Hacking Cities: A New Methodology for Urbanism at the Nexus of Architecture and Cybersecurity

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Şehirleri Hacklemek: Mimarlık ve Siber Güvenlik Bağlantı Noktasında Şehircilik için Yeni Bir Metodoloji

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ABSTRACT

Exploring the intersection of architecture, urbanism, and cybersecurity, this paper introduces architects and urban planners as "urban/archi-hackers," proposing a novel approach to urban design. Prompted by the question, "What if an architect and/or urban planner viewed a city as a program and acted like a hacker?", it delves into speculative architecture to reimagine urban identities through hacking methodologies. Advocating for architects, and urban planners to view the city as a program, it outlines "de-code," "encode," and "re-code" phases to speculatively alter urban environments. The "de-code" phase analyzes the city's fabric through literature, maps, and data. "Encode" formulates a blueprint based on the "de-code" findings, while "re-code" envisions speculative hacking interventions to generate strategic, creative solutions. This methodology, embedded in a speculative framework, proposes a dynamic, iterative process adaptable to specific urban contexts. This approach not only challenges architectural norms but also enriches the dialogue between architects, urban planners, and urban spaces. The paper introduces a new lexicon for urban engagement by integrating architecture and urban planning with cybersecurity, emphasizing a comprehensive understanding of cities' social dynamics, including socio-economic and socio-cultural, as well as physical dimensions. It envisions a future of continuous urban innovation, where "urban/archi-hackers" perpetually transform landscapes. By prioritizing curiosity and imaginative engagement, the findings, inherently speculative, underscore the potential of this methodology to foster a dynamic, adaptable urban future, opening new possibilities for archi-hacking methodologies.

Keywords: City as a program; city coding; cybersecurity; hacking cities; speculative architecture; urbanism.

ÖZ

Mimarlık, kent planlama ve siber güvenlik kesişimini inceleyen bu makale, mimarları ve şehir plancılarını "urban/archi-hacker" olarak tanıtarak kentsel tasarıma yeni bir yaklaşım önermektedir. "Bir mimar ve/veya şehir plancısı bir şehri bir program olarak görse ve bir hacker gibi davransa ne olur?" sorusuyla harekete geçen bu çalışma, kentsel kimlikleri hackleme metodolojileri üzerinden yeniden hayal etmek için spekülatif mimarlığa dalmaktadır. Mimarların ve şehir plancılarının şehri bir program olarak görmeleri için savunuda bulunarak, kentsel çevreleri spekülatif olarak değiştirmek için "de-code", "encode" ve "re-code" metotlarını özetlemektedir. "De-code" aşaması, şehrin dokusunu literatür, haritalar ve veriler üzerinden analiz etmektedir. "Encode", "de-code" bulgularına dayanarak bir taslak formüle ederken, "re-code" spekülatif hackleme müdahalelerini vizyon ederek stratejik, yaratıcı çözümler üretmektedir. Bu metodoloji, spekülatif bir çerçeve içinde sunulmuş olup, belirli kentsel bağlamlara uyarlanabilir, dinamik ve iteratif bir süreç önerir. Bu yaklaşım, sadece mimari normları sorgulamakla kalmıyor, aynı zamanda mimarlar, şehir plancıları ve kentsel alanlar arasındaki diyaloğu da zenginleştirmektedir. Makale, mimarlık ve şehir planlamasını siber güvenlikle bütünleştirerek, şehirlerin sosyal dinamiklerini—ekonomik, kültürel ve fiziksel boyutlarıyla birlikte—kapsamlı bir şekilde ele almayı teşvik eder. Sürekli kentsel yeniliklerin geleceğini hayal ederken, "urban/archi-hacker"ların sürekli olarak manzaraları dönüştürebilecek bir geleceği öngörür. Bulgular, doğası gereği spekülatif olup, bu metodolojinin dinamik ve uyarlanabilir bir kentsel geleceği teşvik etme potansiyelini vurgular, aynı zamanda mimarlık-hackleme metodolojileri için yeni olanaklar sunar.

Anahtar sözcükler: Program olarak şehir; şehir kodlama; siber güvenlik; şehirleri hacklemek; spekülatif mimarlık; şehircilik.

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TMMOB Şehir Plancıları Odası

1. Introduction: Fictional Framework

In Nolan's Inception (2010), Cobb and his team embark on an odyssey through the labyrinth of the human mind, navigating dreams within dreams to probe the complex interplay between reality and the subconscious. Their mission, to master the architecture of dreams, reflects the age-old parable of a man's relentless quest for understanding, aiming to reshape these ephemeral realms before the inevitable return to consciousness. This journey finds a counterpart in the philosophical odyssey of The Matrix (1999), where Neo, under Morpheus's tutelage, explores the fine line separating reality from illusion. Morpheus's probing question, "What is real? How do you define real?" positions our perceived reality as merely electrical signals de-coded by the brain, drawing a parallel to the Matrix's cityscape-a digital dream, sculpted by external perceptions.

Popular culture works like The Matrix (1999) and Inception (2010), which challenge our understanding of reality and perception, are deliberately woven into our methodology. These films serve as both allegorical references and foundational inspirations, enhancing our study of cities as dynamic and programmable entities.

Both tales sketch a vision of reality as a malleable construct, shaped within the dreamscapes of Inception (2010), or the digital mirages of The Matrix (1999). Cobb, the dream architect, and Neo, the seeker of truth within the Matrix, embody the universal struggle for autonomy and comprehension of reality, challenging the boundaries set by unseen forces. These cinematic explorations invite us to reevaluate the core of urban architecture-not as rigid edifices but as realms brimming with potential, crafted by the speculative architects and urban planners of our collective consciousness. This dialogue opens the door to reimagining urban environments in the digital and cyber era, envisioning them as dynamic canvases that provoke our perceptions of reality and deepen our connection to the spaces we navigate.

Building on this foundation of speculative fiction and urban paradox, this article advocates for a revolutionary perspective in architectural thought, delving into the question, "What would happen if an architect and/or urban planner perceived a city as a program and acted like a hacker?" It proposes a methodology for envisioning cities as vast computational entities. In this scenario, architects and urban planners assume the role of urban/archi-hackers, penetrating the urban "code" to unlock new dimensions of urban environments. This perspective invites us to consider city architecture not merely as a physical craft but as an interaction with a computational entity-where the process entails gradually uncovering the dynamics of this computational and physical entity, thereby "de-coding" this complex puzzle.

In this discourse, we recognize the traditional distinctions between architects and urban planners but assert their roles as fundamentally interconnected within the "Hacking Cities" framework, essential for effective urban coding.

2. Can an Architect and/or Urban Planner Hack a City?

Yes. However, before delving into the depths of this question, we want to examine what the city has meant for us so far and what it will begin to mean for us from now on.

The journey begins by contemplating cities, not merely as geographical locations, but as canvases of civilization itself. Turgut (2021) introduces us to the notion of the city as an "urban palimpsest," a metaphor for how cities layer history, culture, and social change atop one another. Much like a manuscript that's been written, erased, and written over again, cities embody this layering process, where new experiences and structures overlay old ones, continuously reshaping the urban fabric.

