question is whether diverse groups of people can, in fact, live together harmoniously within urban space?" This important question discloses the underlying interest of this research.

We are currently living through a radical transition, a radical shift in relation to urbanization. The relationship of power and the way we must relate to the changes rapidly occurring in space, brought about by globalization has resulted in great tensions across the globe that have emerged like wildfire within our cities whose appearances we have seen from revolts in the central squares of Zuccotti Park in New York City to those in Cairo, Madrid, Athens, Mexico, Barcelona, Venezuela into the current climate marches known in the United Kingdom as the Extinction Rebellion and in the uprisings of the Black Lives Matter Movement. What we often find is that urbanity - that quality of being part of the unique social life of the city - which requires inclusion. Yet, this act of inclusion is challenging work, and exclusion often appears to be so much easier. These difficulties are especially recognized when we are talking about public spaces, immigration, environments, nationalism, populism, globalism, and the myriad issues which are occurring around the use of space which perpetually arise as a result of our current methods of development, and orientation to architecture, urbanism, transit, and planning systems.

As a consequence, bureaucratically organized and unimaginatively implemented spaces are not life-giving; yet, continue to be the order of the day. A wealth of literature, empirical research, and real-world examples collectively support the assertion that structures and urban environments are often built without much, if any, democratic input from the communities they are meant to serve. Often the implementations of these spaces are based on old policies that have become redundant. cookie-cutter examples of how governments maintain a deep collusion with developers and urban planning standards. It also is a proof of the inability of our cities to keep pace with the social changes, specifically the changes in areas of equity and social justice, which are exacerbated with community relation to gentrification and displacement, transportation equity, environmental justice, educational disparities, policing and criminal justice practices, community development and economic empowerment in communities.

The transition in urban environments is articulated best in its challenges and complexities that are inherent in contemporary urban environments. Scholars in urban studies, sociology, anthropology, and related fields have long highlighted the tensions between urban development, power dynamics, and social justice. Old methods preserve standards of early municipal codes that have been shown to be both racists, inhumane, and damaging to people. Such policies like the Federal Highway Act and redlining. Without these codes being updated and intentionally changed, cities end up colluding in the reiteration of what political sociologist Eduardo Bonilla-Silva (2022) called "racism without racists" and what political activist Stokely Carmichael (1966) coined as "structural racism." These historic policies such as redlining, urban renewal, zoning laws, exclusionary housing covenants segregated public facilities, blockbusting and racial steering have had long-lasting and profound impacts on the racial and economic landscapes of cities and is still contributing to persistent disparities in housing, education, employment, and access to resources and opportunities. These practices maintain inequities within a system of class privilege and domination that continues to be etched into the physical makeup of the landscapes of the cities in which we live. Moreover, instead of really digging in and working through these difficulties, what is commonly found in cities is that our structures of governance maintain the divided city. This structural racism continues to erase, silence, and push people around. The reaction of communities being pushed around in space regularly compels what Foucault (1976) described as a perpetual "civil war" in our cities on the grounds of contested space. These civil wars reveal the de facto maintenance of structures as they are related to power, social organization and the continued production of the built environment.

Something to be celebrated in cities is the recognition that these same urban spaces provide us as social scientists with a source of vital information. Gathering this information requires the deepest understanding of the relationships and thorough network analysis of constituents and local processes that are being perpetually expressed within and through these urban settings. This analysis shows us the freedoms and constraints of the built environment and its effect on local people and the commons. A process must exist that allows for all bodies, of many different groups, to cohabitate and essentially continue productively in the co-creation of space and place within the city. Such a place and space is one that would accurately reflect the multifaceted creative imagination of its population.

This study is important especially to our understanding of who currently has the right to the city. It is important to our understanding of who has the right to production within its space, and how transnationalized groups of immigrants and the poor who live within urban spaces can fully and comfortably acclimate and be comfortably settled in place and space. Moreover, it helps us to understand how populations can potentially work to build bridges in relationships between themselves and those considered "other" in the future. It is important to note that in order for communities to fully and holistically develop an embodied, emotional, physical, and relational

orientation, to obtain a sense of place in urban settings and recognize a sense of community and belonging to one another within a broader community, groups must be allowed to become settled and develop a sense of safety, trust, and rootedness. This allows for an authentic expression of identity to be established. This study claims that this rootedness and identity formation is a necessity for civic cohesion and toward what I am calling her civic poiesis (Francis, 1963) or the capacity of a population to become the makers of their cities.

Presuppositions

There are seven presuppositions of this study I would like to outline here. The presuppositions outlined in this study are foundational principles derived from existing literature in urban studies, architecture, and related fields. Drawing upon insights from renowned scholars and practitioners in these domains, these presuppositions serve as guiding principles for understanding and addressing the complex challenges inherent in urban environments. The choice of seven presuppositions is deliberate, echoing the significance of this number in various cultural and religious traditions, symbolizing completeness and wholeness. These presuppositions encapsulate key concepts such as the interconnectedness of urban space, the importance of community collaboration, and the need for innovative approaches to urban restoration. By grounding the study in these presuppositions, I aim to provide a comprehensive framework for analyzing and addressing the multifaceted issues facing cities today. The citations provided alongside each presupposition demonstrate the diverse sources from which these insights have been drawn, ranging from seminal works by urban theorists like Jane Jacobs and Christopher Alexander to contemporary scholarship by Nikos A. Salingaros and Mindy Fullilove. Through this interdisciplinary approach, we seek to contribute to ongoing discussions and efforts aimed at promoting sustainable, equitable, and vibrant urban environments.

- 1. Cities are what activist Jane Jacobs identified as problems of organized complexity,
- 2. Urban space is realized as being broadly interconnected and a partly self-organizing network that is multidimensional, multifunctional, and open to change,
- 3. Cities and their residents when working collaboratively can develop more non-injurious, catalytic approaches to urban restoration than that which is currently being enacted in top-down processes across American cities today. Facilitation of these local processes must be bridged within and through communities' ease of access to the public commons.
- 4. The capacity for community actors to have fluid access to "public space" or a commons is required for an actualized and authentic transformation of our cities. Regarding the built environment:
- 5. Architect Christopher Alexander declared "A City is Not a Tree" (1965). Alexander's concept of a tree is not a reference to the tree we find outside with leaves, but instead refers to an abstract structure that shows a kind of ordered compartmentalization of place, space, and city parts separated and unable to influence other parts of the same structure (Alexander, 1965 p.1). Alexander compared this structure to an alternative structure

which he called a "semilattice structure" which allows for much greater interaction between its parts.

- 6. Cities have what mathematician Nikos A. Salingaros (2020), described topologically as having eight characteristics "city types", and can be analyzed as a particular mixture of these eight types.
- 7. Psychiatrist, Mindy Fullilove (2013), gets it right when she presents city builders with her nine elements of urban restoration. This study hopes to add to these nine elements with the initiation of a further periodic table of elements of urban restoration and to provide community practitioners with an assessment to follow in the discovery process of this work.

Approach to The Research

As a formative, sociographical, critical ethnographic study, this research hopes to share my personal practice, interventions, and findings which are aimed toward developing a clearer understanding of a design methodology for the intersections within a new and emerging field in critical community psychology paired with placemaking. This study includes a series of case studies about specific problems of urban life including poverty, housing, economic development, public safety, social fragmentation, and corruption within a city. It also describes a community's struggle to transform these situations while encountering a deep lack of structural support to achieve these goals. This study is framed as an autoethnographic memoir as well to share the depth of the researcher's personal commitment to reflect on how witnessing and accompanying a community through a series of harrowing trials for collective liberation brought about this realization.

This study shares an empirically grounded analysis of a series of community interventions where local residents were compelled to challenge city practices and the successes, failures, and opportunities found. The research was conducted over a fourteen year period from 2011-2024. When reflecting on the relationship between urban heritage and cultural identities along with the geopolitical and socio-cultural landscape within the city, this study required the examination of a number of pressing methodological and theoretical questions relating to urban change, and urban renewal, and its continuing influence upon and level of participation by its residents. This change required the researcher to coin a term which is here being called "civic morphology" which is distinct from urban morphology. Urban morphology that focuses on the formation and transformation of social populations in relation to these urban forms and the psychological and social characteristics that civic life takes in populations over time. These understandings help to inform appropriate social interventions to promote social cohesion and resilience within urban populations in their myriad communities.

The work is guided by the theoretical lens of depth psychology which provides an overarching theory and framework for understanding the manner of investigation and methods of intervention. Depth psychology is a field of psychology that explores the unconscious aspects of human experience, emphasizing the importance of unconscious processes, dreams, symbols, and myths in shaping individual behavior and personality. Developed primarily by Sigmund Freud, Carl Jung, and their followers, depth psychology posits that much of human behavior is influenced by unconscious drives, conflicts, and desires that lie beyond conscious awareness. This approach suggests that individuals can gain insight into their psychological functioning and achieve personal growth and transformation through the exploration and integration of unconscious material. The theoretical lens outside of depth psychology has developed and been influenced by the work of others dealing with issues of urbanity such as the civic activist Jane Jacobs, archetypal psychologist James Hillman, the living architect, and design theorist Christopher Alexander, the mathematician Nikos Salingaros, the psychiatrist Mindy Fullilove, community psychologists Paloma Pavel, architect and regional planner Carl Anthony, Latino Urbanist, James Rojas as well as the theoretical contributions of the educator Paulo Freire, and the historian /social theorist Michel Foucault. The work is also inspired by authors and urban sociologists Franco La Cecla, activist Eric Corijin, Psychologists for Social Responsibility, and Placemaking US.

Expected Results and Outcome

First, this study shows that enabling "civic poiesis" or city-making requires city planning to remove its discriminatory policies as well as its focus on the unidimensional logic entangled in ideas of control, commodification, and the monofunctional use of space. Furthermore, this shows that city planning ought to be concerned with applying regulations in a more flexible and skillful way, in order to foster careful stewardship, while harnessing, facilitating, and directing an open, even porous foundation, for the transformation of public space by and for its residents. This transformation ought to follow a bottom-up approach as directed in very honest collaboration with the city's constituents. This requires that cities, rather than only serving speculative interests, begin to direct attention toward the full understanding and positive economic and social function of its local residents and their key role in sustaining, renewing an actualizing what is to become a city's truest and actualization of urban culture maintaining the primacy of living systems rather than being dangerous to living systems.

Secondly, this study reveals a pressing need to transform the relationships between cities, institutions, environments, built spaces, people, and their organizational processes within cites through making the move toward bottom-up integration, which if carried out sensitively ought to provide greater cohesion within communities. This research seeks to advance the need for a bridge as related to the current multicultural encounter experienced by communities within cities. This suggests the need for a transformation of current methods of development through greater dialogic and collaborative design practices.

Thirdly, this study recognizes that civic poeises requires cities to adopt the wisdom of local constituents through direct engagement and inclusion in planning and urban design processes within cities. These processes ought to occur as related to 'bottom-up' feedback from community stakeholders who work collaboratively. It also suggests the necessity of "vision-based" organizing efforts and community design spaces where community action and participation will directly influence and impact the very communities, therefore; upholding the built environment within the city is meant to serve. This requires an in-depth focus by cities and city builders on building "ecologies of place" a term described as "... representing all of those idiosyncratic ecological features – including spatial location and time period – that defines the ecological context of a field.... (Billick, Price; 2010)"

Finally, civic poiesis occurs when residents within urban space are finally given the real opportunity to become willful actors and producers rather than mere consumers of space. This research expresses the need for cities to better embrace and consider the input and implementation of local populations (from all multi-cultural and socio-economic backgrounds) in planning. It also requests that cities give fuller acknowledgment of the desired uses of space by these populations for cultural production and this is the desire of the broadest group with the range from children to seniors, from those disabled to able. The research is meant to persuade cities and city builders to become familiar with vison-based collaborative organizational design, typologies of space, placemaking interventions, different pattern languages, city types, and elements of urban restoration. In this way, cities can open up spaces for equal access, representation, and influence in the processes of urban development. This follows the conviction of a necessity requiring that cities develop real sensitivity to the absolute importance of building and maintaining a resilient, sustainable living city. By providing space for multicultural influences on design processes, the city will be allowing for the highest expression and degree of social and cultural inclusion. By way of inclusion, the vigorous civic morphology of populations within cities, who are able to effectively impact the urban morphology with regard to maintaining living systems, whose design and stewardship in collaboration with professionals will organically begin to re-order the city which will then emerge and individuate particularly to express fully the authentic poetics of each place.

Literature

- Alexander, C. (2017, August 7). A City is Not a Tree. Sustasis Press/Off The Common Books.
- Alexander, C., Ishikawa, S., & Silverstein, M. (1974, January 1). A Pattern Language.
- Anthony, C. C. (2017, October 10). The Earth, the City, and the Hidden Narrative of Race. New Village Press.
- Billick, I., & Price, M. V. (2012, August 1). The Ecology of Place. University of Chicago Press.

Freire, P. (1993, January 1). Pedagogy of the City. Burns & Oates.

Foucault, M. (2003, January 2). "Society Must Be Defended." Macmillan.

Fullilove, M. T. (2013, June 4). Urban Alchemy. NYU Press.

Fullilove, M. T. (2016, October 24). Root Shock. NYU Press.

Fullilove, M. T. (2020, September 8). Main Street. New Village Press.

- Hillman, J. (2006, January 1). City and Soul. Spring Publications.
- Jacobs, J. (1992, December 1). The Death and Life of Great American Cities. Vintage.
- La Cecla, F. (2012, January 1). Against Architecture. PM Press.
- La Cecla, F. (2020, February 15). Against Urbanism. PM Press.
- Mehaffy, M., Kryazheva, Y., Rudd, A., & Salingaros, N. (2020, January 1). A New Pattern Language for Growing Regions.
- Pavel, M. P. (2009, January 1). Breakthrough Communities. MIT Press (MA).
- Salingaros, N. (2017, February 24). Eight city types and their interactions: the "eight-fold" model. Czasopismo Techniczne, 2. <u>https://doi.org/10.4467/2353737xct.17.016.6209</u>
 Sheffield, F. C. C. (2008, April 24). Plato: The Symposium. Cambridge University Press.

IMCL Presentation will Include:

- Discussion of Influences
- Concept of Civic Poiesis
- Concept of Civic Morphology
- List & Description of Space Typologies
- List & Description of Space Interventions
- Spectral Scale of Neighborhoods from Fragmented to Flourishing
- Discussion of Ongoing Development of Periodic Table of the Elements of Urban Restoration
Michael Mehaffy 🛥 🛛 4 days ago 🛛 5 min read

How urban research could build better cities

What do we need to know about the success, failure, and future prospects of creating walkable, diverse urbanism? A discussion piece for the upcoming 60th International Making Cities Livable (IMCL) conference



A park in Mueller airport redevelopment, Austin, Texas. We need more studies of new urban communities, researchers say. Photo by Veronica Castro de Barrera

EDITOR'S NOTE: This is an excerpt from an article by Rob Steuteville of CNU Public Square

(https://www.cnu.org/publicsquare/2020/02/17/how-new-urbanism-research-could-build-better-cities). The CNU is a partner in the upcoming 60th IMCL conference on "Making Cities Livable: Research Into Communication, and ACTION," April 26-28, 2024 at Newport, RI USA.

In the 1990s and early 2000s there were still prominent people who needed convincing that sprawl was a problem and walkability was fundamental, writes Emily Talen, editor of *A Research Agenda for New Urbanism* (Elgar Publishing). Now, "urban planners, environmentalists, elected leaders, and citizens of many stripes accept the validity of New Urbanism's goals," she writes. "On the academic side, scholars have largely moved beyond debates about historicism, architectural weaknesses, and environmental determinism."

A general agreement on goals means that researchers can shift their focus to "uncovering roadblocks to achievement." The book gathers the ideas of academics in design, planning, and civil engineering to examine the research that is done and needed to advance the principles of the Charter of the New Urbanism.

Some of the authors call for the obvious: more studies of new urbanist projects. Surprisingly, they are few and far between. Where these studies have been done, they show promise in New Urbanism alleviating social and environmental problems. Matthew Hardy, senior lecturer in architecture and urbanism at the Prince's Foundation in London, calls for more postoccupancy studies of new urban communities, citing the studies of Orenco Station (2002 and 2009) in Hillsboro, Oregon.

As publisher of *New Urban News*, at the time the leading New Urbanism professional journal, I reported on these studies by sociology professor Bruce Podobnik of Lewis and Clark College, which found significant benefits to Orenco Station's planning. The quantity and quality of social engagement was significantly higher than comparable neighborhoods, residents walked to the store more often, and the community boosted the use of mass transit.

Since then, academics have largely failed to follow up to confirm the results in other communities or dig deeper. "We need to know more about how these places and others function, and how they compare to other places, both new urbanist and conventional," says Hardy. "I would suggest a revitalization of the science of post-occupancy evaluation, combined with better analysis of the new metrics required to assess New Urbanism."

Regulatory barriers

Ajay Garde, associate professor of planning and policy at UC-Irvine, calls for researchers to "investigate the regulatory and nonregulatory barriers to transit-oriented and infill development. To what extent would removal of these barriers reduce GHG emissions, improve air quality, and address housing affordability?"

He calls for more studies on the impact of zoning reform, which he says has been given little attention. Given the widespread occurrence of zoning reform, this lack of research is surprising. "There is scant research that has examined the implications of these zoning reforms for addressing the problems that communities are likely to face in the future."

