



URBAN ACUPUNCTURE AT DISTRICT-SCALE

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Systems, Patterns, Place: A Novel Framework for Urban Transformations



| A mosaic of systems and patterns that represent place.
Image: Arthur Mazi, Wynn Loner U. Uy

Despite decades of green standards and sustainability practices, cities continue to struggle with mounting environmental pressures and declining quality of life. This deterioration reveals a gap between action and impact, pointing to a deeper systemic problem rooted in our approach to design and planning.



The boundary condition within which this conversation must happen is not the building but rather the city.



One reason for this gap is a persistent myth of greening: that improvements of parts aggregate into system-wide transformation. Despite the proliferation of green-certified buildings over the past two decades, cities have not been able to achieve meaningful change. This dichotomy between parts and wholes reveals the limitations of component-based approaches to complex urban challenges.

Another greening myth is that it suffices to simply do less harm. However, the time for incrementalism has passed. Climate change and ecosystem losses have accelerated to a point where small improvements within large, faltering systems serve as mere placebos. We must now find new ways to do good, and at the right scale, moving past mitigation towards regeneration.

Redefining 'Good' in Urban Systems

But what constitutes 'good' in this new paradigm? Good is not merely the absence of harm but the active enabling of human and ecological systems to thrive together. It involves creating positive feedback loops that enhance the life-supporting capacity of urban environments whilst generating social, economic, and natural capitals. This understanding of good is inherently systemic—emerging from an understanding of the relationships and exchanges between parts rather than optimising their individual performance.

Good is also place-based. Unlike universal metrics or standardised solutions, good manifests differently across situations, responding to local ecologies, cultures, economies, and social structures. It is multivariate and dynamic, requiring continuous adaptation

Cebu City, Philippines

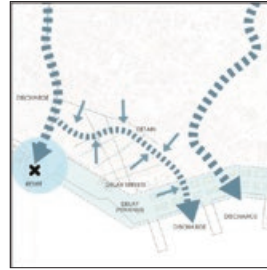
Future Patterns



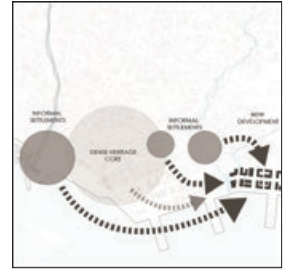
a. Establishing a heritage axis



b. Reclaiming waterfronts



c. Creating flood resilience

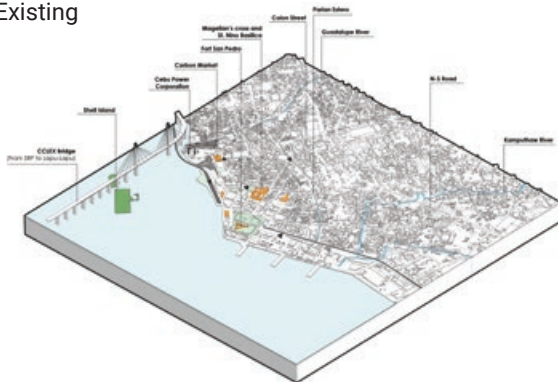


d. Creating new economic nodes

Proposed Master Plan



Existing



Proposed



The potential of the historic-commercial district of Cebu City is presently constrained by traffic congestion, flood risk, water pollution and an inaccessible waterfront. The studio proposed alterations that were guided by two ideas of 'good': the restoration of ecosystems—addressing water quality, flood inundation and green social space—plus the augmentation and de-fragmentation of public space networks. Both actions elevate economic capital by enhancing the value of real estate and creating new jobs.

rather than fixed outcomes. Here, the goal of design is to foster systems that can learn, evolve, and respond to changing context and circumstance.

The boundary condition within which this conversation must happen is therefore not the building but rather the city, framed as a complex living system. From this understanding of a living whole, we determine what roles the parts must play and how they ought to interact.

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Beyond 20th Century Urbanism

Current conventions of urban design and city planning were forged in the 20th century around a particular vision of the future. The fragmentation of the city into pathways for automobiles, hard edges between building and street, discrete mono-functional precincts, etc., all reflect a machine-like view of the metropolis—robust, rational, enabled by technology, but soulless.

Author and theorist, Jane Jacobs, warned in 1961 that this approach constituted the de facto death of the city, arguing instead for a more organic, living systems understanding of urban environments. Over six decades later, her warning continues to be pressing and relevant.