This perspective echoes the early 20th-century sociological focus. Sociologists like Simmel (1950), Weber (1958), and Park et al. (1925), alongside Walter Benjamin, as interpreted by Gilloch (2013), were pivotal in framing the city as the epicenter of societal transformation. Their work delved into the profound impacts of industrialization, urbanization, and the cultivation of 'urbanity,' showcasing the city not just as a space but as a reflection of the era's major social processes.

The evolving narrative of cities is further enriched by the insights of Wirth (1938) and Lynch (1960), alongside later thinkers such as Sassen (2010) and Mumford (2015). They perceive the city as a dynamic entity, shaped by its social relationships and physical geography. Here, the city's growth emerges as a gradual, organic process, crafting a complex urban tapestry where paths, landmarks, and districts are not just physical markers but symbols of collective memory and identity. This growth is influenced by both the tangible-buildings, streets, and parks-and the intangible, such as community bonds and historical narratives.

Entering the discourse of McFarlane (2021) and Gandelsonas (1998), we encounter the themes of "fragmentation" and "reimagining" alongside the critique and interdisciplinary views of Parker (2003). The concept of fragmentation refers to the breaking apart of this urban tapestry into distinct, often disjointed, pieces, reflecting the diverse, sometimes conflicting, nature of urban life. The process of reimagining, then, is about creatively assembling these pieces into a new whole, envisioning urban spaces that better reflect and serve their inhabitants' needs. This reimagining is a bridge connecting the historical and perceptual insights of Wirth (1938) and Lynch (1960) to contemporary urban challenges and opportunities.

Molotch (1976) and Arida (2002) further enrich our understanding by juxtaposing the "city as a growth machine" and the "quantum city." Le Corbusier (2020) and Wright (2020) contribute utopian visions of cities that attempt to free the individual through contrasting means. The former views cities as engines of economic and social expansion, driven by indus-

try, commerce, and urban development synergies. The latter concept, the quantum city, introduces a perspective where urban spaces are seen as fields of potential, brimming with possibilities that transcend traditional physical and economic constraints. Together, these concepts suggest that the city's growth and evolution are not linear but multidimensional, characterized by both tangible expansion and intangible shifts in how we perceive and interact with urban spaces.

3. City as a Program

Bridging these scholarly insights allows us to affirmatively address the question, "Can an architect and/or urban planner hack a city?" Despite the diverse conceptualizations of cities by various scholars, they all converge on the inherent complexity of urban structures. This complexity prompts the proposal of a novel perspective in architecture and urban planning: Viewing the city as a program. Similar to a computer program, which is comprised of bits (the smallest units of data in computing, represented by 0s and 1s) and bytes (a group of eight bits that together "encode" a single character of text), together creating coded software with files, subtexts, and other elements, cities exhibit comparable levels of complexity and stratification.

In addition, Turgut (2021) enriches our understanding of urban complexity by introducing the metaphor of the city as an "urban palimpsest." According to this metaphor, cities are dynamic entities, akin to manuscripts that have been written, erased, and rewritten, where historical, cultural, and social layers continuously overlay and transform one another. This metaphor underscores the multilayered and evolving nature of urban spaces.

This notion of multilayered transformation is pivotal to viewing the city as a program, which suggests that, due to its intricate and layered structure, a city resembles the precision and detail characteristic of software. Within this framework, an architect and urban planner is akin to a hacker of the urban program, as can be seen in Figure 1. Mirroring the speculative approach in architecture, the "What if?" questioning is also pivotal in computer science, where hackers emerge as curious innovators. This mindset fuels the exploration and expansion of possibilities, challenging the current limitations of both digital and urban spaces (Erickson, 2008). This spirit of inquiry and innovation seamlessly connects to the role of architects and urban planners in the urban fabric. When the city is perceived as a program, the architect and urban planner, much like a hacker, possesses the necessary tools and expertise to investigate, evolve, and, when required, "de-code" and "re-code" this urban software. Thus, the analogy between urban planning and software development not only highlights the complexity and programmability of cities but also suggests a profound expansion of the traditional scope of architecture and urban planning. In this

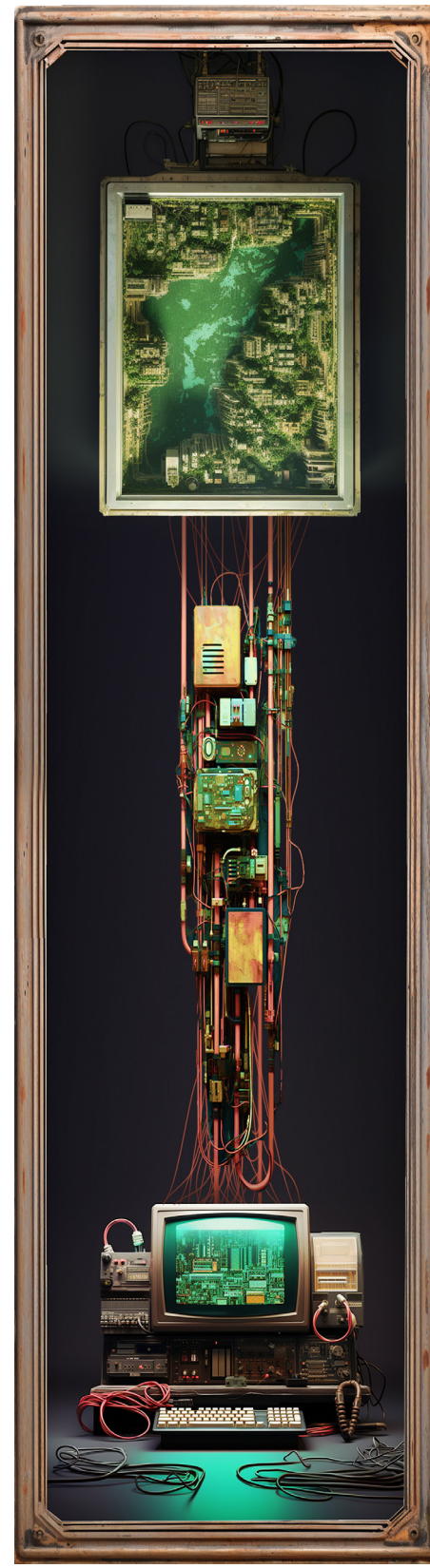

Figure 1. City as a program.

expanded role, the architect's and urban planner's responsibilities transcend mere design, embracing the broader task of reconfiguring and reimagining urban environments.

To further illuminate the analogy of the "city as a program," we draw upon insights from computer science. Brookshear and Brylow (2019) define a program as the representation of an algorithm, a set of steps designed to perform a specific task, highlighting that programs are structured in a way that is comprehensible to humans while being "encoded" for machine execution. Similarly, Van Roy and Haridi (2004) describe programs as mathematical constructions that adhere to logical laws and are built from basic concepts to form more complex structures. This suggests that, like computer programs, cities can be understood and reconfigured through a systematic approach that considers both their foundational elements and the complex interrelations between them.

The foundation of this "city as a program" concept inherently relies on the hacking of cities. "Hacking cities" symbolizes a methodology that encompasses a series of interconnected methods. In other words, while "hacking cities" may represent a methodological approach, it also denotes a title that embodies the various methods of hacking a city. Before explaining our proposed hacking method, we aim to elucidate this term from both urban studies and computer science perspectives.