Garde suggests that too little is known about what makes mixed-use projects, e.g. those with retail, succeed. More study is needed on urban retail types and the "spatial dynamics of success," agrees Conrad Kickert, assistant planning professor at the University of Cincinnati. While malls are dying due to the impact of online shopping, he says, the renewed interest in urban living is fueling a demand for an experience-based retail. "America's growing desire for unique experiences cannot be met online," he writes. Moreover, retail is crucial for the health, economy, and social life of city neighborhoods. "Many of these arguments are in their early stages, and would benefit from empirical evidence and theoretical embedding."

Green urbanism

Urbanism's impact on microclimate is a critical area of climate research, according to V. Kelly Turner, assistant professor of urban planning at UCLA. "Research on microclimate regulation and New Urbanism is sparse. Especially needed are studies that evaluate the role of design in adapting to hotter urban environments." One promising study found that new urbanist design at Civano in Tucson, Arizona, reduced land surface temperature compared to conventional development, but more work needs to be done in this area.

Some environmental benefits of New Urbanism have been well established, Turner says, like the literature on transit-oriented design, walkability, and reduction in CO2 emissions. Yet there is a lack of empirical assessment of the relationship between new urbanist design and ecosystem services, climate adaptation planning, and other environmental outcomes, she says. "New Urbanist design theory constitutes a series of hypotheses that, if tested through empirical methods, could contribute to a scientific theory about the relationship between design and environment."

One useful idea would be to establish field tests at new urban projects around the US and the world—which are located in a wide variety of geographic contexts, she says. "In the case of microclimate regulation, it would be possible to collect a longitudinal database of land surface temperature across multiple new urbanist sites and, potentially, distribute a network of thermal comfort sensors. ... Built examples of New Urbanism contain a wealth of untapped environmental data that could be of interest to design professionals and academics alike."

Transportation

"While New Urbanists have increased the supply of walkable, mixed-use places with access to transit, the supply falls far short of meeting the demand for such places," writes Wes Marshall, professor in Civil Engineering at University of Colorado, Denver. "This has forged an affordability problem, and, in turn, and equity problem." Central to solving the supply problem is building more walkable infrastructure so that supply of mixed-use neighborhoods can keep up with demand.

"It is especially important to continually ask the right questions. Instead of asking how many cars need to be accommodated 30 years into the future, we should be asking what we want our community to be like and how we can build our public spaces including our streets—accordingly."

Diversity

April Jackson, assistant professor in urban and regional planning at Florida State University, notes that studies have shown new urban projects have more income diversity, but the record on racial diversity is not as good.

"Trudeau and Kaplan (2016) found that New Urbanist projects host more income diversity than their conventional peers and that racial diversity is spurred through (1) strategic commitments by local actors to the social aims of New Urbanism, and (2) neighborhood change resulting in gentrification."

Theoretical foundations

Cliff Ellis, professor in the graduate program in city and regional planning at Clemson, makes a strong argument for new urban academics to participate in philosophical debates on topics like the role of tradition in society and what makes a place "real" and authentic.

"While the central focus of New Urbanism will continue to be the completion of high-quality projects, the development of effective regulatory structures, and the empirical testing of specific spatial patterns, New Urbanist researchers should participate in philosophical debates about urban design and its connection to better and worse forms of civilization."

New Urbanism's willingness to address social goals directly has been controversial, Jackson points out. "New Urbanism, as a planning movement, addresses social goals and highlights their significance in relation to the physical environment. This is perhaps the most significant and distinguishable contribution of New Urbanism. Ironically, this also tends to be a recurrent criticism of New Urbanism: that it attempts to influence social goals via physical design."

Talen is professor of urbanism at the University of Chicago. Other contributors include: Michael Mehaffy, senior researcher at KTH University, Stockholm; Sungduck Lee, assistant professor in the Department of Architecture at Iowa State University;

Donovan Finn, assistant professor in the Sustainability Studies at Stony Brook University; and Gordon Douglas, assistant professor in Urban and Regional Planning at San Jose State University.

For more information about the 60th IMCL conference, visit the conference web page at https://www.imcl.online/2024-newport.

Exploring user experience on improved non-motorised transport (NMT) infrastructure in Nairobi

Wambalaba, E. Akosa

Department of General Education and Department of Languages and Literature, United States International University-Africa, Nairobi, Kenya. Contact: awambalaba@usiu.ac.ke or akosapretoria@gmail.com

Amwoi, Vincent

Kenya Alliance of Resident Associations (KARA), Kenya.

Abstract

Objective: This study aimed to explore pedestrian experience on connectivity, mobility, comfort, aesthetics, personal wellbeing and socio-economic engagement while using walkways. **Methods:** An on street questionnaire was applied to collect the perceptions 30 pedestrians had on connectivity, mobility, safety, aesthetics, personal wellbeing and socio-economic engagement.

Results: In the aesthetics dimension over half of those interviewed (59.6%) agree (43.5%) or strongly agree (16.1%) that there are few trees, flowers, benches for resting and too much litter on walkways. A significant number of pedestrians (74.1%) agreed (45%) and strongly agreed (29%) that noise pollution was present at unacceptable levels. However a strong majority (77.4%) agreed or strongly agreed that walking decreased their stress levels and increased their feelings of good health (80.7%). In terms of safety, the speed of cars, walking at night and crossing at roads junctions were perceived as safety concerns. Connectivity received majority agreement, except for mobility which was slowed down by business activities, physical obstacles and the movement and number of people, motorbikes and bicycles on walkways. In terms of walkway comfort, results were mixed and even numbers agreed and disagreed about comfort.

Conclusions: These findings provide support for pedestrian awareness of the influence of NMT design, use and environment on their perception of personal wellbeing, sense of safety, which in turn indirectly impacts the frequency and type of interaction with socio-economic activities in a developing country context.

Keywords: Pedestrian, walkways, perceived, safety, mobility, connectivity, personal wellbeing, comfort, aesthetics, environment, physical infrastructure

INTRODUCTION

Walking and cycling are the principal modes of travel in developing countries, outnumbering motorized transport (MT) trips (Okoth, 2008). Almost half of all adults in Kenya walk to work and educational institutions (42%) compared to 48% who ride public transport (AUNEP, 2009; Mitullah and Makajuma, 2013; Salon and Gulyani, 2010; 2019; WHO, 2018). In 2005, the majority of daily trips in Nairobi were by walking, 47-48% and 40-50% of them being short distances of less than 2 Kms while 40% were longer, 2-5 Kms with half the trips taking more than 30 minutes (SSATP, 2005).

Walking is associated with economic status. In a county study, 52.9% of Nairobi pedestrians cited unaffordability as a factor in choosing to walk to work (NCG, 2015). About 33% of households in Nairobi, live below the poverty line (Salon and Gulyani, 2019) and cannot access motorized transport. Private ownership of public transport in Kenya also prices out large sections of the poor (NCG, 2015). Consequently, walking is disproportionately experienced by the urban poor and represented as an unattractive low-income mode of transport in Kenya, (Cresswell, 2010; Salon and Gulyani, 2010; Mitullah and Makajuma, 2013). This socio-economic representation of walking underlies the existence and architecture of pedestrian space for the poor for whom walking is the major transport mode largely for functional purposes (UNEP, 2016).

The growth of suburbanization has increased commuting distances and consequently increased transport costs particularly for the poor ((Salon and Gulyani, 2019). This is significant as 41% of the population in Nairobi live in high density pockets in poorly built housing in informal settlements, distant from workplaces.

Studies show that apart from economic factors, individual (cognitive), social, economic and environmental factors also correlate with individual decisions to use non-motorised transport (Zhang et al., 2020: Mertens et al., 2017 and Kerr et al., 2016). A study by Ranne (2019) showed that an individual's experience of the built environment and by extension the natural environment rotated around themes of the environment's attractiveness, its coherence between various elements, its novelty, its stimulation during the use, the feeling of control and the sense of efficiency. The issue of connectivity efficiency between job locations and NMT in Nairobi was highlighted in a UNEP "Share the Road" study (UNEP, 2009). A survey on user perception of quality of NMT infrastructure in Nairobi found a majority considered it of poor standard (Ngira, 2013). 70% of pedestrians rated footpaths as poorly constructed compared to 5% who found them well-constructed. Mitullah (2012) in capturing spatial data through observation found over 90% of the road sidewalks within an area of study in Nairobi were heavily obstructed by informal businesses such as street vendors, trash and open sewer and drainage ditches. The same study showed 81% felt they did not have adequate facilities on their routes while 86% cited absence of safe crossings on their roads, as a safety concern.

In measures of safety, pedestrians made up the highest percentage of road accidentrelated deaths at 37%. (WHO, 2018). A contributing factor to a high pedestrian accident rate, is lack of adequate pedestrian walk paths and cycle lanes separating and protecting users from the high speed of motorized transport.

Insecurity and obstruction of walkways were also cited as factors increasing accident risk. 89.2% of pedestrians cited lack of supportive infrastructure for NMT and 78.5% of pedestrians felt motorized transport users did not respect them on roads (NCG, 2015). The same study found that accidents involving pedestrians accounted for 71.7% of accident casualties.

In 2016, Nairobi recorded 13,463 road fatalities (WHO, 2018) and pedestrians were the highest casualties at 37% and cyclists at 2% (NTSA, 2016). A total of 186 people were killed in traffic collisions in Nairobi between January and July 2018, accounting for 22% of all traffic fatalities in Kenya (NTSA, 2018)¹. Pedestrians and motorcyclists are the most seriously and frequently affected by road traffic collisions, and belong to the lowest income groups.

¹ NTSA, traffic fatalities in Kenya, 2018)

Road infrastructure design also creates safety concerns for non-motorised travel as many are in close proximity to cyclists and pedestrians, resulting in mobility friction, discomfort, limited access and reduced mobility for walkers and cyclist (Cresswell, 2010).

In a research review on HIV treatment and care in sub-Saharan Africa, (Lankowski et al., 2014) found that transportation related barriers have a significant influence on unfavourable HIV health outcomes, along the whole care period. The negative impacts of transportation were in terms of time, cost and quality of infrastructure. Patients reported delayed treatment, missing clinic visits, dropping out of care or forgoing HIV testing due to lack of money or poor road conditions and difficulty in accessing reliable transport. In the same field, Andrews et al. (2013) established that public transportation was a significant factor is sustaining tuberculosis rates in South Africa, due specifically to poor ventilation and high respiratory contact rates.

High levels of noise pollution are associated with health problems such as cognitive impairment, stress, fatigue, and sleep disorders (Berglund et al., 1999; WHO, 2011). Transport time and length have been correlated to negative affective, cognitive and behavioural outcomes at the end of a trip (Hennessey, 2011). Skinner, Wu, Schweizer, According to UNEP, about 1.2 million MT related fatalities occur annually, mostly in developing countries, Residents in low-income neighbourhoods of Nairobi who frequently use footpaths parallel to gridlocked traffic experience high levels of pollution (Salon and Gulyani, 2010; 2019; WHO, 2018).

Availability of sidewalks, density of population and aesthetics quality may affect the frequency of daily walking by individuals (Roux, 2003). The spatial experience of NMT users (walking) as measured objectively by physical environmental variables have positively associated increased frequency of walking with transportation walking and sidewalk presence with frequency of recreational walking (Lee and Moudon, 2006). Transport is an asset that enlarges the boundaries of people's freedoms, choices, opportunities and wellbeing by facilitating individual relationships with others and social institutions (Stock and Duhamel, 2005). In a cross-sectional study looking at correlates for transport walking, Lee and Moudon (2006) found higher social support seeking explaining people's walking behaviour.

As such, transport provides avenues for people to be human, for themselves and for others (Brofennbenner, 2005). Indeed, physically and economically disadvantaged groups are able to build social capital, through social participation, mutual assistance and trust (Currie and Stanley, 2008).

In Nairobi, workers residences and job locations are not well connected and low income workers travelling by foot are able to access on average less than 10% of jobs within an hour (Nakamura and Avner, 2021). This limits the accessibility of poor populations to economic opportunities in distant parts of the city, restricting their potential for upward social and economic mobility. Friendship and family interactions become less, decreasing social engagement, which in turn limits the level of social support, with potential negative consequences to mental health.

Consequently as transport infrastructure in Nairobi transitions to one that is more human oriented (Acevez-Gonzalez et al., 2020), it is hoped that equitable access to markets, products, services, social connections and recreational facilities will be planned, designed and built. It is hoped that the increasing attention given to good quality NMT facilities will result in visible cultural shifts regarding walking and cycling as non-segregate modes of transport and unrepresentative of the poor. Servaas (2000) suggests that too much focus on motivating non-NMT users to walk or cycle, ignores the imagery power of social status. Efforts should instead be directed at NMT road users (who are the majority) rather than trying to get MT road users out

of their cars, by improving NMT transport facilities for ease, connectivity, comfort etc. (Wilson, 2002).

The Kenya Alliance of Resident Associations (KARA) in collaboration with the Nairobi County Government (NCG) and United Nations Environment Programme (UNEP) developed a Non-Motorized Transport (NMT) Policy for Nairobi in 2015. The Nairobi city county NMT policy objective is to increase mobility and accessibility by increasing modal share of walking from 47% to 50% for trips less than 5 kilometres by 2025. It is expected, this will reduce pedestrian fatalities from 500 to 50 per year by 2025. To enable diverse income groups choose NMT as mode of movement, a dedicated NMT fund to accelerate NMT infrastructure growth was set up. (KARA,2020.)

This paper adds to the body of research by increasing measures of the range of pedestrian experience variables when using transport infrastructure in an under resourced NMT context. This will provide evidence for infrastructure and environment enhancement, making walkways more human centered in design (Aceves-Gonzalez et al., 2020). Mittulah and Makajuma (2009). call for more holistic research of entire environmental factors that cover NMT user experiences as perceived by pedestrians in Nairobi city, beyond security, safety, comfort and convenience. Lee and Mouton (2006) also called for further research in social variables within the realm of social support and their association with walking and walking frequency. The perspective of the user experience becomes an opportunity for urban design research (Liu et al., 2018) to improve the NMT user experience by integrating the physical, social, economic, ideological and historical contexts (Cresswell, 2010) in infrastructure design.

This study extends the research to include how the built and natural environment transforms personal wellbeing among resource constrained users and builds equitable access to socio-economic activities. This study can contribute to theory development in the field of non-motorised mobility, whose scarcity has hampered the development of infrastructure that is useful and safe for cyclists and pedestrians (Koglin and Rye, 2014). In methodology, previous studies have focused attention exclusively on NMT in low income neighborhoods. This study expands the socio-economic dimension by covering five corridors in upper middle income areas bordering high density low income "slum" settlements.

Methods

This study involved an on street questionnaire that collected the perception of 30 pedestrians on connectivity, mobility, safety, aesthetics, personal wellbeing and socio-economic reasons for using walkways. An individual's subjectively experienced feelings are important in evaluating a built environment (Hosany et al., 2007). The sampling method was convenience because of the need to capture a representative sample.

Study design

An on street questionnaire was applied to collect the perception of 30 pedestrians on connectivity, mobility, safety, aesthetics, personal wellbeing and socio-economic impact in 3 middle and lower income neighbourhoods in Nairobi ; along Thika highway, Kasarani, Ngong road in Kilimani and Ring road in Kileleshwa. (all representing high walkability areas). Walkability was by the availability of concrete walkways along the roads. The three areas were selected because of heir large middle income populations next to large settlements of low income populations thereby creating a more representative income population.

Study site

The population for this study were pedestrians along four select road corridors in Nairobi that have been designed and built with separate pedestrian, cyclist and motorized lanes, namely: 1) Thika Highway (Kasarani); 2) Ngong Road –(phase one from Kenya National Library to Prestige Plaza), Western Ring Road (Kileleshwa), Jogoo Road (Makongeni) and United Nations Road (Gigiri) as shown and respectively numbered on the map below.



Study site

- 1) Thika Highway from Ngara to Kasarani (in Ngara street patterns are regular, while irregular in Kasarani and Jogoo road from Donholm to Kaloleni (Street pattern largely irregular)
- 2) Ngong road from Kenya National library to Lenana school exit (From Ngong road regular grid pattern and irregular towards Lenana school) and the Western Ring Road from Westlands roundabout to Kileleshwa, Hurlingham and Lavington (From Westlands to Lavington, largely regular grid).
- 3) Two corridors: The western ring road from Westlands roundabout to Kileleshwa, Hurlingham and Lavington and Ngong road from Kenya National library to Lenana school intersects with high density upper middle income neigbbourhoods as well as high density low income slums such as Kibra, the largest slum settlement in Kenya is within close proximity of Ngong road and another high density small slum at the edge of Lavington and lower middle income settlements close to Lenana High school.

The study areas are similar in that they have newly built walk ways leading directly to the city centre and away from city centre directly to the neighbourhoods or their periphery. Two corridors, Thika highway from Ngara to Kasarani and Jogoo road from Donholm to Kaloleni cut through high density largely low and lower middle-income neighbourhoods, interspersed within proximity with very small pockets of low density high-income areas such as Muthaiga and Garden estate

Participants on street questionnaires

An on street questionnaire was given to a convenient sample of 30 pedestrians. Participants were walking on the road and questionnaires were given face to face. Selection of participants was done off peak hours and it was noted that there were few pedestrians and most were male. To avoid bias (Robson, 2011) through non-representation of population segments, every person was invited to be part of the survey. If a pedestrian refused to participate, the next pedestrian was approached.