Today, cities also face new imperatives: climate change, biodiversity loss, rapid urbanisation, and deepening social inequity. In this environment, good is often viewed as ad-hoc mitigation—actively countering the negatives where they occur or correcting situations that exacerbate these problems.

But good, at this moment in time, must transcend the cautionary and reactive. It must seek out the positive, cultivate new forms of life, beauty, and delight. This calls for a shift in how we see urban systems and act on them.

Cities as Complex Living Systems

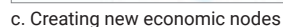
Cities are complex organisms with emergent phenomena characterised by the collective behaviour of their deeply entwined human and natural systems. Understanding urban complexity begins with recognising that multiple systems are operating simultaneously: ecological systems (water cycles, energy flows, biodiversity networks), social systems (communities, economies, governance structures), and built systems (infrastructure, buildings, transportation networks)—each in perpetual dialogue with each other.

These systems manifest characteristics of complex adaptive systems: they are non-linear, exhibit emergent properties, demonstrate self-organisation, and display adaptive capacity. The key to understanding complexity is systems thinking. Once we visualise cities through a systems lens, every act of design is an opportunity to alter flows and exchanges so that the system as a whole becomes balanced and deconflicted.

This systems approach obliges us to start by taking stock of current conditions, including assets embedded in existing communities, ecological services provided by local ecosystems, cultural wealth accumulated through history, and economic relationships between traditional livelihoods and emerging opportunities.

Equally important are the invisible threads of urban systems: flows of energy, materials, information, and socio-economic relationships. Water cycles connecting watersheds to neighbourhoods, energy flows linking renewable generation to consumption patterns, economic exchanges creating livelihoods, and social networks building community resilience, all represent invisible but essential infrastructure.

Future Patterns



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Designing Systems: A Three-Step Methodology

A systems approach to design and planning has been developed at the Integrated Sustainable Design (ISD) studio at the National University of Singapore. The studios experiment with spatial visualisation and problem-solving, focusing on large urban precincts as microcosms of the city-at-large. These are approached with four ideas of 'good': autonomy (decoupling from extractive practices), ecology (protecting ecosystems as urban infrastructure), society (creating new nodes for interaction), and economy (protecting existing livelihoods whilst creating new opportunities).

Step 1: Cartography of Systems, Patterns, Place

"Systems" are mapped as discrete layers to reveal spatial contiguity or fragmentation. The studio prioritises systems with spatial attributes: mobility, buildings, green cover, public space, energy,

water, and food. Mapping is done at multiple scales—precinct, city, metropolitan region—to understand cross-scale connections and how system granularity changes with scale. Systems mapping also looks back to the recent history which, depending on the city, may be prior to periods of rapid economic growth or, further back, to pre-colonial times.

"Patterns" are relationships between systems—overlaps and synergies, flows and exchanges, edge conditions and buffers that occur within and between systems—resulting in specific behaviours. For instance, how people move through a city at different times of day or week depends on how mobility networks are designed (or not designed), and how land use and density are distributed. Understanding patterns opens up the possibility of small interventions for large impacts, for example, a

new cycling pathway that eliminates vehicular bottlenecks between two points in a city.

"Story of Place" is made up of the unique geographical, cultural, and historical characteristics that define a location's identity and potential. Understanding this narrative enables design responses that honour local knowledge and strengthen community identity. Place-seeking also identifies stakeholder groups and areas of conflict or contestation, which aids in understanding how power dynamics and competing interests are manifest. Place mapping can be partly spatial, for instance, processional routes during festivals, networks of public gathering spaces, or commercial corridors. Place can also be ecologically informed by the role of geography or hydrology in shaping the life of a city.



The "system" diagrams show the mapping of four urban layers: blue (water), green, mobility and built form. Each is an implicit pattern of connectivity and flows. The proposal (bottom row) shows how these systems are altered, taking cues from each other, to create new patterns of movement and flux.

Step 2: Deficits and Surpluses of Capitals

The spatial mapping from Step 1 reveals elements and connections that make up the urban landscape. Step 2 unpacks the value of these structures by observing and understanding the economic, human, social, and natural capitals present in each city. Every city consists of a dynamic relationship between these capitals—some are deprioritised, others are unevenly distributed across the city or between groups.

Natural capital consists of ecological systems and ecosystem services that reduce flooding, mitigate urban heat island effects, and improve biodiversity. Social capital encompasses networks, relationships, and institutions enabling collective action. Human capital includes knowledge, skills, and capabilities of the local population. Economic capital consists of formal and informal economic systems that contribute to local resilience.