From the perspective of urban studies, Maalsen (2022) emphasizes that the significance of hacking extends beyond the mere application of technologies to the urban fabric; it involves translating computational logic to urban environments, thereby setting a research agenda around hacking in urban studies. This translation is not just about importing tools but about adopting a mindset that views the city as a programmable entity, akin to a computer system. This approach allows for the exploration of flaws in existing systems and the unveiling of future possibilities and alternatives, suggesting a "city as system" view that has evolved since the late 1950s. Here, hacking is seen as both a site and method for research, revolving around practices of experimentation, creativity, and iteration to find alternative possibilities within existing urban systems (Gabrys, 2014; Chandler, 2017).

This concept is extended by framing hacking as a small but impactful manipulation of complex systems that can lead to significant consequences (Del Signore & Riether, 2021; Schneider & Friesinger, 2010). This reimagined approach to hacking suggests gaining access to and manipulating the system, thereby enabling the exploration of new relations within the urban environment. Gadringer (2010) adds to this by defining urban hacking as the creative disruption and reinterpretation of urban spaces and systems, thereby questioning, and redefining the city's traditional habitats and architectural constructs.

Expanding on these ideas, Mitchell (1996) bridges the disciplines of urban studies and digital technologies by introducing the concept of a city unbound by physical constraints, shaped by digital connectivity, where code governs every interaction within the virtual and physical realms. This exploration into digital connectivity and code signifies a pivotal intersection between urban studies and computer science, highlighting the profound impact of digital technologies on urban spaces. This view aligns with the notion in computer science that, in digital and urban spaces alike, code is law (Gunkel, 2005). Erickson (2008) further clarifies hacking as the art of finding unintended uses for the rules and properties of a system to solve problems creatively, a mindset that underpins both programming and exploiting computer systems.

Together, these perspectives from urban studies and computer science redefine hacking not just as a technical endeavor but as a transformative approach to urban planning and design, where code and connectivity become central to reimagining urban spaces. The integration of urban studies and computer science perspectives culminates in viewing hacking as a comprehensive methodology for urban planning and design. It is a process characterized by the creative repurposing of existing urban elements, the exploration of ethical implications of urban technologies, and the iterative approach to policy and community engagement (Comité Invisible, 2014; Amin & Thrift, 2002). This holistic view of hacking challenges traditional notions of urban planning and computer science, advocating for a collaborative, explorative, and innovative approach to reimagining and reshaping urban environments.

4. Hacking Cities

Leveraging these interdisciplinary insights, "Hacking a City" emerges as a methodological lens through which we can systematically address the multifaceted challenges and opportunities within urban environments, marking a shift towards more adaptive, responsive, and inclusive urban planning practices. This interdisciplinary foundation sets the stage for a methodological perspective in "Hacking a City," addressing the past, present, and future of urban environments. It begins with the examination of both visible and invisible layers of a designated space, aiming to understand and give meaning to the city down to its depths. This process of understanding begins with social city engineering, which primarily entails engaging architects and urban planners in dialogue and involves the systematic gathering of architectural intelligence. These steps lay the groundwork for the "de-coding" and "encoding" phases of the city. As a result of these hacking methods, two main dynamic forms emerge: First, enabling the urban/archi-hacker to comprehend the city in all its complexity; second, creating a path that will guide future urban/archi-hackers, thus paving the way for new hacks. It is a cyclical process of exploring alternatives for a space by new

groups, leading to the creation of new guides. The hacking methodology does not seek immediate solutions but aims to understand and give meaning to the city down to its depths, thereby opening pathways for future hacking endeavors.

The practical application of these interdisciplinary insights involves two interrelated methods crucial for hacking urban spaces: "De-coding" and "re-coding." Before delving into these methodologies, it is essential to define what "code" means. Similar to how software code forms the operational backbone of digital programs, the "code of a city"-comprising its design, regulations, and lived experiences-serves as the foundation upon which urban life is constructed and experienced. This makes it ripe for 'hacking' to improve urban functionality and livability. Just as software codes are the foundational elements that compose and define a computer program, cities possess a unique coding system. This system encompasses all the interactions, both physical and non-physical, that have shaped and will shape the city across different times (past, present, and future). For example, the morphology of the city, encompassing its past, present, and future, is one of the elements within the "code." This reflects the manifestations of all visible and invisible concepts of the city across various times.

5. Methodologically Hacking a City

In this system, where the city is envisioned as a program, architects and urban planners are seen as 'urban/archi-hackers,' with the architectural engagement with the city being conceptualized as hacking. As mentioned earlier, "hacking a city" represents a methodology in itself, while also encompassing the methodologies of hacking. After explaining what "hacking a city" aims to convey methodologically, we will elucidate the methods of this concept we have proposed.

Firstly, "hacking a city" has a clear objective: To understand and give meaning to the city or territory down to its depths. The primary goal of this process is twofold: Firstly, it equips the urban/archi-hacker with the ability to fully grasp the city's multifaceted nature; secondly, it establishes a guide for future urban/archi-hackers, thereby facilitating the emergence of new hacking methods. Similar to site analysis in architecture but also significantly different, site analyses in architecture predominantly investigate the various yet similar dynamics of a defined site in today's conditions. White (1983) defines contextual analysis in architecture as a pre-design research activity, focusing on existing, imminent, and potential conditions on and around a project site-an inventory of all pressures, forces, situations, and their interactions. While it might include details about the site's past, fundamentally, it is an analysis driven by current conditions and the needs of what is planned to live in the future.

However, "hacking a city" moves beyond the boundaries defined by traditional site analysis. It advocates for examining the past layers, the present layers, and the layers planned for the future of the chosen territory as a single piece, effectively removing the limits and constraints typical of architectural site analysis. In other words, as Arda (2023) suggests the city's historical process should be analyzed not in a linear fashion but rather as a black-hole, where time and space continually interact with each other. To put it more simply, the space is always the same; the real variables are the dynamics beneath and above the space, and their interactions within themselves and with each other. In a variable system, changing variables does not change the system. In a system where cities are acknowledged as variable entities, modifications in the visible and invisible layers of the city do not alter the fact that the city operates within a variable system. This underpins the foundational principle of the "hacking a city" concept, which posits that space and time are always in interaction.

These complications can be seen more clearly in practice. The city, designated for hacking interventions, is scrutinized based on its historical socio-cultural and socio-economic factors, along with a range of other social dynamics and physical variables. In this context, the responsibility of the architect and the urban planner, or the urban/archi-hacker, is to determine, with impartiality and logic, the extent of the historical depth to explore during this retrospective journey. Then, this process should be done both for the present day and the future. The process detailed in the "re-coding" section, focused on envisioning the future, is deeply rooted in speculative architecture. It centers on the perspectives of architects and urban planners-referred to as urban/archi-hackers-employing a "what if" scenario approach to push forward their visionary concepts.