Participants were informed of study objectives, confidentiality, number of survey questions, and their right to refuse to participate at any time during the process. The questionnaire (Fig I) in Appendix) comprised of six socio-demographic questions on age, gender, occupation, area of residence and rent bracket. The second part comprised of transport destination questions and their frequency. The third part comprised of 33 questions to be responded with responses on a five point scale, "strongly disagree", "disagree", "neither agree or disagree", "agree", "strongly agree" with a column next to each statement to provide explanations if desired

Data analysis

Quantitative data from the questionnaire was analysed using SPSS software. Statements were classified as categorical variables. Data with a responses of 1 and 2 were recorded as negative ratings and 4 and 5 as positive ratings and vice versa if the statements were framed negatively. The Chi-squares and Yates correction to determine the significant difference in frequencies of occurrence among participants statements was not done. The reason was to prevent estimation of statistical significance for small data (in this case N = 30). Another reason is that some cells on the contingency table had counts smaller than 5, yet a Yates correction requires a minimum of 5 in each category. A smaller number may lead to an overcorrection.

value of Cronbach's alpha coefficient r was .454 for the items in the mobility dimension on Likert scale, .329 for safety and security and .337 for personal wellbeing For a good measure of internal validity and reliability r should be .70 or above. A low Cronbach coefficient in this study may be explained by the low number of questions per dimension. For example, connectivity had 3 questions and mobility 6 questions. Few question may result in a low Cronbach coefficient. Increasing more questions per dimensions may have increased the r value.

Qualitative data from The explanations of some respondents was captured and analysed thematically using Nvivo.

On street questionnaire statistics

Gender distribution was 83.3% male and 16.6 female. In the survey 76.7% of the respondents

were below 35 years while 23.5 % were above 35 years. The participants who had university level of education comprised 33.3 %, college 26.6%, secondary school, 26.6% and primary school 6.7% and others 3.3%. Participants (53.3%) above the age of 35 years strongly agreed or agreed they experienced noise pollution compared to 20% below 35 years. The difference was statistically significant though those over 35 years were only 16% of the sample population .The results may therefore be skewed due to the small sample of respondents, location and times of survey. The most dominant reasons for walking was to work, 74.1%, physical activity at 61.2%, shopping and restaurants at 61,2%.

Looking at results from indicators of walking, in the aesthetic dimension, 50% of participants with university education agreed or strongly agreed that flower beds were insufficient compared to the percentage among those without university education at 81.3%. More than 86.7% of respondents agreed or strongly agreed that benches were needed along the walkways. Given that 74.1%, of the participants walk the distance to work and back two times a day, the need for cool rest full places is perceived as useful to their potentially long distance movements.

Most pedestrians also fall within the lower income bracket as seen in low rental payments, where 100% of pedestrians interviewed in Kasarani and Ngong paid rent of less than \$155/month and 70% and 90% in Kileleshwa. A slight majority, 56.6% however agreed that Zebra crossing were not safe for pedestrians to cross.

| Characteristics | Survey of respondent characteristics | | | | | | | | | |
|---|--------------------------------------|--------------------------|-------------------|-----------------------|------------------------|-----------------|-----------------------|---------------------|----------------------|-----------------------|
| | | Kileleshwa neighbourhood | | | Kasarani neighbourhood | | | Ngong neighbourhood | | |
| | | | Lower Income % | Higher Income % | | Lower Income | Higher Income % | | Lower Income % | Higher Income % |
| Number of Respondents | 11 | 1 | 5 | 5 | 10 | 10 | 0 | 10 | 10 | 0 |
| % of male | 83 | 8 | 40 | 40 | 81 | 100 | 0 | 90 | 100 | 0 |
| % of female | 16 | 2 | 10 | 10 | 18 | 100 | 0 | 10 | 100 | 0 |
| Age % less than 35 Years | 80 | 7 | 40 | 20 | 100 | 100 | 0 | 70 | 100 | 0 |
| Age % above 35 years | 16 | 3 | 20 | 20 | 0 | 0 | 0 | 20 | 100 | 0 |
| % university education | 33 | 4 | 10 | 30 | 27 | 100 | 0 | 30 | 100 | 0 |
| % college and below Education | 64 | 4 | 80 | 20 | 73 | 100 | 0 | 80 | 100 | 0 |
| % of monthly house rent of less than 25,,000 shillings (\$155) per month | 74 | 5 | 50 | 0 | 73 | 100 | 0 | 100 | 100 | 0 |
| % of monthly house rent of more than 25,,000 shillings | 16 | 5 | 0 | 50 | 0 | 0 | 0 | | 0 | 0 |

Table 1. Study area and survey respondent characteristics

| (over \$155) per month | | | | | | | | | | |
|---|----|---|----|----|----|-----|---|----|-----|---|
| % students | 19 | 1 | 10 | 20 | 27 | 100 | 0 | 20 | 100 | 0 |
| % formally Employed. Incomplet e Survey answers | 45 | 6 | 70 | 30 | 36 | 100 | 0 | 40 | 100 | 0 |
| % informally Employed. Incomplet e survey answers | 25 | 3 | 90 | 10 | 27 | 100 | 0 | 20 | 100 | 0 |
| Unemployed | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Note* Income brackets used as proxy for lower or higher incomes. Lower income 25,000 or less. Higher income above 25,000.

The results on connectivity were significant as 80.5% of respondents strongly agreed or agreed that the walkways were seamlessly and quickly connecting them to their destinations as well as to public transport at 58.4%. "Accessible to all areas". A slight majority,48.4% felt business activities on walk ways impeding their movement "A lot of interference coz you don't move" but providing access to much needed products and services,

"They enable us to access necessary resources such as markets that sell food drinks, household equipment, electrical appliances aesthetic products like tapestry and fishtanks" Motorbikes on walkways were perceived as hindering movement at 58% compared to those in disagreement at 35.5%. In the qualitative analysis they were associated with the theme of endangering lives. "Especially Boda boda they endanger my life too. Especially boda boda who are in a hurry"

There's a general consensus that features like barrier separation from roads and traffic lights along walkways contribute positively to safety perception. In this study there is a statistically significant response. Those who strongly agree or agree, 74.2% compared to 7% who don't, that barriers are an effective protective shield from physical harm. Traffic lights are generally associated with safety, however in this case only 38.7% feel that traffic lights heighten their perception of safety, while a lower percentage at 29.1% feel traffic lights do not support their sense of safety. "We don't have much traffic lights and most drivers don't adhere to them". The perception differences are not significant, suggesting traffic lights do not play an important role in pedestrian mobility as they are not integrated Reasons for this anomaly would be useful to address.

Crossing road junctions from walkways and the speed of cars are aspects that have mixed responses indicating areas of safety concern for pedestrians and potential areas for improvement. "There are a lot of hit and runs especially on weekends" 35.5% of the respondents don't feel safe with the speed of cars while 45,1% feel safe. In the qualitative Nvivo analysis, there were 13 direct references to speed. There is need to determine whether crossing at junctions is perceived as safer with installation of traffic lights and also the potential paradoxical impact of installing traffic lights when almost half of users feel traffic lights do not enhance physical safety.

Zebra crossing, a feature designed for safety has a relatively low lower perception of safety compared to other features with a significant percentage indicating disagreement or strong disagreement. "I do not feel safe because sometimes even vehicles are

not able to stop at zebra crossings"

Each category: trees, cleanliness, flowers, and resting benches. The categories represent different aspects of the environment that contribute to the overall aesthetic perception. The majority of respondents' perceived trees positively in terms of aesthetics as 61.2% agreed there was unsatisfactory tree coverage. For cleanliness responses are evenly distributed with a slight majority of 45.2% agreeing that the walkway environment is clean. A majority of respondents strongly agree that there are not enough flowers 61.4% indicating that flowers are perceived positively in terms of aesthetics. A significant percentage, 86.7% agree that benches along the walkway would be desirable and contribute positively to personal wellbeing. "This makes the tired and sick people to relax before they continue their walk" compared to 6% disagreeing. Overall, trees, flowers, and the availability of resting benches are perceived positively with significant majority of respondents 61.4% indicating dissatisfaction with the absence of flowers and or dissatisfaction with their lack of presence.

However, it's important to note that the interpretation of aesthetic perception can vary among individuals and may be influenced by factors such as personal preferences and cultural background. Approximately one third of respondents (32.2%) of respondents agree air pollution is a problemWhile more than two thirds, 74.1% feel the levels of noise pollution are high. 77.4% associate walking on walkways with reduced levels of stress. Equally important is 80.7% of respondents attribute good feelings to walking. The perceptions of noise pollution indicate a significant concern among respondents. On the other hand there is positive perception regarding stress reduction and promotion of good health through walking with a majority of respondents agreeing that these health benefits are experienced when using the walkway. The results of the relationship between walking and stress showed that 86.7% agree that walking decreases stress levels with 10% saying it led to increased stress. "It increases my stress because I see myself poor and cannot afford to board a vehicle"

The safety perception analysis shows that people generally feel safer walking during the day at 80% compared to the night at 12.9%. A significantly higher percentage strongly disagrees with feeling safe at night at 32.2% compared to day at 3.2%. Among those above 35 year, 57% did not feel safe walking at night while 43% among those younger than 35 years felt unsafe. The difference is not wide suggesting that safety at night at 70%. It is a middle to upper Income neighbourhood and this perception may be explained by the existence of fewer commercial activities, more residential housing and quieter streets that influence safety perceptions, especially if there are non-functioning street lights and less pedestrian traffic. Insecurity perception for Ngong was at 60% which may be partly attributed to bordering the biggest informal settlement (slum) in with high poverty levels. This compares to Kasarani a low income to lower middle class neighbourhood with the highest levels of perception of safety at night at 20%. This may be explained by the walkway bordering a highway and many entertainment and informal businesses operating at night, therefore high pedestrian traffic.

Qualitative data and reasons for significant perceptions

Statistically significant percentages in categories of well being: benches needed 86.7%, 80.7% attributing good feelings to walking, 77.4% reducing stress, 66% desiring more flower beds. In safety zebra crossings were a safety concern, 56.6% while connectivity was almost largely agreed as efficient at 80.5% and barriers protecting from physical harm at 74.2%. There

were 10 mentions of boda bodas, public resources 11, necessary resources 13, noise pollution 6 mentions

Discussions

The aim of this study was to explore user perception of pedestrian experience using built walkways, an uncommon feature, along selected neigbourhoods in Nairobi city and on how this can help improve the design of walkways and the environment to support personal wellbeing and socio-economic life.

Regarding perception of pedestrian connectivity, more than half agreed or strongly agreed with connectivity to destination 80.5% and to public transport 58.4%. Availability of road signs to support movement was at 38.7%, as pedestrians named them as important elements in helping them regulate their speed and direction. In the mobility dimension boda bodas were referenced as slowing pedestrian movement at 58%. Boda bodas made pedestrians slow down because of physical safety concerns. In the safety dimension, while only 30% felt unsafe using zebra crossings, and 56.6% felt safe, this figure is not high enough as it suggests there's a significant percentage for whom the zebra crossing does not serve its predictable safety purpose and respondents suggests that drivers ignore the zebra crossing's function. For 58% the speed of cars not make them feel safe and only 50% feel traffic lights make them feel safe.

The majority of respondents felt that the walkways were aesthetically not meeting their need to rest by having resting benches, trees to reduce the effects of intense heat, flowers to provide a sense of positivity and a clean environment. Walking seemed to mitigate the pollutive effects of noise by reducing stress levels and increasing feelings of positivity among pedestrians.

While this study was not designed to quantify differences between groups of participants results it highlight that some characteristics may influence their views. Overall, results show that older people are more likely to have elevated safety concerns at night than younger populations suggesting walkway designs with less negative impact on older people's mobility decisions. An important result was that Zebra crossings and traffic lights do not give a sense of security to an overwhelming majority of pedestrians. The idea that the built environment does not guarantee safety without the willingness or enforcement of participation by both drivers and pedestrians. Lack of respect for pedestrian freedom, safety, traffic rules, speeding rules and reckless driving were identified as safety concerns. The perceptions on walking are also influenced by the cultural meaning given to it as a mobility mode-choice associated with low economic status (Cresswell,2010).

One of the most significant findings has been pedestrian need for spaces for personal health and wellbeing. Suggestions included being aware of the walking population being tired from walking to and from work as the majority, shown by this study and also providing resting space for the sick or elderly. Further research is needed in identifying enforcement measures around traffic lights and zebra crossings to improve the safety of pedestrians. This data provides useful and relevant information on designing human centered walkways that align the built environment, the behavioural environment and the aesthetic environment to personal well being and socio-economic health.

This study supports involving pedestrians in highlighting areas of concern and the fact that pedestrians are aware of their challenges and what they need to contribute to their success as individuals.Increasing safety measures especially during the night to address the disparity in safety perception. Enhancement of features such as barrier separation from roads and traffic lights and other enforcement measures requiring with compliance of travel safety rules would improve overall safety perception. A reevaluation and possible redesign of zebra crossings to increase safety perception and actual law enforcement of safety of these locations. Lastly addressing concerns related to road junctions and speed of cars will increase safety perception and actual safety at these locations

| Statement problems | Ethical oriented solutions |
|--|--|
| Road signs | |
| Personally I have never come across | Build more signs and information for |
| one | direction identification and speed |
| less signs on the side walk | management by pedestrians |
| Motorbikes (Bodaboda) | |
| they endanger my life too | Enforce law on no boda boda on walkways |
| boda boda are in a hurry | Boda boda should be compelled to follow traffic rules at |
| reckless riders | intersections and traffic lights |
| bodas along sidewalk | |
| Zebra crossings | |
| Vehicles and riders don't observe road | |
| signs | Law enforcement officers at Zebra crossings to normalize it as |
| Lack of bumps. | giving priority to pedestrians |
| Some aren't marked well | Traffic fines for non compliance |
| vehicles are not able to stop at zebra crossings | Cameras at intersections and zebra crossings |
| Traffic lights | Increase traffic lights to control behaviour |
| Riders don't use traffic lights properly | Law enforcement at traffic lights |
| Not much traffic lights | Install speed cameras especially at crossings |
| most drivers don't adhere to them | Pedestrians to only cross at intersections or zebra crossings |
| It takes much of my time | |
| I have not seen traffic lights at this | |
| Speed of cars | |
| drivers are reckless. | |
| They overspeed leading to accidents | |
| lot of hit and runs especially on | |
| weekends | |
| | |

| Table 2. | Challenges in | pedestrian | perception | of walkability | dimensions |
|----------|---------------|------------|------------|----------------|------------|
|----------|---------------|------------|------------|----------------|------------|

Policy in the county government of Nairobi, needs to shift form viewing walking as a mobility activity to one whose foundation is ethically based supporting economic development, boosting individual wellbeing and reducing the risk of sedentary diseases and isolation related mental health conditions.

Conclusion

In terms of physical connectivity, mobility, security and comfort the mobility needs of pedestrians are being met. The built environment, according to pedestrians is meeting their access needs. However mobility plays other functions. It is connected to social, mental , emotional and physical wellbeing. Pedestrians walkways will better serve communities if they are desiged with different goals in mind that build and strengthen personal wellbeing. Policy makers and transport departments now need to further focus on designing and building walkways in collaboration with sociologist and psychologists so that they address the emotional and physical needs of pedestrians. In laying a balanced emphasis on a balanced view of mobility: emotional, physical, economic, more people may be drawn to walking to reduce high levels of stress , generate more positive feelings and consequently lead to reduced incidence of lifestyle diseases associated with physical and mental health.

References

- Abuhamoud, M. A. A., Rahmat, R. A. O. K., & Ismail, A. (2011). Transportation and its concerns in Africa: a review. *The Social Sciences*, 6(1), 51-63.
- Aceves-González, C., Ekambaram, K., Rey-Galindo, J., & Rizo-Corona, L. (2020). The role of perceived pedestrian safety on designing safer built environments. *Traffic injury* prevention, 21(sup1), S84-S89.
- Agrawal, A. W., & Schimek, P. (2007). Extent and correlates of walking in the USA. *Transportation Research Part D: Transport and Environment*, *12*(8), 548-563.
- Ameli, S. H., Hamidi, S., Garfinkel-Castro, A., & Ewing, R. (2015). Do better urban design qualities lead to more walking in Salt Lake City, Utah?. *Journal of Urban Design*, 20(3), 393-410.
- Boehmer, T. K., Hoehner, C. M., Wyrwich, K. W., Ramirez, L. K. B., & Brownson, R. C. (2006). Correspondence between perceived and observed measures of neighborhood environmental supports for physical activity. *Journal of Physical Activity and Health*, 3(1), 22-36.
- Cerin, E., Macfarlane, D. J., Ko, H. H., & Chan, K. C. A. (2007). Measuring perceived neighbourhood walkability in Hong Kong. *Cities*, 24(3), 209-217.
- Cresswell, T. (2010). Towards a politics of mobility. *Environment and planning D: society and space*, 28(1), 17-31.
- Ewing, R., & Cervero, R. (2010). Travel and the built environment: A meta-analysis. *Journal of the American planning association*, 76(3), 265-294..
- Hennessy, D. A. (2008). The impact of commuter stress on workplace aggression. *Journal of Applied Social Psychology*, 38(9), 2315-2335.
- Hosany, S., Ekinci, Y., & Uysal, M. (2007). Destination image and destination personality. *International Journal of Culture, Tourism and Hospitality Research*.
- Koslowsky, M., Kluger, A.N., Reich, M., 1995. Commuting Stress: Causes, Effects, and Methods of Coping. Plenum Press, New York.
- Koslowsky, M., Aizer, A., Krausz, M., 1996. Stressor and personal variables in the commuting experience. International Journal of Manpower 17 (3), 4–14
- Krambeck, H. V. (2006). *The global walkability index* (Doctoral dissertation, Massachusetts Institute of Technology).
- Krizek, K., Forsyth, A., & Baum, L. (2009). Walking and cycling international literature review. *Victoria Department of Transport, Melbourne, Australia*.
- Lankowski, A. J., Siedner, M. J., Bangsberg, D. R., & Tsai, A. C. (2014). Impact of Geographic and Transportation-Related Barriers on HIV Outcomes in Sub-Saharan Africa: A Systematic Review.
- Lee, C., & Moudon, A. V. (2006). Correlates of walking for transportation or recreation purposes. *Journal of Physical Activity and health*, 3(s1), S77-S98.
- Lee, C., & Moudon, A. V. (2004). Physical activity and environment research in the health field: Implications for urban and transportation planning practice and research. *Journal of planning literature*, 19(2), 147-181.

