

Three-dimensional thermal stress analysis of multilayered piezoelectric curved panels

Original

Three-dimensional thermal stress analysis of multilayered piezoelectric curved panels / Brischetto, S., Cesare, D., Mondino, T.. - In: COMPOSITE STRUCTURES. - ISSN 0263-8223. - 387:(2026), pp. 1-22.
[10.1016/j.compstruct.2026.120338]

Availability:

This version is available at: 11583/3009688 since: 2026-04-08T07:29:58Z

Publisher:

Elsevier

Published

DOI:10.1016/j.compstruct.2026.120338

Terms of use:

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

Publisher copyright

(Article begins on next page)

Notes

1. Text from the PhD Workshop exercise 0, Saskia De Fabritiis, 2025.
2. Garbin, Emanuele, *Bathygraphica, Disegni e visioni degli abissi* (Macerata: Quodlibet, 2018), 15–37.
3. Garbin, *Bathygraphica*.
4. William M. Ivins, *Prints and Visual Communication* (Harvard University Press, Cambridge Mass, 1953).
5. Rebecca Horn, (n.d.) in *Drawing and Thinking. Confronting an Electronic Age*.
6. With contemporary CAD software, we draw brick walls (which we know will be built on muddy sites, by workers wearing thick gloves) to six decimal places. The wall drawn to several decimal places is an extraordinary methodological absurdity that, nonetheless, strangely does not seem to embarrass us. Quite the contrary - we exult in its exactitude". From *Matter, Measure and the Misadventures of Precision*, Hughes, 2014.
7. Hughes, *Matter, Measure, and the Misadventures of Precision* (Cambridge: The MIT Press, 2014).
8. William M. Ivins, *Prints and Visual Communication* (Harvard University Press, Cambridge Mass, 1953).
9. "Architectural forms are no longer created by the craftsman's tools, but by the pencil. From the elevation of a building, from the manner of a piece of ornamentation, one can tell whether the architect was using a no.1 or a no.5 pencil. And what a terrible havoc has the compass wreaked on our taste! Since architects have taken up the ruling pen, architectural drawings have come out in a rash of little squares and no window embrasure, no marble slab in uninfected. The tiniest details are drawn in on a scale of 1:100 and the bricklayer and stonemason have to chip out or build up the graphic nonsense by the sweat of their brow. If the draftsman happens to have colored ink in his pen, then the gilder has to be called in". From *On Architecture*, 1910.

Image Captions

- Fig. 1 Vija Celmin, Untitled [Waves], 1970.
 Fig. 2 Tavola IX, Matthew F. Maury, The Physical Geography of the Sea, 1855
 Fig. 3. Exercise 1, PhD Workshop The Drawing and the Detail, Politecnico di Milano, 2025. Image by the author.
 Fig. 4. I fari del Nautilus, in Jules Verne, *Vingt mille lieues sous les mers*, 1870.
 Fig. 5. Exercise 5, PhD Workshop The Drawing and the Detail, Politecnico di Milano, 2025. Image by the author.

References

- Bartman, William S., ed. *Vija Celmins. Interviewed by Chuck Close*. New York: Art Resources Transfer Press, 1992.
 Diserens, Corinne, ed. *Gordon Matta-Clark*. London: Phaidon Press, 2003.
 Evans, Robin. *Translations from Drawing to Building and other essays*. Architectural Association, 1997.
 Garbin, Emanuele. *Bathygraphica. Disegni e visioni degli abissi*. Macerata: Quodlibet, 2018.
 Hughes, Francesca. *Matter, Measure, and the Misadventures of Precision*. Cambridge: The MIT Press, 2014.
 William M. Ivins, *Prints and Visual Communication*. Cambridge Mass: Harvard University Press., 1953.
 Loos, Adolf. *On Architecture*. Trans. Michael Mitchell. Selected and introduced by Adolf Opel. Riverside, CA: Ariadne Press, 1998.
 Treib, Marc, ed. *Drawing/Thinking. Confronting and Electronic Age*. London/New York: Routledge, 2008.

Biography

Saskia De Fabritiis is an architect and currently a doctoral researcher at the Faculty of Architecture and Urban Planning (DAStU) at Politecnico di Milano. In her autonomous practice, she engages in building actions for community design, collective care of public spaces and the regeneration of broken ecosystems. She teaches architectural and landscape design in Mendrisio and Milan.

The search for a *weak* legacy. Drawing as a tool to reorient the reading of urban space in Tirana

Della Scala, Valerio

Polytechnic of Turin, Department of Architecture & Design (DAD), TdpLab, Turin, Italy, valerio.dellascal@polito.it

Abstract

This contribution aims to explore the potential of drawing both as a tool for critical urban analysis and as a basis for transformative scenarios, through some visualisations extrapolated from a research in progress.

The work presented is part of an ongoing transnational project (called See:4 Cities) focused on the architectural socialist legacy in the Western Balkans (specifically in: Belgrade, Podgorica, Skopje, Tirane), aiming to rethink it as a partial countermeasure to the real estate speculative drifts that are affecting, albeit in a particular way, the aforementioned cities.