All the processes undertaken, as detailed in the previous sections, culminate in the formation of the "code of the city." This "code" emerges not merely as an artifact of urban design but as a dynamic schema reflective of the city's selected dynamics, brought to light through the urban planner's and architect's multifaceted approach akin to that of a hacker. It is through this lens that the city's coding system-encompassing both its tangible and intangible interactions across time-becomes a fertile ground for hacking, aimed at enhancing urban functionality and livability, as can be seen in Figure 2. This endeavor, rooted deeply in the confluence of urban studies and computer science, transcends traditional boundaries of urban planning and architecture. It beckons a return to our initial discussion on the critical importance of integrating interdisciplinary insights to fully harness the innovative potential of the hacking methodology in urban environments. By revisiting this foundational premise, we underscore the transformative capacity of hacking, poised to reimagine the fabric of urban spaces through a collaborative, explorative, and iterative process. Thus, the journey of hacking a city, characterized by the continuous "encode," "de-coding," and "re-coding"

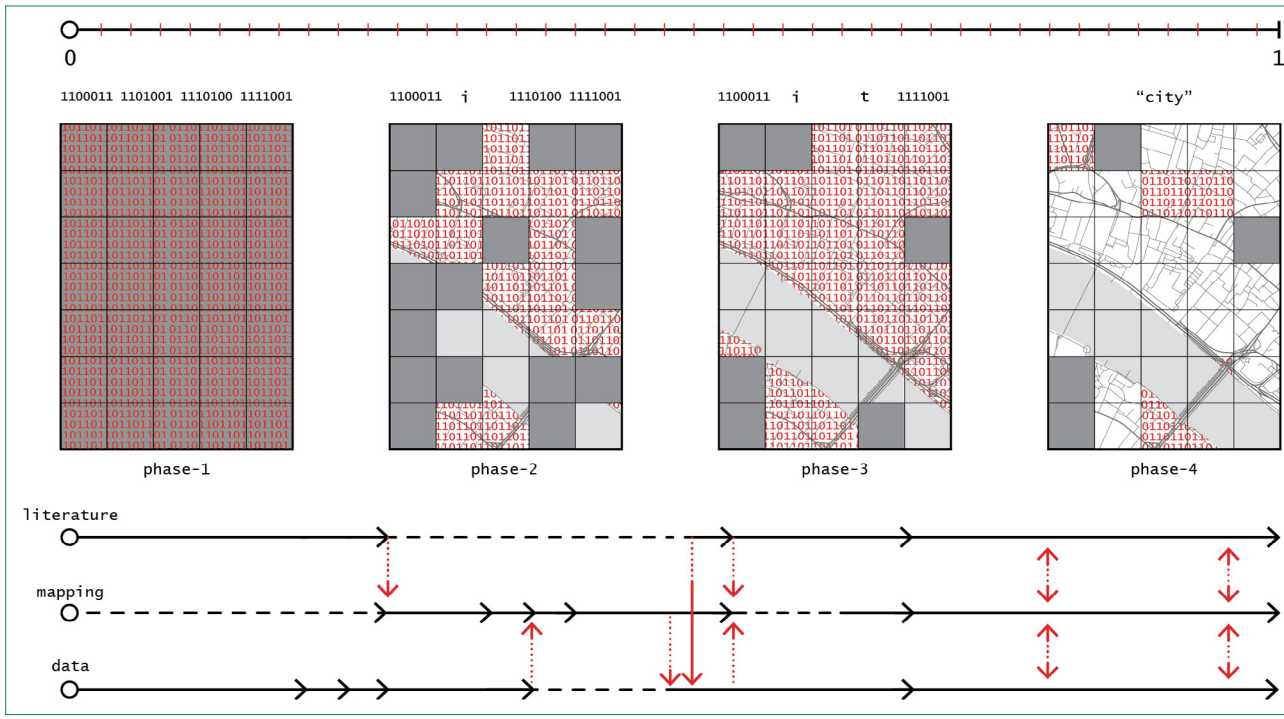

Figure 2. Hacking a city.

of urban spaces, stands as a testament to the power of viewing cities through an interdisciplinary lens, where the synthesis of urban studies and computer science provides the blueprint for future urban innovations.

Following the methodological explanation of hacking a city, we can now delve into the details of the previously mentioned hacking methods: "Encode," "de-coding," and "re-coding." But first, let us briefly recap that "code" encompasses all the dynamics-both visible and invisible, existing and forthcoming-that interact within a city. While a significant portion of this "code" is identified during the "encode" and "de-coding" process, achieving comprehensive understanding necessitates engaging in the "re-coding" phase as well. This conception of "code" as the extensive interplay of urban dynamics sets the stage for a deeper exploration of how these methodologies-"encoding," "de-coding," and "re-coding"-operate within the framework of hacking a city.

5.1. Methods of Hacking a City: "Encoding"

In the realm of computer science, the process of "encoding" typically succeeds in "de-coding." However, in the architectural framework of hacking cities, we introduce "encode" before "de-code" for a strategic reason. This approach stems from the foundational methodology of architectural hacking, which inherently revolves around the processes of "de-coding" and "re-coding." Unlike the sequential nature seen in cybersecurity, our emphasis here highlights the interlinked nature of these processes in the architectural context.

In cybersecurity, "encoding" is defined as a technique where data is transformed from one form to another. To put it simply, it is akin to how a computer interprets text written in English, utilizing various language bases. While the reader perceives this process as reading straightforward English, the computer is tasked with navigating and processing the complex underlying structures. This analogy extends to the perception of cities by urbanites. While urban dwellers experience the city as a dynamic space, the reality is that the city embodies a much more intricate form.

This complexity at the heart of the "City as a Program" concept underscores the necessity for architects, urban planners, or "urban/archi-hackers" to thoroughly understand and impart meaning to the city's multifaceted nature. This understanding is achieved through architectural intelligence gathering and social city engineering, exploring the city's dynamics over space and time through a lens of various social and physical dynamics.

The decision to frame this understanding and comprehension process under the guise of "de-coding" aims to highlight the initial step of deconstructing the city's existing complex structure. It sets a precursor for the "encoding" phase, where the gathered architectural intelligence and insights into the city's social engineering help to reimagine and reshape the urban landscape. Thus, "encoding" in this context is not just a preliminary step but a critical component of understanding and redefining the urban environment, facilitating a seamless transition between understanding the current complexities and envisioning future possibilities.

5.2. Methods of Hacking a City: "De-Coding"

In this framework, where the city is perceived as a program, the exploration and in-depth analysis of its inherent details mark the initial stage of essentially scripting this program. While our focus is on any existing city, rather than fabricating a new one from the ground up, this does not preclude the possibility of deconstructing and analyzing the city's established script. A prerequisite for initiating the city's hacking process is the execution of the "de-code" operation at least once. This is because, in an environment where the city's meaning remains undefined, proceeding to the next planned step of "re-coding," where the city will be re-imagined by the hacker, is not feasible. This pivotal process of "de-coding" involves delineating what is referred to as the "code" of the city, viewed through architectural and historical lenses. It encompasses the entirety of the city's visible and invisible physical and socio-cultural dimensions across various sections of time. If the "code" is unencrypted, the process proceeds with "de-coding." However, if encrypted, it necessitates decryption, adding a nuanced layer to the exploration. Following this, the "encode" phase entails the construction or formulation of this "code," refining and organizing the "de-coded" information into a structured format that lays the groundwork for speculative interventions and future urban planning strategies. This structured "code" then becomes the basis for the "re-code" phase, where innovative, speculative hacking interventions are envisioned to creatively address urban challenges and open pathways for strategic solutions.