- Leslie, E., Coffee, N., Frank, L., Owen, N., Bauman, A., & Hugo, G. (2007). Walkability of local communities: using geographic information systems to objectively assess relevant environmental attributes. *Health & place*, *13*(1), 111-122.
- Lo, R. H. (2009). Walkability: what is it?. Journal of Urbanism, 2(2), 145-166.
- Mittula, W. and Opiyo, R. (2012). Mainstreaming non-motorised transport (MNT) in policy and planning in Nairobi: institutional issues and challenges. *Southern African Transport Conference, 9-12 July 2012, Pretoria, South Africa.*
- Njoh, A. J. (2000). Transportation infrastructure and economic development in sub-Saharan Africa. *Public Works Management & Policy*, 4(4), 286-296.
- Njoh, A. J. (2012). Impact of transportation infrastructure on development in East Africa and the Indian ocean region. *Journal of Urban Planning and Development*, 138(1), 1-9.
- Olvera, L. D., Plat, D., & Pochet, P. (2008). Household transport expenditure in Sub-Saharan African cities: measurement and analysis. *Journal of Transport Geography*, 16(1), 1-13.
- Pirie, G. (2014). Transport pressures in urban Africa: practices, policies, perspectives. *Africa's urban revolution*, 133-147.
- Ranne, J. (2019). Designing for multisensory experiences in the built environment. Masters' thesis.
- Roux, A. V. D. (2003). Residential environments and cardiovascular risk. *Journal of Urban Health*, 80(4), 569-589.
- Salon, D., & Gulyani, S. (2019). Commuting in Urban Kenya: Unpacking Travel Demand in Large and Small Kenyan Cities. *Sustainability*, 11(14), 3823.
- Salon, D., & Gulyani, S. (2010). Mobility, poverty, and gender: travel 'choices' of slum residents in Nairobi, Kenya. *Transport Reviews*, *30*(5), 641-657.
- Servaas, M. (2000). The significance of non-motorised transport for developing countries: Strategies for policy development.
- Sub-Saharan Africa Transport Policy Program
- Thambiran, T., & Diab, R. D. (2011). Air pollution and climate change co-benefit opportunities in the road transportation sector in Durban, South Africa. *Atmospheric Environment*, 45(16), 2683-2689.
- UN World Urbanisation Prospects (2018). United Nations Department of Economics and Social Affairs. <u>https://population.un.org/wup/</u>
- UN environment programme (2019). Kenya prioritizes non-motorised transport to enhance road safety. 27th February, 2019.
- van Lenthe, F. J., Brug, J., & Mackenbach, J. P. (2005). Neighbourhood inequalities in physical inactivity: the role of neighbourhood attractiveness, proximity to local facilities and safety in the Netherlands. *Social science & medicine*, *60*(4), 763-775.
- Vasconcellos, E. A. (2014). Urban Transport Environment and Equity: The case for developing countries. Routledge.
- Weinstein Agrawal, A., Schlossberg, M., & Irvin, K. (2008). How far, by which route and why? A spatial analysis of pedestrian preference. *Journal of urban design*, *13*(1), 81-98.
- Wilson, S. (2002). Assessment of the Non-Motorized Transport Program in Kenya and in Tanzania. Sub-Saharan Africa Transport Policy Program. World Bank, Washington, DC, USA.

- World health Organisation, (2018). *Global status report on road safety 2018*. Retrieved from http://www9.who.int/violence injury prevention/road safety status/2018/en/
- World Health Organization. (2011). Burden of disease from environmental noise: Quantification of health life years lost in Europe. World Health Organization. Regional Office for Europe.
- Wurhofer, D., Krischkowsky, A., Obrist, M., Karapanos, E., Niforatos, E., & Tscheligi, M. (2015, September). Everyday commuting: prediction, actual experience and recall of anger and frustration in the car.
- Zhang, R., Zhang, C. Q., Wan, K., Hou, Y. S., & Rhodes, R. E. (2020). Integrating perceptions of the school neighbourhood environment with constructs from the theory of planned behaviour when predicting transport-related cycling among Chinese college students. *European journal of sport science*, 1-10.

IMCL Conference 2024

Paper for e-reader

From the dissertation of Veronica Westendorff

URBAN HEAT ISLANDS AND COOLING STRATEGIES: A COMPREHENSIVE ASSESSMENT OF CHARLOTTE, NC AND NATIONAL COMPARISONS

A dissertation submitted to the faculty of The University of North Carolina at Charlotte in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Infrastructure and Environmental Systems

Using Urban Heat Health Score to Compare the Heat Health of Different Locations in the United States

ABSTRACT:

With increasing urbanization, determining the severity of Urban Heat Island (UHI) phenomena and its variations between regions and neighborhoods presents a difficult challenge. This research introduces a novel metric, urban heat health score (HHS) designed to facilitate the presence of and severity of UHI. As UHI is unique to each city, a strictly temperature-based approach will not be effective. A comparison or continuum between the "urban" or densest area and surrounding rural or "rural-like" area provides more insight to the heat health of these areas. Differences in daily average high temperature between these locations and land cover of tree and shrub areas, compare the Heat Health Score (HHS) allows municipalities and community groups to rate the heat health of locations. Results show

that most urban locations remain hotter and with lower vegetative cover than their suburban or rural counter parts.

Keywords: heat health, heat health score, land use, land cover, urban heat island

1 Introduction:

In the past decade, Urban Heat Island (UHI) has become a topic of great concern. Rather than simplifying or even clarifying the causes and effects of UHI in cities, we have instead found that the process is more complicated. The effects of different weather, regions, rainfall, water bodies, latitude, wind patterns, elevation, and building canyons all influence UHI and create unique situations in each city that do not lend themselves to improvement by any one single method. This poses a greater challenge for small municipalities, nongovernment or design agencies and just regular people trying to understand the effect of programs and policies on the everyday wellbeing of their community. Urban trees provide many benefits. Urban forests can sequester carbon (Godwin, Chen & Singh, 2014) and trees provide aesthetic and health values for humans (Williams, 2017). Trees provide economic benefits estimated \$18.3 billion in the United States annually (Peterson et al. 2020). While urban zones are warming at twice the rate of rural zones, trees have been shown to reduce air temperature; a 40% increase in urban tree cover decreased air temperatures by an average of 1.8 to 3.6°F (Urban Heat Island Management Study, 2017). A study by Salmond et al (2016) of Phoenix, AZ showed a 20% increase in vegetation decreased average daily temperature by 7.18%. Additionally, street tree shading can reduce building wall temperatures by 9° Celsius thus reducing energy costs (Salmond et al, 2016).

With the continued increase in urbanization, the urban forest is facing more challenges than ever. More development creates more impervious area which limits the available space for urban trees (Yin et al, 2019). Disease, pests, storm damage, drought and age affect the canopy, which is an indicator for increasing heat in an area. Cooling is site specific and is nontransferable between areas making off site mitigation or payment in lieu options essentially useless for improving the site conditions. In many locations, there is a lack of understanding about how trees grow, how to maintain them, what services and disservices they offer that prevent long lasting choices for tree canopy locations and species (Anderson et al, 2021). One of the largest challenges in replanting is following the "Right tree, right place" philosophy that sets urban spaces up for successful tree survival and benefits for the long term. Finally, monitoring trees for health and maintenance is limited, with confusion over public versus private lands and who is responsible for such work (Anderson et al, 2021).

2 Objective:

Trees provide essential ecosystem services including reducing heat, but how does one define an area as "having UHI?" When communities and their leaders want to understand how to define urban heat island and address the areas that need attention, how do they do this? Filho et al (2018) in their literature-based study, point out that different climates need different approaches. Using heat, or days over 32° C to assess vulnerability to UHI has limitations. For example, in temperate climates, an increase of 1-11 days over 32° is a significant increase, whereas in cities located in hotter climates, the increase in days over 32° is more in line with 1956 more days (Filho et al, 2018). Although the range is quite different, the more temperate environment is often not seen as vulnerable as the sub-tropical or tropical environments. This can lead to a false sense of heat health. While it would seem to suggest V.E. Westendorff

that UHI is not as big an issue for those living in more temperate areas, the effects are felt and equally challenging to manage.

Urban areas must find a way to meet these challenges to the urban forest. Indeed, in my professional experience, many areas do not have the funding or staff to allocate to manage UHI issues. A simple method to compare areas that uses free, easily accessed tools is greatly needed. This type of tool could be used to influence leaders and community members to act, which includes implementing the policies and programs in place in other cities across the United States.

Policies and programs that can be implemented to address UHI include:

- Tree protection ordinances (larger older trees provide more benefit)
- Landscape ordinances to add new trees and vegetation
- Climate Action Plans
- Public/Private groups to plant trees and educate
- Tree health monitoring
- Tree maintenance and management

With these policies and programs in mind, which have proved to be the most effective across

the United States to reduce UHI in cities using trees?

- What differences do location, developed area and tree cover experience in temperature?
- How can we compare heat health between urban/suburban/rural areas around the city?
- Can urban Heat Health Score (HHS) explain the relationship between land cover and temperature? Does this support the policies and programs areas currently employ?

UHI phenomenon is unique to each city, and so a strictly temperature-based approach to define if an area has UHI will not be effective. While literature shows connections between UHI and land cover, it becomes a comparison or continuum between the "urban" or densest area and surrounding rural or "rural-like" area. By looking at the difference in daily

average high temperature between these locations and comparing that to the land cover of tree and shrub areas, a score to rate the heat health can be created. This paper will fill the gap in methods to score or rank parts of cities based on a ratio or urban heat health score to compare areas through a continuum of values that reflect the presence of and severity of UHI. With this HHS, comparisons of temperature and land cover for different locations reveal the impact tree cover has on daily high temperatures in areas across the US, providing a system for evaluating heat impacts down to the neighborhood scale.

3 Methodology:

A review of literature shows that tree cover directly influences the land surface temperature of an area (Miner et al. 2017; Ziter et al., 2018). There is a gap in defining where UHI is present, comparing different locations in cities and across the US, and what, if any, policies for tree cover influences this. Having lived and practiced landscape architecture for the past 30 years in the metro area of Charlotte, NC, the author has seen the city transition from a secondary size (at best) location to one of the largest in the United States. One of the most amazing assets that Charlotte has is its majestic tree cover, once making the city almost invisible when flying overhead, and now facing serious canopy loss due to growth, age, pests, climate changes and changes in the value the population places on trees. As Charlotte continues to benefit from the growth in the area, protecting this valuable resource to maintain the title of "Tree City" has become a goal of many groups, and one that is held dear by many. This makes Charlotte an excellent case study for this research on the role of trees in mitigating urban heat island. The American Council for Energy Efficient Economy (ACEEE) has created a list of cities in the United States that have policies and programs in place to address UHI. From this list (64 cities when last updated in 2020), 50 of the cities listed used V.E. Westendorff

trees and vegetation to manage UHI (ACEEE 2020). The variety of ideas, programs, policies, partnerships, processes and funding across these cities, showcases how complicated UHI can be and emphasizes the inability for a single approach to meet the needs of any given place, partially because of the difficulty in defining when an area is experiencing changes in heat health. However, certain similarities in climate, biome, and environments do have common approaches, and this paper seeks to clarify which policies and programs are effective for cities like Charlotte, NC, with temperate climates.

The following six cities were selected from the ACEEE list to provide examples of different strategies in place to address UHI, that are somewhat similar in climate and scale to Charlotte, NC, and offer a variety of UHI strategies. Table 1 summarizes the programs and policies in place for these cities.

- Atlanta, GA, nearby large city to Charlotte, provides a good example for monitoring heat in the city to identify both corridors of use and hot spots. UrbanHeat ATL uses volunteers to carry portable sensors to take temperature along the path they walk or bike. The group Atlanta City Design: Nature identifies street corridors that can be used to increase street trees to reduce heat. Protection of the urban forest is a high priority (UrbanHeatATL.org, 2023).
- 2. Dallas, TX, enforces their tree protection policies with costly tree replacement values, based on classifications prescribed by their ordinance. Values are derived from the tree age, size, species. Historic trees are valued at a 3:1 ratio (replacement value= RV \$579/inch at diameter breast height), significant trees valued at a 1.5:1 ratio (RV \$290/inch dbh) and other classes of trees range

from \$193- \$77 /inch dbh. In contrast, trees that are considered "trash" trees or invasive tree species do not have a replacement cost associated with their removal (Dallas City Hall Tree Mitigation Standards, 2018). Fees are placed into a special tree reforestation fund.

- 3. Hartford, CT has an Urban Forest Equity and Resilience Grant Program. This is used to fund projects that reduce tree cover inequity. It includes the planting, management and tree care to aid in the survival of the trees after they are planted (*DEEP Announces Urban Forest Equity and Resilience Grant Program*, 2021).
- 4. Louisville, KY completed the 2015 Urban Tree Canopy Assessment to create an interactive program that provides data on tree cover and heat at the neighborhood block level. Heat management scenarios and modelling of the status quo compared to cooling building materials and greening strategies allow users to compare the results and inform recommendations (Stone et al., 2019).
- 5. Raleigh, NC requires tree conservation on new developments, including tree protection on infill projects (less than 1 acre). Street protective yards along road right-of-way's are included as part of the Complete Street designs and a minimum of 1 shade tree per 2000 sf of parking area is required. Equity, resilience, sustainability and accessibility are part of their strategies (*Raleigh Strategic Plan*, 2020).
- Washington D.C. utilizes two different programs to address UHI. Sustainable DC plan focuses on mitigating UHI through the reduction of greenhouse gases (*Sustainability DC*, 2011) while the Climate Ready DC plan expands the

existing tree canopy with landscape codes and ordinances (Climate Ready DC,

2016). Priority is given to high risk and underserved areas of the city.

| Location | UHI Strategies including Trees | | | | | | | | |
|-----------------|---------------------------------|---|------------------------------|------------------------|-------------------------|---|---------------------------------|--|--|
| | Tree Protection Ordinance | Trees and Vegetation requirements | Canopy Cover requirements | Climate Action plan | Green Infrastructure | Sustainability Classifications (STAR, LEED, SITES, GBCI) | Monitoring and Management | | |
| Atlanta, GA | yes | yes | yes | yes | yes | yes | yes | | |
| Dallas, TX | yes | yes | yes | yes | yes | yes | yes | | |
| Hartford, CT | yes | yes | yes | yes | yes | yes | yes | | |
| Louisville, KY | yes | yes | planned (2018) | yes | yes | planned (2025) | yes | | |
| Raleigh, NC | yes | yes | yes | yes | yes | yes | yes | | |
| Washington D.C. | yes | yes | yes | yes | yes | yes | yes | | |

Table 1: Urban Heat Island strategies implemented by selected cities from ACEEE.org.

How do these cities determine if and how much UHI is impacting their communities and the success of these programs? Comparing the temperatures across the city provides a limited picture of the situation but is a good first step. To create a means of understanding the heat health of a location, data on temperatures was collected using PV Watts website (www.pvwatts.com). This website compiles sun exposure, ambient temperatures with satellite views to locations around the US. Data on temperatures is averaged over multiple years then compiled into a Typical Meteorological Year (TMY) and allows the user to see the land cover as well as which National Renewable Energy Laboratory (NREL) designated grid V.E. Westendorff for solar radiation and temperature the data came from. Using TMY has some drawbacks since many changes can occur in landcover over a multiple year period, but in the case of this paper, the use of TMY can provide many benefits that outweigh possible aging of the data. The website is free, designed to allow users to evaluate the suitability of specific sites for solar energy. This allows data to be collected in several important ways for this project:

- It is free.
- It is easy to use.
- Ambient temperatures at the site-specific level are available across the United States.
- NREL grids are highlighted so that areas with different data can be used without overlapping data.
- NREL provides temperatures based on TMY, at 5 m above ground. For this study, the year is 2020.
- Plan view and satellite views are both available. Satellite views are from Google Earth, which are updated every 1-3 years.
- Satellite views allow the user to see the approximate land cover of the site area.
- Hourly temperature data for each location is available and is consistent across test sites.

For comparison, a single day of the year is selected for the different cities. In the city itself, the Central Business District or main business core of the city is selected as the baseline for reference and labelled "urban". This becomes the area other locations are compared to as it is a location that we can agree is developed, predominately impervious and built out. For the comparison of other locations, areas are selected from each city, based on how "suburban" or "rural" they are. There is a large amount of discussion and definitions of what is suburban or rural, however, in many cities these lines are blurred. Residential communities once seen as suburban are becoming denser and more built out, and rural areas in some cases are so far out as to be in different counties or further. Therefore, for the purpose of this study, a location that is somewhat suburban or somewhat rural will be selected and used to model locations for each city. This is made through a visual assessment of impervious areas and green areas on the map image. Several sample cities are selected to make these comparisons, taken from the ACEEE website list and based on similarity to Charlotte, NC. An example of the website data is shown in Figure 1. First a developed area of the city, the central business district, is selected. This is our urban area. Next, an area outside of the central city business area with development, mostly residential type, and signs of green space or treescapes, is selected as a suburban type of area. And finally, a park, open space, natural area, forested area or other rural land use pattern is selected to represent a rural area more like what the cooler, undeveloped, non UHI affected area would reflect. This may be adjacent to the city, within the outskirts of the city or a nearby area, depending on how far the urban development of the city extends. For each of these, hourly temperatures are collected for the single day. These temperatures must all come from a different NREL grid. Temperatures are compared, looking at daily minimum, maximum and median, as well as the daily average. The difference between urban and suburban, and the urban and rural are calculated and evaluated.



ton David

Figure 1 PVWatts website was used to identify selected areas for temperature data. The PVWatt's energy and temperature data estimate is based on an hourly performance simulation using a typical-year weather file that represents a multi-year historical period for Charlotte, NC for a fixed photovoltaic system, at 2 meters above ground.