Step 3: Capital Creation through Spatial Planning

The ISD approach posits that: (a) spatial networks and land use can be seen as proxies for capitals, and (b) that the rise of one capital can increase or diminish another. A deficit or surplus of capitals can therefore be inferred from space. The growth of one space type, linked to a capital, can affect adjacent spaces and their capitals. A new park, for instance, can raise the rental value of nearby properties, while an ecologically vibrant park might improve ecosystem services in the neighbourhood.

Designing for good therefore requires understanding of how certain space types act as levers for capital gains.

Natural Capital can be gauged from the quantity and connectivity of green and blue spaces, size and shape of biodiversity habitats, contiguity of wildlife corridors, and presence of ecotones, wherein ecological functions and human activities overlap.

Social Capital arises in part from the availability and accessibility of public spaces, the diversity of amenities and social infrastructure, and the presence of cultural or economic nodes, such as churches or markets, that engage communities.

Economic Capital is enhanced when, in a precinct, there is a nexus of revenue-generating activities that attract a community of consumers, a presence of spaces that support formal and informal economies, close proximity to sourcing, manufacture, use, and reuse, and connectivity between residential areas and employment opportunities.

Integration is key. The most effective interventions create spaces that serve multiple capitals simultaneously. Economic targets for local autonomy in food, for example, can be coupled with creation of social capital, if the farms are also community-led. The same farm might also offer ecosystem services such as carbon sequestration, which improves natural capital.

Future Patterns



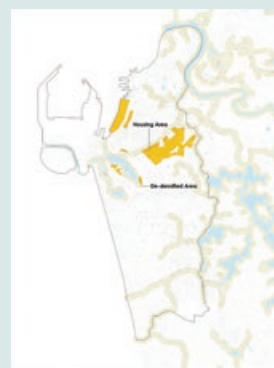
Restored blue-green networks



Increased & connected public spaces



De-fragmented land use



New residential & commercial nodes

"Pattern" maps show new capitals in metropolitan Colombo. The restoration of blue-green networks creates new public space that re-connects the city. Elevating the railway lines in the city centre—and freeing railway land for development—creates new possibilities for commercial and residential nodes, thereby generating social and economic capitals. A new transit node, east of city centre, de-congests the city and creates opportunity for high-value real estate.

Implementation: Tools, Metrics, and Assessment

The three-step methodology demonstrates systems thinking as a tool for design—allowing urban designers and planners to see the connection between spatial planning and capital gains. Moving forward, the implementation of masterplans will require complementary governance and finance metrics and tools that mayors, investors, and community stakeholders can use. These include "upstream" assessment tools that estimate return on investment, prior to implementation, as well as "downstream" management tools.

Starting with the upstream: traditional economic assessment focuses on single-benefit calculations. Emerging frameworks are attempting to expand on this approach by providing multi-capital accounting methods that value ecosystem services, social infrastructure benefits, and economic multiplier effects within integrated metrics. Tools like Integrated Return on Investment (IROI) quantify capital gains by type and beneficiary for every dollar invested, creating business cases for systems interventions that generate value across multiple domains.

For downstream management, digital technologies—including ecosystem services valuation software, AI-powered risk assessment platforms, digital twin technologies, and participatory mapping tools—enable real-time monitoring and adaptive management of complex urban systems. These technologies make visible the flows and relationships, providing feedback loops for continuous system optimisation.

The future of urbanism lies in combining the rigour of systems thinking and place-based design at the drawing board, and supporting upstream assessment and downstream management tools that make complex system behaviours visible, measurable, and actionable for diverse stakeholders operating at the intersection of public policy, private investment, and community development.

Conclusion

The persistent failure of component-based approaches to solve complex urban challenges necessitates a fundamental shift toward systems thinking. By understanding cities as complex living systems and employing integrated methodologies that map patterns, assess capitals, and design for multiple good outcomes simultaneously, we can move beyond incremental improvements toward regenerative transformation.

This approach requires new forms of collaboration between designers, planners, communities, and investors—supported by tools that recognise and value the interconnected nature of urban prosperity. The three-step systems methodology provides a design framework, combining spatial mapping and multi-capital analysis, which sets the stage for a 21st-century approach to urbanism. 🔗



The Cebu and Colombo studios, carried out between August 2024 and May 2025, were co-led by Dr Swinal Samant, and supported by Mr Alakesh Dutta. The Cebu studio was also facilitated by Ms Marianne Amores Dutta.