The method of "de-coding" begins with gathering architectural intelligence, akin to the reconnaissance process in cybersecurity, serving as an in-depth exploration to understand and imbue the urban environment with meaning. Though in cybersecurity, this term typically refers to the act of collecting information, for a city undergoing the "de-code" process, this stage is characterized by a more analytical and spatial approach. This foundational phase incorporates a wide array of analytical techniques, encompassing both historical and contemporary literature reviews, mapping of present and past spaces, data analysis of various numerical dynamics, and the integration of architectural and urban planning dynamics, including regulations and laws. The integrated progression of these analytical techniques and the parallel advancement of historical data/information with the mapping process is significant. Although the spatial reading of a city might seem paramount from an architectural and urban planning perspective, emphasized through maps and drawings, the diversity of disciplines involved in the readings enhances the accuracy of spatial analyses.

Furthermore, the interpretation derived from city maps should adopt a transdisciplinary approach, using methodologies from computer science alongside insights from architecture, sociology, geography, geology, statistics, and economics. This approach mirrors the computational practice of layering diverse data sets. For example, overlapping a historical city plan with geological maps from the same period can reveal different dynamics of the city, while overlapping demographic analysis with land use maps uncovers different spatial and social interactions. Such methods reveal unique urban dynamics and demonstrate how algorithmic techniques can enhance our understanding of spatial and social interactions within cities, reflecting the hacking ethos of reconfiguring complex systems. In this process, the architect and/or urban planner, acting as a hacker, is tasked with creating as detailed a folder system as possible for the city's "code," containing data across various dynamics. Subsequently, they are tasked with implementing a "re-coding" process (the subsequent step) that aligns with their unique vision.

At its heart, "de-coding" involves exploring the city's architecture, its overarching planning strategies, and insights drawn from literature and various analytical methods to grasp the city's fundamental character, the "code" of the city. This crucial step is aimed at establishing foundational knowledge-the primary input data-that paves the way for the subsequent phase of "re-coding," where the city's representation is redefined. "De-coding" is akin to embarking on a journey of time travel through the different times and spaces of the city, entering a metaphorical black-hole to unveil its past. This journey through the black-hole is foundational to the "hacking cities" concept, illustrating that the city does not possess a dynamic unique to a single time but, on the contrary, reflects the dynamics of various times within it. Practically, this can manifest in various ways, for example, an old law still preventing land use in space, or a region poised for transformation being closed to construction for extended periods. The city, traversing through these disparate temporal layers, embodies the essence of multiple epochs. This process is fundamentally about sensing the city's zeitgeist across various periods and spaces. Through this, the city's "code" evolves from being one-dimensional to being detailed and complexified within time and space.

Furthermore, "de-coding" transcends the mere analysis of urban dynamics; it is a nuanced art that demands a deep understanding of the city's layered narratives, akin to interpreting complex puzzles or decrypting hidden messages. This intricate process involves "de-coding" messages conveyed in the specific languages of different periods and spaces within the city, each characterized by unique socio-cultural dynamics and ideologies. This understanding is crucial, as each era and space within the city communicates through its own distinct socio-cultural "code," reflecting the ideologies and dynamics of its time. It is crucial to distinguish this "language" from the spoken or written language encountered in daily life. In this context, "language" pertains to the computer science term, which specifies the intended message of a prompt. In our discussion, this "language" is instrumental in unveiling the city's zeitgeist across different periods.

Uncovering this zeitgeist, as previously outlined, is fundamentally an analytical endeavor. A critical component of the "de-coding" process is the synergistic integration of both historical and contemporary literature reviews with cartographic analyses. What is critical during "de-coding" is that the data unveiled, or the narrative history unfolds should be spatialized, ensuring that what the map reveals is corroborated by data and historical context. This integrated approach ensures that the "de-coding" process is not merely a technical exercise but a holistic investigation into the city's life and spirit, blending tangible architectural elements with the intangible forces that shape urban existence. Through this comprehensive and nuanced understanding, "de-coding" equips architects and/or urban planners, the "urban/archi-hackers" with the necessary insights for engaging in the creative and transformative endeavor of "re-coding," ultimately reimagining the fabric of urban spaces.

What, then, does a city look like once the "de-coding" process is complete? In essence, the process of de-coding a city is ongoing, perpetually advancing as the city evolves. However, the primary goal at the outset is to examine the webs of past times and spaces that have led to its current dynamics, thus likely resulting in a complex mapping system and a repository of information. Additionally, another outcome of this process is the heightened awareness the architect and/or urban planners, or the "urban/archi-hackers," gains. While this process indeed constitutes a tangible investigation and data processing operation, the perspectives and insights acquired by architects and urban planners, collectively known as "urban/archi-hackers," by its conclusion, introduce another dynamic that enriches the hacking process.

A city that has undergone the "de-code" process, or the "program," is now unobstructed to move to the next stage, the "re-code" phase, without hindrance. It is worth noting that a city that has been "de-coded" can indeed be "de-coded" again by another "urban/archi-hacker." This is because, although history remains unchanged, reading it is a subjective process; thus, having the "de-code" process conducted by different architects can bring the understanding of the city's "code" closer to objectivity. Furthermore, an architect or urban planner, termed as the "urban/archi-hacker," who has previously "de-coded" a city, may find themselves in a position to hack the city again at a future point in time. Such an approach raises two fundamental questions: Why might there be a need to hack again, and would repeat hacking yield different results? Primarily, considering the city's ongoing dynamic nature, the main purpose of a new hacking operation would be to understand the impact of new dynamics that the city acquires over time. Moreover, when considering that the architect "urban/archi-hacker" conducting the hacking operation might gain new insights throughout the process, the nature of the subsequent hacking operation is likely to differ.

5.3. Methods of Hacking a City: "Re-Coding"

The "re-coding" method, forms the speculative part of the research and fundamentally, as initially mentioned, can be seen as an indirect interpretation of constructing new dreams in Inception (2010) and the fictional universes between reality and perception in The Matrix (1999). After defining encryption in the context of cybersecurity, its significance within the hacking cities concept will be explained. As identified during "encoding," computers perceive languages beyond the reader's comprehension through a much more complex process, where any manipulation of the message content or even the slightest change in its parts can be defined as "re-coding." Essentially, this implies altering the intended message. "Re-coding" involves the adept reprocessing of the original message, modifying and adapting it to fit the language, culture, or perception of the target audience. Moreover, it is the art of translating the message into terms that the audience can easily understand and relate to. What is fascinating is that these two processes, "de-coding" and "re-coding," are not isolated but closely interrelated actions.

What, then, does "re-coding" mean in the context of architectural and/or urban hacking? In this system, where the profound meanings of cities are understood and grasped to their fullest, re-defining cities or explaining them in different formations is defined as "re-coding." It is the message that emerges intending to create a new awareness or reality for the perceiving audience. After elucidating the logic behind "re-coding," we will describe potential pathways that may emerge from it.

It is crucial to establish a methodological clarity that at the heart of "re-coding" lies the combination of historical urban research findings, the visible and invisible dynamics of the city, and the impact of these dynamics on the city, including socio-cultural, socio-economic, and other social effects, all merging with the physical space, i.e., the "code of the city." The manipulation of this city "code" is what "re-coding" entails. The foundation of this manipulation is the urban/archi-hacker's subjective goal, targeting the urbanites living within the city as its audience. In this process, where the intense interplay of urban planning and architecture is necessary, the urban/archi-hacker must initiate the process with urban planning dynamics and have the capability to delve into architectural scale and transition between scales.