4. Analysis

July 14 was selected as a day likely to experience summer heat and serves as a starting point for data collection and analysis. The most recent temperatures for PV Watts were collected between 2019-2021 using data from the National Solar Radiation Database

V.E. Westendorff

Google

(NSRDB) geostationary satellites with temporal resolution of 10, 30 and 60 minutes and a spatial resolution of 4 km. Temperatures are shown in Celsius. For the urban area of Charlotte, NC on July 14 the daily minimum temperature was 22° C, high of 36°, median 27°, and average of 28°. Peak temperature occurred between 13:00 and 14:00 and the minimum temperatures were between 2:00 and 5:00. The location selected was partially impervious commercial area, and partially residential area with high tree cover and with high level of infrastructure. Similarly, a nearby suburban area, between Cornelius and Davidson, NC, experienced a minimum temperature of 19° between 1:00 and 4:00 am. The high temperature was 30° between 12:00-14:00, with a median temp of 23.5° and average of 23.9°. Land cover in this area is a mix of suburban residential with commercial areas, Interstate 77 and state highway 115. These two locations are somewhat similar however they vary by a range of 7° at 10:00 am (Charlotte was hotter).

In comparison, the more rural location of Mt. Mourne (Iredell County; Charlotte covers almost all the land in Mecklenburg County) recorded a high temperature of 30° C between 14:00 and 15:00. The lowest temperature of 19° was between 4:00-6:00 and again at 23:00. Median was 22.5° and the average was 23.8°. The differences in temperature between Charlotte and Mt. Mourne range from 1-7° hotter in Charlotte, with no case of Mt. Mourne being warmer at any time that day. Figure 2 displays the hourly temperature changes for July 14, typical meteorological year 2020. Table 2 contains the data derived from PV Watts for the three locations comprising information on Charlotte, NC.



Figure 2 Comparing urban, suburban and rural temperatures for July 14, typical meteorological year (TMY) 2020.

| Requested | | | Requested | - | Requested | |
|--------------|------------------------|---|--------------|------------------------|--------------|------------------------|
| Location: | Charlotte, NC | | Location: | Davidson,NC | Location: | Mt Mourne NC |
| | | | | | | - |
| | Lat, Lng: | | | Lat, Lng: | | Lat, Lng: |
| Location: | 35.21, -80.82 | | Location: | 35.49, -80.86 | Location: | 35.53, -80.86 |
| Lat (deg N): | 35.21 | | Lat (deg N): | 35.49 | Lat (deg N): | 35.53 |
| Lng (deg W): | 80.82 | | Lng (deg W) | 80.86 | Lng (deg W): | 80.86 |
| Elev (m): | 217.1600037 | | Elev (m): | 241.559998 | Elev (m): | 247.0500031 |
| Ur | ban | | Sub | urban | R | ural |
| Hour | Ambient Temperature | | Hour | Ambient Temperature | Hour | Ambient Temperature |
| 0 | 23 | - | 0 | 20 | 0 | 21 |
| 1 | 23 | | 1 | 19 | 1 | 21 |
| 2 | 22 | | 2 | 19 | 2 | 21 |
| 3 | 22 | | 3 | 19 | 3 | 20 |
| 4 | 22 | | 4 | 19 | 4 | 19 |
| 5 | 22 | | 5 | 20 | 5 | 19 |
| 6 | 24 | | 6 | 22 | 6 | 20 |
| 7 | 27 | | 7 | 24 | 7 | 22 |
| 8 | 30 | | 8 | 25 | 8 | 24 |
| 9 | 32 | | 9 | 26 | 9 | 26 |
| 10 | 34 | | 10 | 27 | 10 | 27 |
| 11 | 35 | | 11 | 29 | 11 | 28 |
| 12 | 35 | | 12 | 30 | 12 | 28 |
| 13 | 36 | | 13 | 30 | 13 | 29 |
| 14 | 36 | | 14 | 30 | 14 | 30 |
| 15 | 35 | | 15 | 29 | 15 | 30 |
| 16 | 34 | | 16 | 28 | 16 | 29 |
| 17 | 32 | | 17 | 27 | 17 | 28 |
| 18 | 29 | | 18 | 25 | 18 | 25 |
| 19 | 27 | | 19 | 23 | 19 | 23 |
| 20 | 26 | | 20 | 22 | 20 | 21 |
| 21 | 25 | | 21 | 21 | 21 | 21 |
| 22 | 25 | | 22 | 20 | 22 | 20 |
| 23 | 24 | | 23 | 20 | 23 | 19 |

Table 2 Daily temperatures for urban, suburban and rural type areas for Charlotte NC on July14, TMY 2020

This same process was applied to each of the example cities, and then each of the cities which responded to the survey sent to all the ACEE cities. Results for the example cities are discussed below:

 Charlotte, NC: On July 14, temperatures in Charlotte, center city in the uptown commercial area, reached a high of 30° between 12:00 noon and 14:00. The low temperatures were 22° C in Charlotte, and 19° C in both Davidson and Mt. Mourne.

Comparing the difference in hourly temperatures of Charlotte- Davidson with Charlotte-

Mt. Mourne shows a range of 1-7° of cooler temperature at all hours than in Charlotte. Suburban Davidson is an average of 4.42° lower and more rural Mt. Mourne has an average of 4.54° lower.

2. Atlanta, GA: Temperatures in Atlanta peaked at 33° between 13:00 and 14:00, while suburban Marietta reaching 32° during the same period. East Cobb, the rural designated location, reached a high of 31° for a more extended time between 12:00 noon and 15:00. Atlanta however, reached a low of 21° between 3:00 and 5:00 am as compared to

Marietta, which never got below 22°, which was maintained from 0:00 midnight through 6:00 am and again at 23:00. East Cobb reached a low of 19° between 4:00-5:00 am and again at 22:00-23:00. The higher temperatures during the nighttime in Marietta may reflect the effects of urban sprawl outside of the urban core of the city, new development with young tree cover or even more tree cover in the urban part of Atlanta.

3. Dallas, TX: The suburban location chosen was Bear Creek Nature Park, specifically selected to see the contrast between the urban center city area and a highly treed and greened space. The difference is the highest of the locations selected. While the suburban area of Cockerel Hill shows a range of difference in temperature from -1 to 1°, the rural park area ranged from 7 to 12° cooler than the urban center. Planning departments and city governments are not able to create park conditions continuously throughout the city, but the rural park location does show that the temperature

difference is worth noting and considering if "urban forest pockets" could bring similarly cooling effects within developed areas.

- 4. Hartford, CT: The urban area reaches a peak temperature of 27° earlier in the day (10-11:00 am) with a short period of the minimum temperature of 18° at 0:00 and 1:00 am. The suburban area of Central Manchester showed a slower increase in temperatures though out the day, peaking at 13:00 with 26°. Lowest temperatures were from 22:00-23:00 with 16°. The rural area of Glastonbury reached a peak temperature of 20° between 12:00 and 15:00 with lowest temperature of 15° between 1:00 and 6:00. While the peak high was held longer in the rural area, it was a significant 7° cooler than the peak temperature in the urban area. Rural area was 2-9° cooler than the urban area while the suburban area ranged from -2 through 5° difference.
- 5. Louisville, KY: In this example, suburban area of Floyds Knob was very similar to the temperature of the city center of Louisville differing by 0-.2°. The rural location of PeeWee Valley, a wooded natural area, ranged from 3.8-7.9° different. Temperature in PeeWee Valley reached a low of 14° between 2:00 and 4:00 am with a daily high of 26°. In comparison, for both urban and suburban areas, the daily minimum was 20° and high was 32.5 and 32.2° respectively.
- 6. Raleigh, NC: Urban temperatures ranged from 21-31°, suburban Ridgewood from 20-28° and rural Forest Park from 20-27°. The suburban area here peaks at 28° at 13:00 hour time slot, but that is the only peak temperature hour. City center reached 31° at the 11:00 and 12:00 time slots. Rural area peaks at 27° from 9:00 through 15:00, the longest span but remains the lowest temperature of the three. However, the suburban area tracked with the rural site, remaining similar in temperatures. This may show a

positive result from the ordinances already in place to preserve existing neighborhoods with older trees that are larger and denser.

7. Washington, DC: Washington DC urban area had temperatures n between 23 and 32°, with the rural area of Greenbelt Park ranging from 20-28°. In some cases, the difference was up to 5° lower in Greenbelt Park. Tacoma Park, a suburban neighborhood, had a range of 18.3-31.4°, reaching similar high temperatures between 10:00 am and 16:00, but cooled faster that the urban area and to lower temperatures than both the urban and rural areas.

A comparison of urban-suburban-rural temperatures for the example cities discussed here as well as the surveyed cities can be seen in figure 3.




V.E. Westendorff

Another way to determine the magnitude of UHI is to look at land use/land cover (LULC) as well as temperature. This can be accomplished using i-Tree Canopy, a free program developed by the USDA Forest Service (https://www.itreetools.org/). I-Tree is used by multiple municipalities in the creation of assessments, planning and data sets on tree canopy cover. Examples of cities from the ACEEE list which have used i-Tree in their assessments include Sacramento, CA; Tucson, AZ; Boise, ID and Pittsburg, PA. The methodology for determining percent land cover using i-Tree for all of the cities is:

- Sites for this study were selected both assuring different National Renewable Energy Laboratory (NREL) grids and different land use/land covers, as determined in the selection of locations using PV Watts for temperature data.
- A screen shot of the aerial maps from PV Watts was taken to show location.
- i-Tree used the PV Watts boundary for land cover data.
- Minimum of 100 random locations selected within the area boundary.
- Land cover/land use determined at each random location.

I-Tree is used to estimate the land cover for each area, and percent tree cover may serve as a proxy for UHI, with higher tree cover reflecting lower UHI effect. The boundary from the PV Watts website for each temperature station is copied into the i-TREE program, and a minimum of 100 points are selected at random from the site. These points are labeled into predetermined land cover categories, including tree/shrub, grass/herbaceous, impervious building, impervious road, impervious other, water and bare soil. Figure 4 is an example of the i-Tree calculations for Mt. Mourne, just north of Charlotte, NC. The results for the urban, suburban and rural locations are listed in Table 3.

i-Tree Canopy

Cover Assessment and Tree Benefits Report Estimated using random sampling statistics on 1/19/2023



No ANDER

| | | Land Cover | | Satemite | Map White | | Mar y | |
|-----------|--|-------------|--|----------|-----------|--------|--------------|-----------------|
| % Covered | 40% 30% 20% I 10% H IB IO Cov | IR S T W | 3mi ² Grass/Herbaceous 2.5mi ² Impervious Buildings Impervious Other Impervious Road 2mi ² Soi/Bare Ground 1.5mi ² Soi/Bare Ground 1.mi ² Soi 0.5mi ² 0.5mi ² | Google | | | | |
| Abbr. | Cover Class | Description | | | | Points | % Cover ± SE | Area (mi²) ± SE |
| н | Grass/Herbaceous | | | | | 20 | 20.00 ± 4.00 | 1.32 ± 0.26 |
| IB | Impervious Buildings | | | | | 2 | 2.00 ± 1.41 | 0.13 ± 0.09 |
| ю | Impervious Other | | | | | 3 | 3.00 ± 1.73 | 0.20 ± 0.11 |
| IR | Impervious Road | | | | | 5 | 5.00 ± 2.24 | 0.33 ± 0.15 |
| s | Soil/Bare Ground | | | | | 11 | 11.00 ± 3.13 | 0.73 ± 0.21 |
| т | Tree/Shrub | | | | | 39 | 39.00 ± 4.88 | 2.57 ± 0.32 |
| w | Water | | | | | 20 | 20.00 ± 4.00 | 1.32 ± 0.26 |
| Total | | | | | | 100 | 100.00 | 6.59 |

Figure 4: Example of i-Tree land cover results for Mt. Mourne

| Cover class | % | Cover class | % | Cover class | % |
|-------------|---|--------------------|---|-------------|---|
| Charlotte | | Davidson/Cornelius | | Mt. Mourne | |

Table 3: Land cover results from i-tree for Charlotte area.

| Urban | | Suburban | | Rural | |
|---------------------|-------------------|---------------------|---------------------|---------------------|-------------------|
| | | | | | |
| Grass/ Herbaceous | 0.19 | Grass/ Herbaceous | 0.1778 | Grass/ Herbaceous | 0.2 |
| Impervious Building | 0.16 | Impervious Building | 0.0444 | Impervious Building | 0.02 |
| Impervious Other | 0.16 | Impervious Other | 0.067 | Impervious Other | 0.03 |
| Impervious Road | 0.16 | Impervious Road | 0.111 | Impervious Road | 0.05 |
| Soil/bare ground | 0.02 | Soil/bare ground | 0 | Soil/bare ground | 0.11 |
| Tree/shrub | <mark>0.31</mark> | Tree/shrub | <mark>0.4667</mark> | Tree/shrub | <mark>0.39</mark> |
| Water | 0 | Water | 0.133 | Water | 0.2 |

With information from both PV Watts and i-Tree, the percent of land cover between urban/suburban and urban/rural can be compared. With these two variables ($\Delta temp/\Delta tree$ cover) a value for urban heat health score is created that allows for comparison between the heat health of different areas of a city.

3.4.1 Analysis of Charlotte:

For Charlotte, an area in the downtown was selected, followed by a nearby town, Davidson, which is a suburban community north of Charlotte (suburb) and Mt. Mourne (rural) although these areas have their own municipal governance and ordinances as well as county ordinances. Areas were selected with varying visible green space coverages to allow for greater comparison between the locations. Charlotte downtown has impervious areas that total 48% of the land cover. Tree and shrub cover is 31%, and turf or herbaceous ground cover is 19%. Davidson has 22% impervious land cover. Tree and shrub cover is 47% and turf and herbaceous cover decreases to 18%, showing more land area is dedicated to tree cover. Mount Mourne has only 10% impervious area with a high of 39% tree and shrub cover. In this situation, turf and herbaceous cover is also higher, at 20% due to large pasture and farmland. When land cover is compared with ambient temperature, we see Mount Mourne with its higher tree cover and lower built upon area shows lower temperatures across all hours of the day compared to Charlotte. The temperatures track in a similar pattern of highs and lows, with coolest temperatures occurring in the early morning hours. Davidson temperatures

and land cover show higher tree cover than Mount Mourne and provide a middle range between urban and rural type settings.

While observing land cover types can often predict temperature differences, this approach does not always explain the whole picture. UHI is influenced by elevation, wind and rain patterns, proximity to water, building locations and urban canyons, among other factors (Eastin et al., 2017), making it cumbersome to use to compare areas in a quick and effective manner. Instead, a method that includes both ambient temperature and percentage of land cover would create a way to compare smaller areas, even ones near each other and could have a practical application for planning departments, committees and neighborhoods to locate areas of concern and priority in tree planting. This Heat Health Score (HHS) is a unique metric that represents a continuum of differences in temperatures and land cover that allows one to see the effects of different land cover types on temperature in an area-effectively the heat health of that location.

Temperature is affected by landcover type and a comparison of temperature to land cover can show a range or continuum of differences in urban heat impacts and through the heat health score of a location (T1:L1 compared to T2:L2).

The formula for Heat Health Score (HHS) = $(\Delta T/\Delta L)$

It creates a value that reflects the relationship between the daily high temperature and the percentage of land cover with tree and shrub cover.

 ΔT represents the difference between the daily high temperature of the urban area (T1), less the daily high temperature of the suburban(T2) or rural (T3) area. (T1-T2) or (T1-T3)

 ΔL represents the difference in percent of tree/shrub cover between the urban area and either the suburban or rural area. (L1-L2) or (L1-L3)

| Variable combinations may b | e as follows: |
|-----------------------------|---|
| ΔT is positive | urban area is hotter than the suburban/rural. |
| ΔT is negative | urban area is cooler than the suburban/rural. |
| ΔL is positive | urban area has more tree cover. |
| ΔL is negative | urban area has less tree cover. |

These combinations result in positive or negative scores which represent different outcomes. Negative results show that either the urban area is hotter with less tree cover (the expected result), or that the urban area is cooler with more tree cover (a desired result). Positive results show the urban area is hotter with more tree cover or that the urban area is cooler with less tree cover. These results require a deeper look into the other possible causes for change in UHI. This ratio creates a score spanning little or no difference between the ratio of daily high temperatures and tree/shrub cover, to increasingly divergent results. Results may be positive, showing that the urban area is cooler that the area used to compare it to, or negative, with the larger the negative number, the greater the difference in HHS between the areas. The smaller the value, the greater the effect of UHI between two locations, and the higher the need for policies that regulate green spaces in those areas. The urban area is used as the base line, allowing one to see how divergent the city spaces are from the rural. The

results are often negative numbers, although that is not always the case. Table 4 shows the values for ΔT and ΔL for Charlotte compared to suburban Davidson and rural Mt. Mourne.