Within this framework, a portion of the city of Tirana become here the subject of an in-depth visual analysis based on the construction of a specific syntax: conventional modes of representation are combined to interrelate heterogeneous factors – such as land configuration, tenure regimes, proper and improper uses of the space, social and building density and architectural distribution – thus bringing out material and immaterial elements of the space.

Instead of a mere spatialisation of pre-tagged data, such approach primarily aim to reorient questions on particular urban areas and on their transformability. The output, in this sense, is conceived neither as a genealogical mapping nor as a basis for design in the strict sense. Rather, the scope is to identifying relationships which can only be grasped if visualised and thus defining a support for new urban reasoning. As a working method, the meaning of the proposed visualisations is never absolute or definitive: they are incremental, and will evolve further by integrating multiple dimensions depending on the different lens one chooses to adopt.

The work deliberately straddles the line between automation and analogic, in the belief that the inquiry phase cannot be delegated in its entirety to a specific software or product, especially if drawing is considered in an epistemological sense.

Key words: Tirana, dispositions, hybrid mapping, post-socialist urbanism, weak legacy.

1. Introduction

“Yet the ball does not have to roll down the incline to have the capacity to do so, and physical objects in spatial arrangements, however static, also possess an agency that resides in relative position. Disposition is immanent, not in the moving parts, but in the relationships between the components.”¹

I have been reflecting for some time on the concepts of “disposition” and “active forms of interplay” as they were introduced by Keller Easterling.² In particular, on their possible design and “visualisable” implications. Although these notions mainly refer to exceptional objects such as the so called ‘zones’ – in a broader sense, the infrastructural sphere – they challenge design skills, by offering particularly relevant insights into the architectural and urban fields. How and if, for instance, this form of spatial agency can be represented in a projective sense in order to identify its potential. The suggestion to observe the space by identifying possible transformative *lines*, understood neither as master plans nor as architectural prefiguration, but rather as “a set of instructions for an interplay between variables”, explains what the American scholar means by using those two specific definitions: “not a thing but a means to craft a multitude of interdependent relationships and sequences: an updating platform for inflecting a stream of objects”.³

However, this is not an isolated suggestion: claims about the urgency to reveal the opaqueness of urban environments – in the various forms it may presents itself – have been emerging for some time⁴, leading to several experiments.⁵

This paper follows a similar line of thought by focusing on a critical mapping of an urban sample of the city of Tirana (I will return later to what is meant here by the term mapping) with a twofold objective: on the one hand, to analyse it in a deep and materialist way, unveiling relationships between tangible and intangible elements; on the other, to explore the potential for further transformation. Thus, apart from the descriptive goal, mapping is here intended as a “device that operates, more or less directly, towards an architectural intervention”.⁶ This enables a relative understanding of the existing urban fabric and its implicit capacity to orient and support interventions conceived as alternatives to the most common city-building vectors.

1.1 Background

The core of this article is a visual excerpt from the ongoing transnational project SEE:4C (South Eastern Europe: 4 Cities)⁷, a research which involves different universities from Italy and the Western Balkans and focuses on the potential of the socialist architectural legacy in relation to the current transformative policies and the strong real estate developments that are affecting the region (specifically in: Belgrade, Podgorica, Skopje, Tirane). Within its framework, a team composed by scholars from Turin and Tirana⁸ is exploring some issues related to the current urbanisation of the Albanian capital. Though the topics of that research are not the subject of this paper, it is worth mentioning them briefly for context.

Recent urban policies related to Tirana have put the city on the global architecture map, making it fertile ground for the impulses of many top firms in world design. It is a well-known story: BIG, MVRDV, innovation, acceleration, ARCHEA, futuristic, 51N4E are some of the tags of a growing narrative that, whether considered as a vector for economic growth and for redefining the political country's status⁹, or as a counterproductive pursuit of a mirage¹⁰, conceals much more.

Urban transformation is occurring at such an intense and rapid pace that it often creates problematic overlaps, making it very difficult to analyse its current and future effects. Though it has entered a different phase almost twenty years ago – once the illegal building practices have been curbed through the reinforcement of the regulatory framework – the city-building is still fuelling issues that emerged with the explosion of unregulated settlements that marked the 1990s, during the first post-socialist era; in particular, dramatic land consumption and the indiscriminate erasure of pre-existing traces, public space and permeable soil.¹¹

These are mainly the effects of a real estate economy which, according to some analyses, appear to be a huge speculative bubble¹² with asymmetry between the rapid increase in housing supply and the related credit rates on the one hand, and the actual demand on the other.¹³

To give an idea of the current construction pace, 894 building permits were granted in 2024, corresponding to over 1.9 million square metres in a city of just over 40 km². Further complicating matters is the inefficiency of a planning system made by a sequence of media-resonant visions – once again, a field of engagement for global firms –, with little or no practical application.¹⁴ Construction sites follow one another inexorably regardless of land use law and compensatory measures – often, even rules and codes –, contributing to a critical misalignment between the increase of the built surface and any planned strategy.¹⁵ The intersection between post-socialist sprawl and ongoing interventions is resulting in an increasingly dense and fragmented urban agglomeration, in which nothing seems to exist outside of vertical market-driven dynamics.