To illustrate, consider a scenario where urban planners "re-code" a city's traffic system using real-time traffic and pollution data. This enables dynamic adjustments to traffic signals and public transport schedules, reducing congestion and enhancing air quality. Another example sees urban planners "de-coding" and "re-coding" zoning regulations in a historic district, effectively promoting a vibrant mixed-use environment that supports residential, commercial, and cultural activities. These practical examples showcase how "re-coding" leverages computational logic and innovative urban planning techniques to transform urban spaces.

This ability to transition across scales allows urban planning dynamics to be manifested spatially when the "re-coding" process moves from the city-wide level to a smaller spatial scale. Therefore, "re-coding" not only revises the physical layout but also calls for a more interdisciplinary approach to urban planning and architecture.

Because the city's "code" underlies the methods described earlier, this interdisciplinary approach is advocated not only for this method but for all stages of hacking. Situated at the intersection of architecture and urban planning, and incorporating various other disciplines (such as geography, economy, sociology, and so on) when necessary, this process should examine the city as a cumulative ensemble of various perspectives. Through the manipulative effect to be applied as a result of this examination, the intention is to add a new dynamic to the city, bringing a new perspective through "re-coding," thereby "re-coding" both the city and its inhabitants.

After revealing and processing the city's "code" through "en-coding" and "de-coding," the right atmosphere for "re-coding" has been prepared. This opens various paths for the urban/archi-hacker. Although these paths encompass the general logic of "re-coding," it is possible to open various new paths using the "re-coding" method, which "re-coding" itself advocates. The first path is "raising awareness," aiming to create awareness of the dynamics found within the city. Another path is "speculative architecture," which involves creating a fictional city by reimagining the dynamics within the city. Last but not least, "urban politics" aims to influence the city's decision-making mechanisms in conjunction with its social dynamics.

5.3.1. Re-coding as a Way of Raising Awareness

Involves using various storytelling techniques in architecture and urban planning to create awareness and communicate to the perceiving audience after researching the complex structure formed by the visible and invisible layers of the city, defined as the city's "code" or the program-like structure, "city as a program." The primary aim of this transmission is to impose a feeling or thought on the perceiving audience, making them aware of what reality is. For example, mapping a city prone to earthquakes with land use maps, population charts, and geological data to create a new mapping that raises awareness of the potential scale of the disaster could be one format. Alternatively, the transmission of various dynamics alongside different historical data could highlight dynamics emphasized throughout history. This process, driven by the urban/archi-hacker's intention to create awareness, remains a project despite its subjective aims. This awareness-raising process is a direct outcome of the "en-coding" and "de-coding" of the city's layered existence, reflecting the newly emerged dynamics of the current urban condition.

This endeavor to create awareness can extend beyond the analytical phase, incorporating the newly discovered layers to foster a new dynamic within the city and its community. The representation of this raising awareness to the city's inhabitants becomes part of the process itself, signifying that various exhibitions, conference series, and workshops can also be viewed as outcomes of the "re-coding" process. The design of these awareness-raising initiatives by the urban/archi-hacker can manifest as social events or even spatially based installations, illustrating that the effort to enlighten and engage the urban populace is a multifaceted process inherently linked to the transformative journey of urban "re-coding." Through such initiatives, urban/archi-hackers facilitate a broader discourse on urban realities, enabling a deeper, shared understanding of the city's complexities and challenges.

"Re-coding as a way of raising awareness" positions awareness at the core of urban/archi-hackers' efforts, underscoring the significant role of architectural and urban creativity in shedding light on the complex layers and dynamics of urban existence. This "re-coding" method acts as a catalyst for community engagement and understanding, emphasizing the critical role of awareness in shaping the interactions between city inhabitants and their environment, including both visible and hidden dynamics.

5.3.2. Re-coding as a Way of Speculative Architecture

On the other hand, the second path introduces the "what if" scenarios of speculative architecture into the "de-coding" process. Although it fundamentally progresses in the same direction as "a way of raising awareness," the difference lies in presenting the city in an unexplored form or concept. This speculation, entirely the vision of the architect or urban planner-referred to as the urban/archi-hacker-is fundamentally an architectural project at its core. As mentioned at the beginning, like Cobb in the Inception (2010) creating a new dream environment in Inception or the construction of an almost unreal city in The Matrix (1999), control lies entirely with the architect. Importantly, the envisioned new complex structure should not be too detached from reality. A digital city perceived as distorted or unrealistic by the urbanites will not be satisfying or sustainable as a "re-coding" and hacking process.

The culmination of the "re-coding" processes results in the conceptualization of a city form, a tangible manifestation of the urban/archi-hacker's creative vision. This innovative urban blueprint, born from the fusion of imaginative speculation and rigorous architectural analysis, embodies the unique perspective and aspirations of its creator. Within this transformative framework, every detail, from the overarching narrative style to the intricate plot, is meticulously crafted and controlled by the architect or urban planner, referred to as the urban/archi-hacker. It is a deliberate orchestration of urban elements and narratives, designed to provoke thought, evoke emotions, and inspire action.

"Re-coding as a way of speculative architecture" underscores the expansion of speculative architecture's horizons,

bridging the gap between the theoretical and the imagined space. "Hacking Cities" introduces a novel proposition: Viewing the city not merely as a backdrop for science fiction narratives but as a canvas ripe for the urban/archi-hacker's creative envisioning. This perspective invites them to reimagine the city as their fictional universe. Grounded in a subjective utopia, this fictional realm is informed by the dynamic interplay of the city's multifaceted layers across various epochs and spatial dimensions-echoing the intricacies of a black-hole. This imaginative leap urges urban/archi-hackers to merge speculative concepts with the city's reality, positioning the tangible transformation of urban spaces within the realm of possibility and architectural innovation.

This speculative universe is envisioned to host a hypothetical populace, depicting it as speculative as the universe itself. By situating a speculative city at the crossroads of science fiction, architecture, and urban planning, "Hacking Cities" aspires not to entertain and embed meaningful narratives within the urban fabric. This vision, championed by the urban/archi-hacker, serves as a foretaste or trailer of a narrative that poses an alternative "what if" scenario for the city. It is a call to probe the limits of urban imagination, challenging urban/archi-hackers to propose transformative visions that could redefine the essence and trajectory of urban development.

5.3.3. Re-coding as a Way of Urban Politics

The concept of "city as a program," suggests that cities are dynamic structures not limited to physical spaces but also encompassing social arenas. This perspective challenges the conventional view of time and space as linear, suggesting instead that cities function more akin to a black-hole, where various temporal and spatial dimensions intersect and interact. This framework is built on the premise that decisions made for cities often pertain to different times and are designed for spaces distinct from the current environment. Beyond the visible social networks created by cities and their inhabitants, there exists an invisible network structure-the decision-making mechanism dynamic. This political infrastructure, arguably one of the most critical components of a city, typically employs urban planners and architects as tools to make decisions for the city. However, the journey to envision the urban, or the "re-code" method posits a paradigm shift, and advocates for political dynamics to serve as tools for urban planners and architects, not the other way around.