Table 4 Results of temperature and land cover for the Charlotte, NC area.

| Charlotte to Davidson | |
|-------------------------------|------|
| Tree/shrub | |
| | |
| Difference in daily high | |
| temperature urban/suburban °C | 6 |
| | |
| | |
| Difference in land cover %, | |
| urban and suburban | 16 |
| | |
| Difference in average temp °C | 4.42 |

| Tree/shrub | |
|-------------------------------|------|
| | |
| Difference in daily high | |
| temperature urban/rural °C | 6 |
| | |
| | |
| Difference in land cover %, | |
| urban and rural | 08 |
| | |
| Difference in average temp °C | 4.54 |

Heat Health Score (HHS)

HHS between the urban area of Charlotte and the suburban area of Davidson (6/-.16) = -37.5HHS between the urban area of Charlotte and the rural area of Mt. Mourne (6/-.08) = -75

There is a larger difference in the HHS between Charlotte and Mt. Mourne than the HHS between Charlotte and Davidson, showing that the effects of UHI are greater in Davidson than Mt. Mourne, with Charlotte's urban location feeling a larger impact from UHI than either of the other two communities. Table 5 reflects the i-Tree percentages for land cover in these areas.

| Charlotte to Davidson | | Charlotte to Mt. Mourne | |
|-------------------------------|------|-------------------------------|-----|
| Difference in land cover (%), | | Difference in land cover (%), | |
| urban and suburban | | urban and rural | |
| Grass/ Herbaceous | 12 | Grass/ Herbaceous | -01 |
| | | | |
| Impervious Building | 11.5 | Impervious Building | 14 |
| Impervious Other | 9.3 | Impervious Other | 13 |
| Impervious Road | 4.9 | Impervious Road | 11 |
| Soil/bare ground | 02 | Soil/bare ground | -09 |
| Tree/shrub | -15 | Tree/shrub | -08 |
| Water | -13 | Water | -20 |

Table 5 Land cover percentages determined through the selection of 100 random points using i-Tree Canopy.

4.2 Analysis of Multiple Cities

The comparison of urban/suburban/rural for Charlotte reflects expected results, but will this approach work in other areas? To explore that question, a survey regarding goals and policies addressing urban heat island was created and sent to the planning departments of each city on two occasions, July 17, 2022, and a follow up reminder on September 13, 2022. Appendix A contains the sample survey. Of those 50 cities surveyed, 16 responses from 14 cities were received. The temperature data from the cities that responded to the survey was used to learn about the perceived success of UHI policies implemented by each city. Using the same process for these cities as for Charlotte, PV Watts for neighborhood level ambient temperatures along with i-Tree software to determine the percentages of each land cover for the area, data from these next cities can be combined with the data from the 6 sample cities. Figure 5 shows both the ratio of change in temperature to change in tree and shrub land cover, the Heat Health Score, for urban to suburban and urban to rural.



Figure 5 shows the comparison of urban to suburban and urban to rural Heat Health Score. Both Boise, ID and Kansas City, MO had two respondents to the survey. Richmond, VA alt was included later to compare to the outlier rural location.

In these results the heat health is not always greater outside the urban core of cities as seen by the HHS. Suburban and even rural areas can experience higher effects from heat than their urban counterparts. Tree cover appears to be a major variable, but in cases where the HHS is higher in suburban and rural areas, we must explore other variables for answers. Table 6 shows the data for both the surveyed cities and the locations selected for literature review.

In many cities, the data reflected the expectations; urban area had higher temperatures than the suburban area. Boise, Charlotte, Seattle and Raleigh had the greatest difference between urban and suburban temperatures with 6° C, 6° C, 5° C and 4° C differences in temperature respectively. Dallas, Grand Rapids, Indianapolis, Orlando, Richmond and Tucson experienced no change in temperature between urban and suburban areas.

The difference in temperature between urban and rural sections of the city mostly followed this expectation. In some cases, rural areas remained the same temperature as their urban counterparts, for example Orlando and Philadelphia show no temperature changes in both areas. The other rural areas ranged from 0.2° C lower to the highest of 12° C difference. Three cities showed the reverse, however. Indianapolis Scott Starling Nature Preserve was 1° C warmer that the urban area, Richmond Forest Ridge was 2° warmer and Tucson Gates Pass Trailhead was 2° warmer. For Richmond, this can be explained by the reduced tree cover in the area selected as rural (it was a cemetery) but a higher grass/herbaceous percentage of 21%. Forest Ridge Park tree/shrub land cover category was 24% in the cemetery as well as having 12% water and a combined impervious covers and bare soil of 40% but Richmond urban area was a close 23% in tree cover 52% impervious areas and 6% water in the urban area. Turf or lawn can rate like impervious surfaces in heat adsorption, and this combined with the high impervious infrastructure in the cemetery may have raised the temperature. A second Richmond site, Stony Point, was selected for comparison, with a much higher tree cover of 69% tree cover, 14% impervious areas and bare soil, 10% grass/herbaceous and 7% water. These different land covers change the HHS between Richmond urban and rural to a 0, which suggests that the policies and programs for tree cover in Richmond should be looked at for insight.

Tucson is a very interesting case since the rural area of Gates Pass Trailhead is a natural area that is composed predominately by rock and low vegetation, both of which do little to minimize heat. Tucson's urban area has greater 2% tree/shrub cover than the rural area. Indianapolis Scott Starling Nature Sanctuary has a tree/shrub land cover of 58% versus the urban area's 15%, therefore would be expected to be significantly cooler. Since that is not

the case, other factors which might impact this result include elevation, cloud cover, wind patterns, urban canyons and albedo, and warrant closer inspection.

Land cover predominately followed the expected results. Urban areas had the highest percent of impervious surfaces, rural the lowest. Tree/shrub cover in the selected areas had more variation. Boise locations had the highest tree cover at 32% with Charlotte and Hartford close at 31%. Las Vegas had 5% and Phoenix had 8% tree/shrub cover in these built-up areas. In the suburban areas, Raleigh at 52% has the highest tree/shrub land cover of all the cities. Charlotte and Hartford have 47%, Seattle has 44%, and Washington, DC has 42%. Lowest tree/shrub cover in rural areas include Louisville at 10%, Phoenix at 11% and Tucson at 16%. The rural classification was meant to reflect the natural biomes of the areas, which in some cases it did. Raleigh "rural" tree cover was 61%, and Atlanta, 55%, which reflect the temperate forest of the mid-Atlantic while Tucson, 17% and Phoenix, 23% reflect the more arid landscapes (much of this % is low trees and shrubs). In Tucson this is particularly evident in the positive value of 2% more tree cover in the urban area than in the natural park setting due to ordinances and required plantings.

| | Location | | | Daily H | igh Tempera | ture ^e C | | | Landcover | (% of trees a | nd shrubs) | | Heat Health Score urban to suburban | Heat Health Score urban to rural |
|------------------|-----------------------|------------------------------------|------------|-------------|-------------|---------------------|--------|------------|-------------|---------------|------------|--------|--|-------------------------------------|
| City | Suburan | Rural | T1 (urban) | T2 (suburb) | T3 (rural) | ΔT1-T2 | ΔΤ1-Τ3 | L1 (urban) | L2 (suburb) | L3 (rural) | AL1-L2 | ΔL1-L3 | (S-U) SHH | HHS (U-R) |
| Atlanta, GA | Marietta | East Cobb | 33.00 | 32.00 | 31.00 | 1.00 | 2.00 | 0.19 | 0.38 | 0.55 | -0.19 | -0.36 | -5.26 | -5.56 |
| Boise, ID | West Bench | Robie Creek | 35.00 | 29.00 | 26.00 | 6.00 | 9.00 | 0.32 | 0.23 | 0.42 | 60.0 | -0.10 | 69.99 | 00'06- |
| Boise, ID | 6 | 2 2 | 35.00 | 29.00 | 26.00 | 6.00 | 00'6 | 0.32 | 0.23 | 0.42 | 60.0 | -0.10 | 66.67 | -90.00 |
| Charlotte, NC | Davidson | Mt. Mourne | 36.00 | 30.00 | 30.00 | 6.00 | 6.00 | 0.31 | 0.47 | 0.39 | -0.16 | -0.08 | -37.50 | -75.00 |
| Dallas, TX | Cockerell Hill | Bear Creek Nature Park | 39.00 | 39.00 | 27.00 | 0:00 | 12.00 | 0.25 | 0.26 | 0.45 | -0.01 | -0.26 | 0.0 | -46.15 |
| Grand Rapids, MI | East Grand Rapid: | s Aman Park | 26.20 | 26.20 | 26.00 | 00:00 | 0.20 | 0.31 | 0.43 | 0.58 | -0.12 | -0.27 | 0.00 | -0.74 |
| Hartford, CT | Central Manchester | Glastonbury | 27.00 | 26.00 | 20.00 | 1.00 | 7.00 | 0.31 | 0.47 | 0.42 | -0.16 | -0.11 | -6.25 | -63.64 |
| Indianapolis, IN | Glenroy Village | Scott Starling Nature Sanctuary | 27.00 | 27.00 | 28.00 | 0.00 | -1.00 | 0.15 | 0.29 | 0.58 | -0.14 | -0.43 | 0.0 | 2.33 |
| Kansas City, Mo | East Community | Coachlight | 37.00 | 36.00 | 36.00 | 1.00 | 1.00 | 0.19 | 0.40 | 0.54 | -0.21 | -0.35 | -4.76 | -2.86 |
| Kansas City, Mo | | 2 2 | 37.00 | 36.00 | 36.00 | 1.00 | 1.00 | 0.19 | 0.40 | 0.54 | -0.21 | -0.35 | -4.76 | -2.86 |
| Las Vegas, NV | Sun City | Red Rock Canyon | 37.00 | 36.00 | 36.00 | 1.00 | 1.00 | 0.05 | 0.25 | 0.08 | -0.20 | -0.03 | -5.00 | -33.33 |
| Louisville, KY | Floyds Knob | PeeWee Valley | 32.50 | 32.30 | 26.00 | 0.20 | 6.50 | 0.15 | 0.10 | 0.53 | 0.05 | -0.38 | 4.00 | -17.11 |
| Orlando, FL | College Park | Maitland | 31.00 | 31.00 | 31.00 | 00.00 | 0.00 | 0.25 | 0.40 | 0.26 | -0.15 | -0.01 | 0.00 | 0.00 |
| Philadelphia, PA | Fairhill | Penn Wynne | 28.00 | 27.00 | 28.00 | 1.00 | 0.00 | 0.23 | 0.20 | 0.34 | 0.03 | -0.11 | 33.33 | 0.00 |
| Phoenix, AZ | Scottsdale | Anthem | 37.90 | 37.10 | 36.20 | 0.80 | 1.70 | 0.08 | 0.11 | 0.23 | -0.03 | -0.15 | -26.67 | -11.33 |
| Raleigh, NC | Ridgewood | Forest Ridge | 31.00 | 28.00 | 27.00 | 3.00 | 4.00 | 0.28 | 0.52 | 0.61 | -0.24 | -0.33 | -12.50 | -12.12 |
| Richmond, VA | Montrose | Forest Hills Park (cemetary) | 28.00 | 28.00 | 30.00 | 0.00 | -2.00 | 0.23 | 0.38 | 0.24 | -0.15 | -0.01 | 0.0 | 200.00 |
| Richmond, VA 2 | Montrose | Stony Point | 28.00 | 28.00 | 28.00 | 00.00 | 0.00 | 0.23 | 0.38 | 0.69 | -0.15 | -0.37 | 0.00 | 0.00 |
| San Diego, CA | Mountain View | Clairmont Mesa West | 28.00 | 28.00 | 27.00 | 00.00 | 1.00 | 0.15 | 0.21 | 0.31 | -0.06 | -0.16 | 0.00 | -6.25 |
| Seattle, WA | Ravenna | Hamlin Park | 26.00 | 21.00 | 22.00 | 5.00 | 4.00 | 0.16 | 0.44 | 0.38 | -0.28 | -0.22 | -17.86 | -18.18 |
| Tucson, AZ | Tahoe Park | Gates Pass Trailhead | 37.00 | 37.00 | 39.00 | 00.00 | -2.00 | 0.19 | 0.16 | 0.17 | 0.03 | 0.02 | 0.00 | -100.00 |
| Washington, DC | Takoma Park | Greenbelt | 32.00 | 31.40 | 28.00 | 0.60 | 4.00 | 0.14 | 0.42 | 0.51 | -0.28 | -0.37 | -2.14 | -10.81 |
| | | | | | | | | | | | | | | |

Table 6 shows the data collected for both the surveyed cities and the locations selected for literature review. This includes the multiple locations for Boise, Kansas City and Richmond.

What does this mean for understanding urban heat island effects? Since the presence of UHI may be determined by impervious area versus tree cover, recognizing the land cover in each area is important. While this is not the only considerations (elevation, cloud cover, rainfall, wind, time of year, time of day) it is a clear one to use as a proxy. Different regions have different temperature ranges to begin with. For example, Tucson will be hotter and drier than Seattle. So how do we create a means of measuring the prevalence of UHI to an area in a way that can be used to recognize the continuum of heat a single city might experience in relation to its locales across the country? One way is to create a ratio of the difference of temperature versus the difference of tree/shrub cover, as shown above with a heat health score, HHS. Where there is no temperature difference between the areas, the nominator of the equation remains 0 and results in a HHS of 0. A score of zero may imply that the effects of urban sprawl are wider than the selection of suburban and rural locations. In the case of Richmond, where the temperature difference in the first scenario is reversed (urban temperatures are LOWER that the selected "rural" area, which was a cemetery) the HHS become significantly larger, a HHS of 200 between urban and rural Richmond, but the HHS between urban and suburban Richmond is 0 because there is no temperature difference between the two locations. With this high HHS for Richmond, and alternate rural location, Stony Point, was selected and tested. In this case, the change in daily high temperatures was 0 (both were 28° C) and the rural tree cover was 67%, creating a change in tree cover of 37% less in the urban part of Richmond. HHS for this location was 0.00 which was more in line with expected results.

Indianapolis experienced a similar result because the temperature in the "rural" area selected was higher than in the urban area, resulting in a positive HHS of 2.33. This reversed result is more common in the urban to suburban ranges, with Boise, Louisville, and V.E. Westendorff

191

Philadelphia experiencing positive values for HHS, indicating that urban locations may have higher tree cover than their suburban counterparts. In these cases, the suburban areas may be experiencing more development, have fewer established trees or may be experiencing the effects of urban sprawl, and heat is a larger factor in these suburban areas. Additionally, these differences may also reflect the impacts from policies and programs in urban areas having the effect of increasing tree cover or improving other heat related variables.

5 Conclusions and Implications

For smaller communities and community groups, using heat health score can provide a free and manageable method to evaluate locations, striving for a HHS of 0 or greater to reflect cooling effects of tree and shrub land cover, allowing them to advocate for funding, policies changes and programming. Over time, this method can also be used to monitor improvements to the heat health of a location, with limitations based on the updates to TMY temperature information and Google maps updates. While PVWatts and i-Tree were used as free programs to obtain weather and tree cover data, they can be used in conjunction with other available data that groups may have access to.

Tree cover remains a consistently import factor in controlling or reducing heat; the need to protect, increase and improve tree cover in cities is essential as increased temperatures and extreme heat events become more frequent. Expecting private landowners to provide the means to achieve these improvements is an unlikely scenario if we consider the economic costs of purchasing land, installing trees, caring for trees and providing long term maintenance including water for these. A more likely scenario is to look at policies and programs designed to acknowledge UHI and determine what impact they have on influencing UHI. A study by Pataki et al. (2021) shows trees provide many benefits to urban areas including increased property values, improved water and air quality, reduced energy use, V.E. Westendorff

supporting animal and plant habitat, improved mental and physical wellness for inhabitants as well as providing aesthetic benefits. The installation of more trees can mitigate the loss of certain ecosystem services and improve the harms caused by climate change, however, land availability in urban areas is limited. This poses challenges for tree growth and health. Urban areas are not necessarily able to plant the quantity of trees needed to mitigate the climate challenges that they are facing, so policies and programs are needed to maximize the allocation of trees within cities through required plantings, equitable programs and partnerships to increase tree canopy area.

Using the HHS, five locations had positive scores, showing that the urban area was either cooler in relation to the suburban or rural, or that the urban area had greater tree cover. What about these areas is creating this positive score? One consideration is that the policies and programs in place are doing their job, reducing UHI in these locations. A look at policies in the next chapter will further this research.

6 References

- Anderson, E. C., Avolio, M. L., Sonti, N. F., & LaDeau, S. L. (2021). More than green: Tree structure and biodiversity patterns differ across canopy change regimes in Baltimore's urban forest. Urban Forestry & Urban Greening, 65(3), 127365. https://doi.org/10.1016/j.ufug.2021.127365
- Antonopoulos, C., Trusty, A., & Shandas, V. (2019). The role of building characteristics, demographics, and urban heat islands in shaping residential energy use. *City and Environment Interactions*, *3*, 100021. https://doi.org/10.1016/j.cacint.2020.100021
- Chen, L., Ng, E., An, X., Ren, C., Lee, M., Wang, U., & He, Z. (2012). Sky view factor analysis of street canyons and its implications for daytime intra-urban air temperature differentials in high-rise, high-density urban areas of Hong Kong: a GIS-based simulation approach. *International Journal of Climatology*, 32(1), 121–136. https://doi.org/10.1002/joc.2243
- Derkzen, M., Teeffelen, A., & Verburg, P. (2015). Quantifying urban ecosystem services based on high-resolution data of urban green space: an assessment for Rotterdam, The Netherlands.

Journal of Applied Ecology, 52. https://doi.org/10.1111/1365-2664.12469

Eastin, M. D., Baber, M., Boucher, A., Di Bari, S., Hubler, R., Stimac-Spalding, B., & Winesett, T. (2017). Temporal Variability of the Charlotte (Sub)Urban Heat Island. *Journal of Applied*

Meteorology and Climatology, 57(1), 81-102. https://doi.org/10.1175/JAMC-D-17-0099.1

Elmqvist, T., Setälä, H., Handel, S., van der Ploeg, S., Aronson, J., Blignaut, J., GómezBaggethun, E., Nowak, D., Kronenberg, J., & de Groot, R. (2015). Benefits of restoring ecosystem services in urban areas. *Current Opinion in Environmental Sustainability*, 14,

101-108. https://doi.org/10.1016/j.cosust.2015.05.001

Escobedo, F. J., Kroeger, T., & Wagner, J. E. (2011). Urban forests and pollution mitigation: Analyzing ecosystem services and disservices. *Environmental Pollution*, 159(8), 2078– 2087.

https://doi.org/10.1016/j.envpol.2011.01.010

- Fang, C., & Yu, D. (2017). Urban agglomeration: An evolving concept of an emerging phenomenon. *Landscape and Urban Planning*, *162*, 126–136. https://doi.org/10.1016/j.landurbplan.2017.02.014
- Filho, Walter Leal, et al. "An Evidence-Based Review of Impacts, Strategies and Tools to Mitigate Urban Heat Islands." International Journal of Environmental Research and Public Health, vol. 14, no. 12, 2017, p. 1600–, https://doi.org/10.3390/ijerph14121600.
- Filho, Walter Leal, et al. "Coping with the Impacts of Urban Heat Islands. A Literature Based Study on Understanding Urban Heat Vulnerability and the Need for Resilience in Cities in a Global Climate Change Context." Journal of Cleaner Production, vol. 171, 2018, pp. 1140–49, https://doi.org/10.1016/j.jclepro.2017.10.086.
- Godwin, C., Chen, G., & Singh, K. K. (2015). The impact of urban residential development patterns on forest carbon density: An integration of LiDAR, aerial photography and field mensuration. *Landscape and Urban Planning*, 136, 97–109. https://doi.org/10.1016/j.landurbplan.2014.12.007
- Gómez-Baggethun, E., & Barton, D. N. (2013). Classifying and valuing ecosystem services for urban planning. *Ecological Economics*, 86, 235–245. https://doi.org/10.1016/j.ecolecon.2012.08.019
- Gong, J., Yang, J., & Tang, W. (2015). Spatially Explicit Landscape-Level Ecological Risks Induced by Land Use and Land Cover Change in a National Ecologically Representative Region in China. *International Journal of Environmental Research and Public Health*, 12(11), 14192–14215. https://doi.org/10.3390/ijerph121114192
- Grove, J. M., & Locke, D. (2011). Urban Tree Canopy Prioritization (UTC): Experience from Baltimore. *Nature Precedings*. https://doi.org/10.1038/npre.2011.6368.1
- Guhathakurta, S., & Gober, P. (2010). Residential Land Use, the Urban Heat Island, and Water Use in Phoenix: A Path Analysis. *Journal of Planning Education and Research*, 30(1), 40–51. https://doi.org/10.1177/0739456X10374187

- Hicks, B. B., Callahan, W. J., & Hoekzema, M. A. (2010). On the Heat Islands of Washington, DC, and New York City, NY. *Boundary Layer Meteorology; Dordrecht*, 135(2), 291–300. https://doi.org/http://dx.doi.org/10.1007/s10546-010-9468-1
- Imhoff, M. L., Zhang, P., Wolfe, R. E., & Bounoua, L. (2010). Remote sensing of the urban heat island effect across biomes in the continental USA. *Remote Sensing of Environment*, 114(3), 504–513. https://doi.org/10.1016/j.rse.2009.10.008
- Ingram, K., Dow, K., Carter, L., & Anderson, J. (2013). *Climate of the Southeast United States: Variability, Change, Impacts, and Vulnerability.* Island Press.
- Lafortezza, R., Carrus, G., Sanesi, G., & Davies, C. (2009). Benefits and well-being perceived by people visiting green spaces in periods of heat stress. *Urban Forestry & Urban Greening*, 8(2), 97–108. https://doi.org/10.1016/j.ufug.2009.02.003
- Langemeyer, J., Baró, F., Roebeling, P., & Gómez-Baggethun, E. (2015). Contrasting values of cultural ecosystem services in urban areas: The case of park Montjuïc in Barcelona. *Ecosystem Services*, 12, 178–186. https://doi.org/10.1016/j.ecoser.2014.11.016
- Li, W., Cao, Q., Lang, K., & Wu, J. (2017). Linking potential heat source and sink to urban heat island: Heterogeneous effects of landscape pattern on land surface temperature. *Science of The Total Environment*, 586, 457–465.https://doi.org/10.1016/j.scitotenv.2017.01.191
- Li, X., Zhou, Y., Asrar, G. R., Imhoff, M., & Li, X. (2017). The surface urban heat island response to urban expansion: A panel analysis for the conterminous United States. *Science of the Total Environment*, 605–606, 426–435. https://doi.org/10.1016/j.scitotenv.2017.06.229
- Loughner, C. P., Allen, D. J., Zhang, D.-L., Pickering, K. E., Dickerson, R. R., & Landry, L. (2012). Roles of Urban Tree Canopy and Buildings in Urban Heat Island Effects:
 Parameterization and Preliminary Results. *Journal of Applied Meteorology and Climatology; Boston*, 51(10), 1775–1793.

https://search.proquest.com/docview/1150113254/abstract/FD43477E56FB4774PQ/1

- Luederitz, C., Brink, E., Gralla, F., Hermelingmeier, V., Meyer, M., Niven, L., Panzer, L., Partelow, S., Rau, A.-L., Sasaki, R., Abson, D. J., Lang, D. J., Wamsler, C., & von Wehrden, H. (2015). A review of urban ecosystem services: six key challenges for future research. *Ecosystem Services*, 14, 98–112. https://doi.org/10.1016/j.ecoser.2015.05.001
- Marando, F., Salvatori, E., Sebastiani, A., Fusaro, L., & Manes, F. (2019). Regulating Ecosystem Services and Green Infrastructure: assessment of Urban Heat Island effect mitigation in the municipality of Rome, Italy. *Ecological Modelling*, 392, 92–102. https://doi.org/10.1016/j.ecolmodel.2018.11.011
- Mariani, L., Parisi, S. G., Cola, G., Lafortezza, R., Colangelo, G., & Sanesi, G. (2016).
 Climatological analysis of the mitigating effect of vegetation on the urban heat island of Milan, Italy. *Science of The Total Environment*, 569–570, 762–773. https://doi.org/10.1016/j.scitotenv.2016.06.111
- Miner, M. J., Taylor, R. A., Jones, C., & Phelan, P. E. (2017). Efficiency, economics, and the urban heat island. *Environment and Urbanization*, 29(1), 183–194. https://doi.org/10.1177/0956247816655676

- Morakinyo, T. E., Ouyang, W., Lau, K. K.-L., Ren, C., & Ng, E. (2020). Right tree, right place (urban canyon): Tree species selection approach for optimum urban heat mitigation - development and evaluation. *Science of The Total Environment*, 719, 137461. https://doi.org/10.1016/j.scitotenv.2020.137461
- Norton, B. A., Coutts, A. M., Livesley, S. J., Harris, R. J., Hunter, A. M., & Williams, N. S. G. (2015). Planning for cooler cities: A framework to prioritise green infrastructure to mitigate high temperatures in urban landscapes. *Landscape and Urban Planning*, 134, 127–138. https://doi.org/10.1016/j.landurbplan.2014.10.018
- Oh, K., Lee, D., & Park, C. (2012, February 2). Urban Ecological Network Planning for Sustainable Landscape Management: Journal of Urban Technology: Vol 18, No 4. https://www.tandfonline.com/doi/full/10.1080/10630732.2011.648433
- Pataki, D. E., Alberti, M., Cadenasso, M. L., Felson, A. J., McDonnell, M. J., Pincetl, S., Pouyat, R. V., Setälä, H., & Whitlow, T. H. (2021). The Benefits and Limits of Urban Tree Planting for Environmental and Human Health. *Frontiers in Ecology and Evolution*, 9, 155. https://doi.org/10.3389/fevo.2021.603757

Peterson, M. (n.d.). *Making Charlotte a Climate-Ready and Just City*. Center for American Progress. Retrieved February 29, 2020, from https://www.americanprogress.org/issues/green/reports/2017/08/02/436078/makingcharlot te-climate-ready-just-city/

- Ramamurthy, P., & Bou-Zeid, E. (2017). Heatwaves and urban heat islands: A comparative analysis of multiple cities. *Journal of Geophysical Research: Atmospheres*, *122*(1), 168–178. https://doi.org/10.1002/2016JD025357
- Rehan, R. M. (2016). Cool city as a sustainable example of heat island management case study of the coolest city in the world. *HBRC Journal*, *12*(2), 191–204. https://doi.org/10.1016/j.hbrcj.2014.10.002
- Salmond, J. A., Tadaki, M., Vardoulakis, S., Arbuthnott, K., Coutts, A., Demuzere, M., Dirks, K. N., Heaviside, C., Lim, S., Macintyre, H., McInnes, R. N., & Wheeler, B. W. (2016).
 Health and climate related ecosystem services provided by street trees in the urban environment. *Environmental Health: A Global Access Science Source*, *15*(43). https://doi.org/10.1186/s12940-016-0103-6
- Schwaab, J., Meier, R., Mussetti, G., Seneviratne, S., Bürgi, C., & Davin, E. L. (2021). The role of urban trees in reducing land surface temperatures in European cities. *Nature Communications*, 12(1), 6763. https://doi.org/10.1038/s41467-021-26768-w
- Sieber, J., & Pons, M. (2015). Assessment of Urban Ecosystem Services using Ecosystem Services Reviews and GIS-based Tools. *Procedia Engineering*, *115*, 53–60. https://doi.org/10.1016/j.proeng.2015.07.354
- Stewardship of Trees in Chatham Park. (2010). *Chatham Park*. Retrieved May 1, 2019, from https://www.chathampark.com/stewardship-of-trees-in-chatham-park/
- Stone, B., Lanza, K., Mallen, E., Vargo, J., & Russell, A. (2019). Urban Heat Management in Louisville, Kentucky: A Framework for Climate Adaptation Planning. *Journal of Planning Education and Research*, 0739456X19879214. https://doi.org/10.1177/0739456X19879214

- Stone, B., & Norman, J. M. (2006). Land use planning and surface heat island formation: A parcel-based radiation flux approach. *Atmospheric Environment*, 40(19), 3561–3573. https://doi.org/10.1016/j.atmosenv.2006.01.015
- Stone, B., & Rodgers, M. O. (2001). Urban Form and Thermal Efficiency: How the Design of Cities Influences the Urban Heat Island Effect. *Journal of the American Planning Association*, 67(2), 186. https://search.proquest.com/docview/14588209
- Tang, J., Di, L., Xiao, J., Lu, D., & Zhou, Y. (2017). Impacts of land use and socioeconomic patterns on urban heat Island. *International Journal of Remote Sensing*, 38(11), 3445– 3465. https://doi.org/10.1080/01431161.2017.1295485
- Taylor, L., & Hochuli, D. F. (2017). Defining greenspace: Multiple uses across multiple disciplines. *Landscape and Urban Planning*, 158, 25–38. https://doi.org/10.1016/j.landurbplan.2016.09.024
- Thermal Inequity in Richmond, VA: The Effect of an Unjust Evolution of the Urban Landscape on Urban Heat Islands. (2021). *Sustainability*, *13*(3), 1511. https://doi.org/http://dx.doi.org.librarylink.uncc.edu/10.3390/su13031511
- *Tree Canopy Action Plan.* (n.d.). City of Charlotte Government. Retrieved April 26, 2022, from https://charlottenc.gov/charlottefuture/Pages/TreeCanopy.aspx
- *Tree Ordinance*. (n.d.). Retrieved August 6, 2023, from https://www.charlottenc.gov/Growthand-Development/Getting-Started-on-Your-Project/Tree-Ordinance
- Trees are the not-so-secret weapon in keeping cities cool | MNN Mother Nature Network. (n.d.). Retrieved November 12, 2019, from https://www.mnn.com/earthmatters/climateweather/blogs/amp/trees-are-not-so-secret-weapon-keeping-ourcitiescool?__twitter_impression=true
- *TreesCharlotte* | *Tree Canopy Conservation* | *Charlotte NC Nonprofit*. (n.d.). TreesCharlotte. Retrieved April 15, 2020, from https://treescharlotte.org/
- *Unified Development Ordinance (UDO).* (n.d.). Retrieved May 12, 2022, from <u>https://raleighnc.gov/zoning</u>-planning-and-development/unified-development-ordinanceudo *Urban Heat Island Management Study: Dallas Texas 2017.* (2017).
- *Urban Heat Island Project.* (n.d.). LouisvilleKY.Gov. Retrieved May 10, 2022, from https://louisvilleky.gov/government/sustainability/urban-heat-island-project
- *Urban Tree Canopy Study* | *Louisville Metro Open Data*. (n.d.). Retrieved May 10, 2022, from https://data.louisvilleky.gov/dataset/urban-tree-canopy-study
- US Environmental Protection Agency. (2008). *Reducing Urban Heat Island: a Compendium of Strategies* (Heat Island Reduction Activities, p. 23). US Environmental Protection Agency. https://www.epa.gov/sites/production/files/2017-05/documents/reducing urban heat islands ch 6.pdf
- US Environmental Protection Agency. (2014, June 17). *Measuring Heat Islands* [Overviews and Factsheets]. https://www.epa.gov/heatislands/measuring-heat-islands
- Westendorff, V. E. (2020). ROLE OF TREES IN MITIGATING URBAN HEAT ISLAND IN CHARLOTTE, NORTH CAROLINA, USA. 73–83. https://doi.org/10.2495/EID200081

- Westendorff, V. (2021, July 22). Urban Trees: Strategies for Reducing Urban Heat Island in Cities. The Field. https://thefield.asla.org/2021/07/22/urban-trees-strategies-for-reducingurban-heat-island-in-cities/
- Williams, F. (2017). *The Nature Fix: Why nature makes us happier, healthier and more creative*. W.W. Norton and Company.
- Wu, J. (2013). Landscape sustainability science: ecosystem services and human well-being in changing landscapes. *Landscape Ecology; Dordrecht*, 28(6), 999–1023. https://doi.org/http://dx.doi.org/10.1007/s10980-013-9894-9
- Yin, J., Wu, X., Shen, M., Zhang, X., Zhu, C., Xiang, H., Shi, C., Guo, Z., & Li, C. (2019). Impact of urban greenspace spatial pattern on land surface temperature: a case study in Beijing metropolitan area, China. *Landscape Ecology*, 34(12), 2949–2961. https://doi.org/10.1007/s10980-019-00932-6
- Zhang, D.-L., Shou, Y.-X., Dickerson, R. R., & Chen, F. (2011). Impact of Upstream Urbanization on the Urban Heat Island Effects along the Washington–Baltimore Corridor. *Journal of Applied Meteorology and Climatology*, 50(10), 2012–2029. https://doi.org/10.1175/JAMC-D-10-05008.1
- Zhang, Y., & Ayyub, B. M. (2018). Urban Heat Projections in a Changing Climate: Washington,
 - DC, Case Study. ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering, 4(4). https://doi.org/10.1061/AJRUA6.0000985
- Ziter, Carly, and Monica G. Turner. "Current and Historical Land Use Influence Soil-Based Ecosystem Services in an Urban Landscape." Ecological Applications, vol. 28, no. 3, 2018, pp. 643–54, https://doi.org/10.1002/eap.1689.