"Hacking Cities," advocating that the complex structure of cities can only be "re-coded" by urban/archi-hackers, positions these professionals at the forefront of creating new urban decision-making arrangements in the stage of "re-coding as a way of urban politics." Through this pathway of "re-coding," urban/archi-hackers have the potential to pioneer the establishment of a spatial decision-making mechanism for cities-whether it is improving the efficiency of existing systems or creating new mechanisms where none previously existed. This approach places urban/archi-hackers in a pivotal role, enabling them to contribute significantly to the urban political landscape, thereby reshaping the urban governance framework through innovative and strategic interventions. It paves the way for fostering spatial justice within cities, ensuring that urban development and policymaking processes are equitable and inclusive. Urban/archi-hackers are positioned to initiate reforms that not only optimize existing governance systems but also craft novel frameworks where needed, thus promoting fairness and equity in the distribution of urban resources and opportunities.

As a result of "re-coding as a way of urban politics," a range of new dynamics can be generated, including recommendations for new urban management mechanisms, strategic urban planning studies, and future master plans based on simulations at the urban planning scale. In addition, specific spatial development plan recommendations could facilitate more comfortable social dynamics for city dwellers. While this process may predominantly require interaction with politics, the pathway followed by the urban/archi-hacker will be a subjective process aimed at achieving the ideal for the city. This approach underlines the transformative potential of urban/archi-hackers in fostering more livable, just, and dynamically responsive cities. By embedding equity and strategic foresight into the fabric of urban development, they set the stage for a more adaptive and inclusive urban future.

6. Ideal Hacking

In this article, we embarked on an exploration to delineate the contours of "Hacking Cities," presenting it as the zenith of urban re-imagination and innovation. However, as we ventured through the intricacies of cities with the mindset of urban/archi-hackers, it became apparent that the journey towards achieving this ideal is influenced by a myriad of dynamics-both visible and invisible, tangible and intangible. These dynamics, spanning across socio-cultural, socio-economic, technological, and political spheres, each play a pivotal role in shaping the hacking process and its outcomes.

To further elucidate the dynamics influencing the "Hacking Cities" methodology, an exploded view diagram titled "City of Urban/Archi-Hacker" (Fig. 3) illustrates the city's physical layers on the vertical axis and social layers on the horizontal axis, highlighting the interplay of socio-cultural, socio-economic, technological, and political factors.

"Hacking Cities" in its ideal form emerges as a visionary concept that seeks to transcend conventional urban planning and architectural boundaries, urging us to reconsider

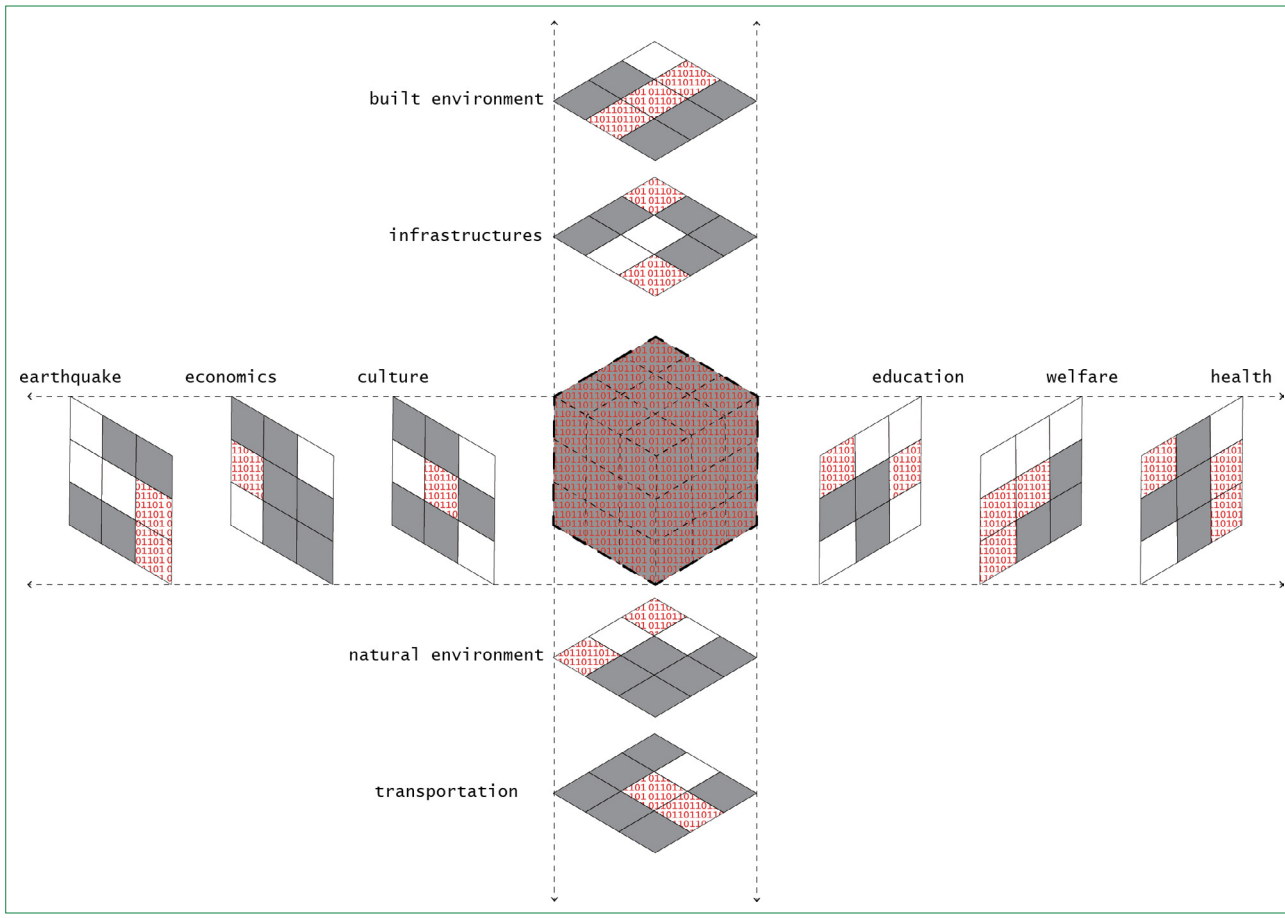

Figure 3. City of Urban/Archi-Hacker.

the city as a programmable and hackable entity. Yet, the realization of this vision is contingent upon navigating the complex network of urban dynamics that define our cities. Through our discussions on "encoding," "de-coding," and "re-coding," alongside the innovative methodologies of urban/archi-hacking, we have illustrated the immense potential for transformative urban interventions. However, the path to ideal hacking is not linear or predetermined but is instead a reflective and adaptive process, shaped by the urban context and its multifaceted dynamics (Fig. 4).

Ultimately, while we strive to showcase the principles and potential of "Hacking Cities," we also recognize that the journey toward realizing such a vision is as much about the process as it is about the destination. It invites urban/archi-hackers to engage deeply with the city, employing a blend of creativity, analytical insight, and collaborative ethos to navigate the ever-changing urban landscapes. In doing so, "Hacking Cities" stands not as a fixed endpoint but as an ongoing dialogue-a conversation among architects, urban planners, and the broader community of cybersecurity members, aimed at co-creating cities that are more livable, equitable, and responsive to the needs and aspirations of their inhabitants.