Online Sources

- American Council for Energy Efficient Economies. (n.d.). *Mitigation of Urban Heat Islands* | *ACEEE*. Retrieved April 30, 2021, from https://database.aceee.org/city/mitigationurbanheat-islands
- Atlanta City Design: Nature | Atlanta, GA. (n.d.). Retrieved May 10, 2022, from https://www.atlantaga.gov/government/departments/city-planning/environment-andurbanecology/atlanta-city-design-nature
- Benefits and challenges of the green belt. (n.d.). *Centre for Cities*. Retrieved September 8, 2021, from https://www.centreforcities.org/reader/benefits-challenges-green-belt/
- Benefits of Trees. (2012, April 10). Urban Releaf.

http://www.urbanreleaf.org/geteducated/benefits-of-trees

Biller, H. (2020, July 14). State of the canopy: 45% canopy coverage. *TreesCharlotte*. https://treescharlotte.org/news/treescharlotte-canopy-study-shows-sharp-decline/

Boulder Valley Comprehensive Plan. (n.d.). Retrieved April 30, 2021, from https://bouldercolorado.gov/bvcp

- *Carrboro, NC Official Website*. (n.d.). Retrieved April 30, 2021, from http://www.townofcarrboro.org/PZI/luo.htm
- *Chapter 21 TREES* | *Code of Ordinances* | *Charlotte, NC* | *Municode Library.* (n.d.). Retrieved April 30, 2021, from
 - https://library.municode.com/nc/charlotte/codes/code_of_ordinances?nodeId=PTIICOOR C H21TR
- Charlotte Explorer. (n.d.). Retrieved April 28, 2021, from https://explore.charlottenc.gov/#
- Charlotte Future Land Use. (n.d.). Retrieved May 5, 2020, from
- https://hub.arcgis.com/datasets/17eded3e874c4be787fbe06deb812a4c_2
- *Charlotte Green Team*. (n.d.). Charlotte Meetings. Retrieved February 29, 2020, from https://www.charlottemeetings.com/charlotte-green-team
- *Charlotte Open Data Portal.* (n.d.). Retrieved April 20, 2021, from https://data.charlottenc.gov/search?groupIds=d806dc703ef848ec88c72af9a95ee5bb
- *Charlotte Tree Plan.* (n.d.). Charlotte Tree Plan. Retrieved April 28, 2021, from http://charlottetreeplan.weebly.com/
- *Charlotte Urban Forest Master Plan 2017 Full Report.* (n.d.). Charlotte Tree Plan. Retrieved November 12, 2019, from http://charlottetreeplan.weebly.com/full-report.html
- *Charlotte/Mecklenburg Quality of Life Explorer*. (n.d.). Retrieved March 7, 2020, from https://mcmap.org/qol/#14/
- *Charlotte's Cathedral.* (2017, August 31). Our State. https://www.ourstate.com/charlotte-treesqueens-road-west/
- Charlotte's Declining Tree Canopy Hides Years Of Loss In Historically Black Neighborhoods. (2020, August 28). WFAE 90.7 - Charlotte's NPR News Source.

https://www.wfae.org/energy-environment/2020-08-28/charlottes-declining-treecanopyhides-years-of-loss-in-historically-black-neighborhoods

Charlotte's losing its green canopy, despite efforts to save trees | UNC Charlotte Urban

- *Institute* | *UNC Charlotte*. (n.d.). Retrieved April 6, 2021, from https://ui.uncc.edu/story/charlotte%E2%80%99s-losing-its-green-canopy-despiteeffortssave-trees
- *City Scorecard Rank* | *ACEEE*. (n.d.). Retrieved April 30, 2021, from https://database.aceee.org/city-scorecard-rank
- Climate Action Plan & Our Climate, Our Future | Sustainability | City of San Diego Official Website. (n.d.). Retrieved April 30, 2021, from

https://www.sandiego.gov/sustainability/climate-action-plan

- *Climate Change US Forest Service Research & Development.* (n.d.). Retrieved April 30, 2021, from https://www.fs.fed.us/research/climate-change/
- *Climate Impact Lab.* (n.d.). Climate Impact Lab. Retrieved September 29, 2021, from https://live-climate-impact-lab.pantheonsite.io/
- *Climate ready DC*. (2016). Climate Ready DC Plan. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/service_content/attachments/CRDCRe port-FINAL-Web.pdf
- V.E. Westendorff

- CODE OF ORDINANCES CITY OF CHARLOTTE, NORTH CAROLINA | Code of Ordinances Charlotte, NC | Municode Library. (n.d.-a). Retrieved February 29, 2020, from https://library.municode.com/nc/charlotte/codes/code_of_ordinances?nodeId=COORCHN O CA
- Cool Policies for Cool Cities: Best Practices for Mitigating Urban Heat Islands in North American Cities. (n.d.). Copenhagen Centre on Energy Efficiency. Retrieved February 7, 2022, from https://c2e2.unepdtu.org/kms_object/cool-policies-for-cool-cities-bestpracticesfor-mitigating-urban-heat-islands-in-north-american-cities/
- Data & Tools Eastern Forest Environmental Threat Assessment Center. (n.d.). Retrieved April 30, 2021, from https://forestthreats.org/research/tools
- DEEP Announces Urban Forest Equity and Resilience Grant Program. (2021) CT.Gov -Connecticut's Official State Website. Retrieved May 10, 2022, from https://portal.ct.gov/DEEP/News-Releases/News-Releases---2021/DEEP-Announces-UrbanForest-Equity-and-Resilience-Grant-Program
- Denver Parks and Recreation | Planning | The Outdoor Downtown. (n.d.). Retrieved April 30, 2021, from https://www.denvergov.org/content/denvergov/en/denver-parks-and-recreation/planning/master-plans/gameplan.html
- District of Columbia. (2011). *Sustainability DC* (p. 129). https://sustainable.dc.gov/sites/default/files/dc/sites/sustainable/page_content/attachments/ SD C%20Final%20Plan.pdf
- *District's Green Construction Code* | *ddoe*. (n.d.). Retrieved March 1, 2020, from https://doee.dc.gov/publication/districts-green-construction-code
- *DOEE* | *Department of Energy & Environment*. (n.d.). Retrieved February 29, 2020, from https://doee.dc.gov/
- *Extreme Heat Vulnerability Map Tool.* (n.d.). Retrieved September 29, 2021, from https://nihhis.cpo.noaa.gov/vulnerability-mapping
- Georgia Tech: Understanding Urban Heat Islands at the Site Scale. (n.d.). Retrieved May 10, 2022, from https://www.vibrantcitieslab.com/case-studies/understanding-urban-heat-islandsat-the-site-scale/
- *Get involved*. (n.d.). UrbanHeatATL. Retrieved May 10, 2022, from https://urbanheatatl.org/getinvolved/
- How Landscape Architecture Mitigates the Urban Heat Island Effect. (2018, September 12). *Land8*. https://land8.com/how-landscape-architecture-mitigates-the-urban-heat-island-

effect/ *How Tiny Forests Can Help India Combat Climate Change*. (n.d.). World Economic Forum. Retrieved June 16, 2023, from https://www.weforum.org/videos/these-tiny-forests-arebringing-trees-back-to-india-s-cities/

- *How Tree Cover Loss Data Has Changed Over Time* | *GFW Blog*. (2021, April 28). Global Forest Watch Content. https://www.globalforestwatch.org/blog/data-and-research/tree-coverloss-satellite-data-trend-analysis
- *i-Tree Canopy*. (n.d.). Retrieved August 29, 2023, from https://canopy.itreetools.org/references

Master Plans - Denver Parks and Recreation | City and County of Denver. (n.d.). Retrieved April 30, 2021, from https://www.denvergov.org/content/denvergov/en/denver-parks-andrecreation/planning/master-plans.html

Mitigation of Urban Heat Islands | *ACEEE*. (n.d.). Retrieved April 30, 2021, from https://database.aceee.org/city/mitigation-urban-heat-islands

NSRDB. (n.d.). Retrieved August 28, 2023, from https://nsrdb.nrel.gov/

O'ahu Community Heat Map. (n.d.). Retrieved April 30, 2021, from

https://www.arcgis.com/apps/View/index.html?appid=ff1b73d836074cf6b2aca420fffbd93 0

Raleigh Strategic Plan. (October, 2020). Retrieved May 12, 2022, from https://raleighnc.gov/government/strategic-plan.

Dallas City Hall. (2018, July 2). Tree Mitigation Standards Article X. dallascityhall.com/departments/sustainabledevelopment/buildinginspection/DCH%20docu me nts/pdf/BI Tree%20Mitigation%20Standards.pdf

Draft 2040 Policy Map and Draft Charlotte Streets Map. (n.d.). Retrieved October 25, 2021, from

https://charlotte.maps.arcgis.com/apps/webappviewer/index.html?id=06d0cafbbf544760b9 af 032c93b8ef60

Ecological Models of Urban Form - Urban Sociology - iResearchNet. (n.d.). *Sociology*. Retrieved March 7, 2020, from

http://sociology.iresearchnet.com/urbansociology/ecological-models-of-urban-form/

Ecological Principles for Managing Land Use | *Watershed Academy Web* | *US EPA*. (n.d.). Retrieved March 7, 2020, from

https://cfpub.epa.gov/watertrain/module.cfm?module_id=48&object_id=793

- *Extreme Heat Vulnerability Map Tool.* (n.d.). Retrieved September 29, 2021, from https://nihhis.cpo.noaa.gov/vulnerability-mapping
- Georgia Tech: Understanding Urban Heat Islands at the Site Scale. (n.d.). Retrieved May 10, 2022, from https://www.vibrantcitieslab.com/case-studies/understanding-urban-heat-islandsat-the-site-scale/
- *Get involved*. (n.d.). UrbanHeatATL. Retrieved May 10, 2022, from https://urbanheatatl.org/getinvolved/
- *Green Area Ratio Overview* | *ddoe*. (n.d.). Retrieved April 30, 2021, from https://doee.dc.gov/service/green-area-ratio-overview
- *i-Tree Canopy*. (n.d.). Retrieved April 15, 2021, from https://canopy.itreetools.org/references
- Master Plans Denver Parks and Recreation | City and County of Denver. (n.d.). Retrieved April 30, 2021, from https://www.denvergov.org/content/denvergov/en/denver-parks-andrecreation/planning/master-plans.html

Mecklenburg's 2012 green space assessment: Fair to middling | UNC Charlotte Urban Institute. (n.d.). Retrieved February 29, 2020, from https://ui.uncc.edu/story/mecklenburg%E2%80%99s-2012-green-space-assessmentfairmiddling

Mitigation of Urban Heat Islands | *ACEEE*. (n.d.). Retrieved April 30, 2021, from https://database.aceee.org/city/mitigation-urban-heat-islands

Multi-Resolution Land Characteristics (MRLC) Consortium | Multi-Resolution Land Characteristics (MRLC) Consortium. (n.d.). Retrieved May 5, 2020, from https://www.mrlc.gov/

NAIP Imagery. (n.d.). [Page]. Temp_FSA_02_Landing_InteriorPages. Retrieved February 29, 2020, from https://www.fsa.usda.gov/programs-and-services/aerial-photography/imageryprograms/naip-imagery/index

North Carolina Climate Science Report :: North Carolina Institute for Climate Studies. (n.d.). Retrieved July 6, 2020, from https://ncics.org/programs/nccsr/

O'ahu Community Heat Map. (n.d.). Retrieved April 30, 2021, from https://www.arcgis.com/apps/View/index.html?appid=ff1b73d836074cf6b2aca420fffbd93 0

- *Raleigh Strategic Plan.* (October 2020). Retrieved May 12, 2022, from https://raleighnc.gov/government/strategic-plan
- Resilient Design: Extreme Heat. (n.d.). [American Society of Landscape Architects]. Retrieved April 29, 2019, from https://www.asla.org/extremeheat.aspx?utm_medium=social&utm_source=linkedin.comp

any&utm campaign=postfity&utm content=postfity1d316

- Sec. 21-65. Tree protection and/or planting required on public property. | Code of Ordinances | Charlotte, NC | Municode Library. (n.d.). Retrieved April 29, 2019, from https://library.municode.com/nc/charlotte/codes/code_of_ordinances?nodeId=PTIICOOR CH21TR ARTIIIMAPRTR S21-65TRPRPLREPUPR
- Street Design Manual. (n.d.). Retrieved May 12, 2022, from https://user-2081353526.cld.bz/StreetDesignManual/113/

Street Tree Layer (STL) 2018 — Copernicus Land Monitoring Service. (n.d.). [Land item]. Retrieved January 12, 2021, from https://land.copernicus.eu/local/urban-atlas/streettreelayer-stl-2018

- *Sustainability Plan Baltimore Office of Sustainability*. (2015, May 10). https://www.baltimoresustainability.org/plans/sustainability-plan/
- *TEEB Manual for Cities:Ecosystem Services in Urban Management.* (2011). www.TEEBweb.org texastrees. (2023, March 22).
- Urban Heat Island Management Study Texas Trees Foundation. https://texastrees.org/urban-heat-island-management-study/
- *The Demographic Statistical Atlas of the United States Statistical Atlas.* (n.d.). Retrieved May 8, 2020, from https://statisticalatlas.com/metro-area/North-Carolina/Charlotte/Population#figure/place
- *The Impact of Trees*. (n.d.). Charlotte Public Tree Fund. Retrieved August 6, 2023, from https://charlottetreefund.org/the-impact-of-trees/
- *The urban heat island effect could be making Phoenix hotter, studies show.* (n.d.). The Sustainability Review. Retrieved May 10, 2022, from

https://www.thesustainabilityreview.org/articles/2021/11/18/the-urban-heat-island-effectcould-be-making-phoenix-hotter-studies-show

- *The Urban Heat Island (UHI) is mapped in major U.S. cities.* (2015, September 18). Watts Up With That? https://wattsupwiththat.com/2015/09/18/the-urban-heat-island-uhi-is-mapped-inmajor-u-s-cities/
- *Tree Canopy Action Plan.* (n.d.). City of Charlotte Government. Retrieved April 26, 2022, from https://charlottenc.gov/charlottefuture/Pages/TreeCanopy.aspx
- *Tree management.* (n.d.). City of Charlotte Government. Retrieved February 29, 2020, from https://charlottenc.gov
- *Tree ordinance*. (n.d.). City of Charlotte Government. Retrieved February 29, 2020, from https://charlottenc.gov
- *Tree Ordinance : ConservationTools.* (n.d.). Retrieved April 23, 2021, from https://conservationtools.org/guides/37-tree-ordinance/
- *TreesCharlotte* | *Tree Canopy Conservation* | *Charlotte NC Nonprofit*. (n.d.). TreesCharlotte. Retrieved April 15, 2020, from https://treescharlotte.org/ TreesCharlotte | Tree Canopy Conservation Goal | Charlotte NC. (n.d.). *TreesCharlotte*.
- Retrieved May 1, 2019, from <u>https://treescharlotte.org/what-we-do/missionandvision/</u> Unified Development Ordinance (UDO). (n.d.). Retrieved May 12, 2022, from https://raleighnc.gov/zoning-planning-and-development/unified-development-ordinanceudo
- UrbanHeatATL. (n.d.). Retrieved May 10, 2022, from https://urbanheatatl.org
- Urban Climate Lab. (n.d.). Retrieved April 20, 2022, from https://urbanclimate.gatech.edu/
- Urban Heat Island Project. (n.d.). LouisvilleKY.Gov. Retrieved May 10, 2022, from https://louisvilleky.gov/government/sustainability/urban-heat-island-project
- *Urban Tree Canopy Study* | *Louisville Metro Open Data*. (n.d.). Retrieved May 10, 2022, from https://data.louisvilleky.gov/dataset/urban-tree-canopy-study
- *Vibrant Cities Lab : Resources for Urban Forestry, Trees, and Green Infrastructure.* (n.d.). Retrieved April 25, 2022, from https://www.vibrantcitieslab.com
- Washington, D.C.'s energy conservation code includes LEED Zero pathways | U.S. Green Building Council. (n.d.). Retrieved April 25, 2022, from https://www.usgbc.org/articles/washington-dcs-energy-conservation-code-includes
 - leedzero-pathways
- Westendorff, V. (2022a, July 28). Urban Heat Island: A Non-Transferable Problem Within Cities, Part 1. The Field. https://thefield.asla.org/2022/07/28/urban-heat-island-a-nontransferable-problem-within-cities-part-1/
- Westendorff, V. (2022b, August 2). Urban Heat Island: A Non-Transferable Problem Within Cities, Part 2. The Field. https://thefield.asla.org/2022/08/02/urban-heat-island-a-nontransferable-problem-within-cities-part-2/
- Westendorff, V. (2023, August 17). *Preserving Urban Tree Canopies*. The Field. https://thefield.asla.org/2023/08/17/preserving-urban-tree-canopies/

Appendix A Survey sample



Policies and Program to manage urban heat island

Understanding UHI policy and program success rates.

This quick survey is designed to gather data on the implementation, monitoring, and success of different programs and policies that use trees to manage urban heat island effect in cities across the United States of America. It is part of the research for a dissertation by V. Westendorff.

- 1. What city do you work for?
- 2. Does your city have policies or programs related to urban heat island (UHI)?

Yes

No

Other (please specify)

1. Are the UHI policies or programs addressed with any of the following methods (check all that apply)

Using pollution reduction methods such as reducing car miles driven, energy efficiency, improved emissions or renewable energy Using plant materials such as trees, shrubs and green spaces Using green infrastructure None of the above

3. Of the policies which the city has implemented, which do you feel are most effective?

Using pollution reduction methods Using trees Using green infrastructure Using a combination of methods None of the above

4. Which types of programs are used in your city to address urban heat island?

Tree protection ordinance Trees and vegetation requirements Tree canopy cover requirements Climate action plan Green infrastructure Sustainability classification (STAR, LEED, SITES, GBCI etc.) Monitoring and management programs None of the above

5. The policies and programs using trees to manage urban heat island are actively implemented and enforced in your city.

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

6. Results from the implementation of policies and programs using trees to reduce urban heat island are measured and monitored.

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

7. Results from the implementation of policies and programs using trees to reduce urban heat island are measured and monitored.

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

- 8. My city believes monitoring tree canopy cover is vital to the city's long-term health.
- 9. Long-term tree care is part of the city's policies and programs to use trees to reduce urban heat island.

- 10. My city believes Public-Private partnerships are essential to the success of tree planting initiatives.
- 11. Within my city, funding for new tree planting, care, and replacement is adequate.
- 12. Within my city, tree canopy cover is equal across all neighborhoods.
- 13. My city considers tree planting in underplanted areas to be a priority.
- 14. Tree regulation and care are part of the pranning department's responsibility.
- 15. In which region of the United States are you located?
- 1. New England (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut)
- 2. Middle Atlantic (New York, New Jersey, Pennsylvania)
- 3. East North Central (Ohio, Indiana, Illinois, Michigan, Wisconsin)
- 4. West North Central (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas)
- South Atlantic (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida)
- 6. East South Central (Kentucky, Tennessee, Alabama, Mississippi)
- 7. West South Central (Arkansas, Louisiana, Oklahoma, Texas)
- Mountain (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada)
 Pacific (Washington, Oregon, California, Alaska, Hawaii)
- 16. What changes would most improve your city's policies on urban heat island?

- 17. In your experience, what types of programs and policies work best to address urban heat island?
- 18. In your experience, how are the successes of these programs and policies measured?