7. Further Discussions

First and foremost, it should be noted that "hacking cities" is not just a methodology; it is fundamentally a way of thinking. At its heart is the ambition to understand cities to their deepest meanings and layers, revealing the intricate tapestry of their existence. This exploration necessitates the use of various hacking methods, and throughout this article, we have elucidated the foundational methods of "encode," "de-code," and "re-code." Alongside these core strategies, we delved into subtopics such as social city engineering and gathering architectural intelligence, showcasing the breadth of analysis required in this innovative approach to urban exploration.

The potential to enrich this methodological network further exists, introducing techniques like the "backdoor attack." This method, reminiscent of cybersecurity tactics, entails creating a covert entry point during the hacking process, enabling future interventions. In the realm of architecture and urban planning, this approach could be likened to identifying a microcosm within the city-a small-scale territory that, once hacked, serves as a conduit for demonstrating broader urban impacts, effectively creating a "backdoor" that links small-scale changes

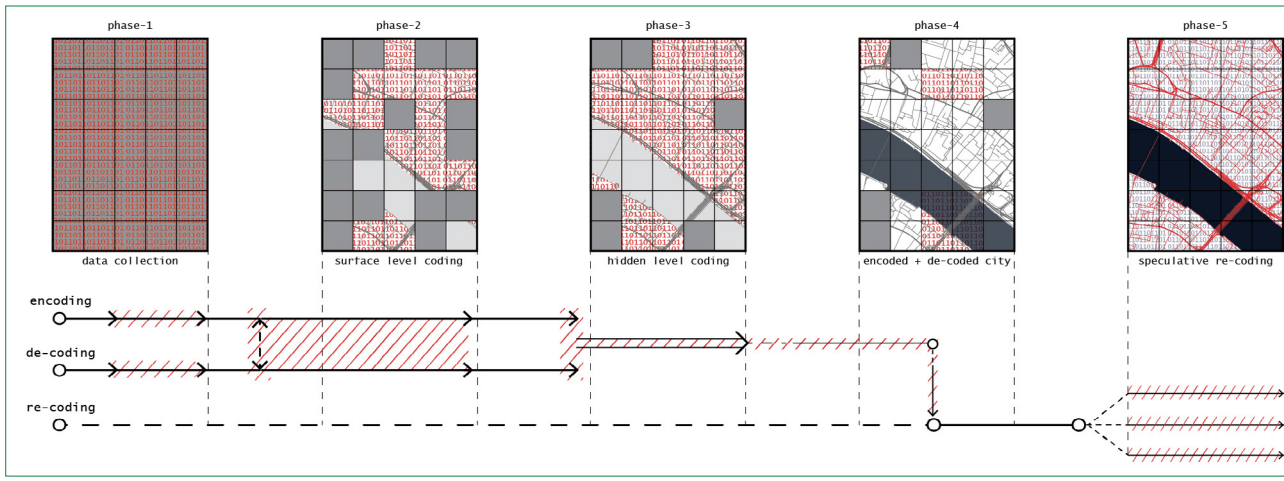

Figure 4. Step by step hacking.

to city-wide transformations. Another methodology entails deciphering the city's complex structure in scenarios where open access data is unavailable, metadata is scarce, and concerns over data transparency and accuracy preclude certain urban dynamics from being readily accessible to architects and urban planners. This process, termed "credential dumping of cities," aims to "de-code" the city's enigmatic, puzzle-like architecture using a combination of contemporary and historical insights, thus revealing its intricate layers. Additionally, the technique known as a "DDOS (Distributed Denial-of-Service) attack on a city" finds a practical analog in urban studies, symbolizing the stress-testing of a city's infrastructural and operational limits through simulations. This might involve assessing the city's thresholds for population density, construction volume, traffic flow, and similar urban dynamics to anticipate potential system overloads or breakpoints.

On the flip side, as long as cities continue to evolve, they remain susceptible to being 'hacked' in the broadest sense. However, fully "de-coding" a city's past presents its own set of challenges, chiefly due to the finite nature and questionable authenticity of historical data. Despite presenting a framework for an ideal hacking methodology, it is essential to recognize that the specific geographic context of the application greatly influences its success. Data-rich environments may facilitate a closer approximation of this ideal, whereas data scarcity and the intricacies of historical narratives may lead to deviations from the envisioned process.

8. Conclusion

In synthesizing the perspectives presented, our conclusion navigates the transformative potential of "Hacking Cities," a methodology that heralds a paradigm shift in how we comprehend, engage with, and ultimately reshape urban spaces. This discourse merges speculative fiction with practical urban research, challenging traditional boundaries between architectural and/or urban theory and practice, and proposing a future where cities are not merely inhabited but actively programmed and reprogrammed by those who understand their deepest layers.

At the core of "Hacking Cities" lies the ambitious aim to bridge the substantial gap between theoretical urban studies and tangible architectural urban practice. It critically addresses the often sequential or parallel progression of theory and practice in urban exploration, highlighting the imbalance where one often eclipses the other in depth and detail. This methodology illuminates the need for a more integrated approach, where architects and urban planners go beyond the confines of their immediate project sites to engage with the city at large, in all its complexity.

As architects/urban planners assume the role of urban/archi-hackers, employing the techniques of "encode," "de-code," and "re-code," they delve into the urban fabric's multiple layers-social, cultural, economic, and physical. This process is akin to navigating a digital and cyber labyrinth, where each turn reveals new insights about the city's past, present, and potential future. Inspired by the narrative depth of films like Inception and The Matrix, "Hacking Cities" suggests that architects and urban planners can reimagine urban spaces as deeply as dream architects/planners sculpt dreamscapes or as urban/archi-hackers navigate digital realms.

This visionary approach is underpinned by a critical understanding that the exploration of cities requires a convergence of interdisciplinary insights, marrying the precision of computer science with the nuanced understanding of urban studies. It proposes that cities, much like vast computational entities, contain "codes" that, when "encoded," "de-coded," and "re-coded," can unlock new dimensions of urban life and functionality. The "city as a program" framework advocates for a novel perspective where cities are dynamic canvases ripe for exploration and innovation, continuously reimagined through the architect's and urban planner's lens.

Reintroducing our lexicon at this juncture-terms like "urban/archi-hackers," "city as a program," and the transformative processes of "encoding", "de-coding," and "re-coding"-underscores our original contributions and the progressive findings of this research. These concepts form the bedrock of our methodology and are pivotal in articulating the envisioned changes in urban dynamics.

By advocating for "Hacking Cities," we envision a future where the act of designing urban spaces is as dynamic and iterative as the development of software, enabling continuous exploration and innovation. This speculative methodology does not pursue definitive solutions but fosters a culture of curiosity, imaginative engagement, and transdisciplinary collaboration, paving the way for urban environments that are more adaptive, responsive, and inclusive.

Concluding our journey, we circle back to the poignant question that sparked this exploration: "What would happen if an architect and/or urban planner perceived a city as a program and acted like a hacker?" This query not only invites us to reconsider the role of architects and urban planners in shaping the cities of tomorrow but also challenges us to imagine a future where urban spaces are as fluid, programmable, and vibrant as the communities that inhabit them. Through "Hacking Cities," we embark on a continuous quest to redefine the urban landscape, ensuring that it remains a fertile ground for innovation, reflection, and collective reimagination.

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