This very brief overview aims to give an idea of the main mechanisms that are radically changing the urban face of Tirana. As things stand, the intensity and frequency of the transformations expose graphic analyses and mapping attempts to the constant risk of obsolescence. Yet, conversely,

precisely because of the frenzy that accompanies urban development, without it being based on adequate spatial analysis, there remains much room for exploration. As anticipated, what is presented here is a partially speculative project, whose ultimate goal is to test some mapping methods that allow for a different approach to design.

1.2 Why talk about weak legacy? Notes on the case study

Legacy is intended here not as a value of physical objects itself, but rather as a form of interplay between tangible and intangible dispositions. Thus, the concept does not refer to heritage understood as something to be safeguarded for its intrinsic value; it is a vision that seeks to go beyond a mere inventory and capitalisation meaning. The prefix ‘weak’, instead, is an attempt to articulate the concept on a particular basis, referring to the marginalisation of the public sphere, and to the lowering of the social and spatial agency connected to Tirana’s urbanisation.

Thus, what can the weak legacy as a lens allow us to grasp? Instead of starting from a clear issue, I let the observation of a particular space suggests which elements to focus on. Thus, reversing the approach underlying the current urbanisation processes.

The chosen sample for the analysis is an area of 1km by 1km surrounding the “Student City” [*Qyteti Studenti*], a public university dormitory that belongs to the socialist architecture period. Positioned between the defined urban and peri-urban zone of the city of Tirana, official traces of this district first appeared in the 1972 Regulatory Plan of the city of Tirana¹⁶ – implemented until the end of the 70s.

Perhaps not much for the architectural value it carries, but rather for its intangible heritage and memory, it is known as the site of the student protests which became the catalyst for the fall of the regime. Its territory on most of the perimeter became then a destination for informal developments. These have densified year after year, changing its very destination from an end-zone to a transitional, intermediary, and connecting one between different stratifications, not only in terms of urban morphology but also at the socio-cultural level of its inhabitants.

With a total surface of 25ha – 8 of which occupied by informal buildings –, it hosts today approximately 13000 students¹⁷, and represents one of the few areas with a high degree of porosity. Given these characteristics, this remains a place where it is still possible to consider integrating the socialist legacy into urban development strategies, making it a suitable case for the purpose of this work.

1.3 Structure of the article

The article is organised into four sections: after this first introductory part on the topic and objectives, the second addresses the theoretical and epistemological approach, illustrating the methodology adopted; the third, instead, represents the core of the paper, containing the graphic elaboration accompanied by a critical reflection on its features and usefulness. Lastly, the fourth section summarises considerations on critical issues and possible further developments.

2. Towards an operational mapping: a theoretical and methodological framework

Drawing is intrinsic to architectural design, but its sphere of relevance extends far beyond individual fields of study. Whether it is investigating human cognition through “knowledge cartography”¹⁸, exploring schizoanalytic cartographies¹⁹ or solving physic problems through a diagram²⁰, its practice permeates knowledge production in a broader sense. Moreover, as Arnheim stated, drawing – visual thinking, extensively – is always a transformative practice.²¹ Therefore, it is essential to delimit the terms in which it is referred to or used. Here I will mainly rely on two concepts: operational mapping and active forms of interplay. Operational mapping is a reworking of Marc Schoonderbeek's reflection on the potential of maps not as an alternative but as an informative act of architectural production. The latter, instead, is an original concept already mentioned as a founding point of the paper, as this and other Easterling's theoretical notions were a trigger for the graphical investigation.

The aim is to critically combine these subjects of thoughts in order to define a specific mapping model. This is not a particularly original attempt: as already mentioned, several experiments in the field of mapping have been and are still being made to bring together heterogeneous dimensions in a transformative perspective. But precisely because they are exploratory trials based on hybrid practices, every contribution in this direction can be considered as a prototyping effort.

Considering this theoretical framework as the basis for operational reasoning, I will now try to delve deeper into its assumptions, examining the perspectives associated with it and how they converge into the graphical work.

2.1 Mapping as a container, spatial analysis as a project.

As mentioned above, mapping in this context should be understood as a device that works on the threshold between spatial analysis and design. Given the many intertwined modes of representation – including cartography, axonometric schemes, territorial sections, spatialisation of quantitative data and diachronic diagrams – the term mapping also seems the one that best lends itself to associating the various categories mentioned.²² It will therefore be clear that I am not referring to the merely

cartographic meaning of this tool, but rather to the chance it provides to draw particular imaginaries, being a medium capable of orienting the perception of places and things by overlapping inscriptions.²³ Without delving too deeply into critical cartographic thinking, I would like to emphasise the importance of viewing the map in the next chapter by detaching it “from an expectation of represented reality”,²⁴ and instead reading it as an informative act of architectural production.²⁵ By showing relationships such as the one between population density, soil coverage index and public services, for instance, one can provide a relevant transformative potential; but this requires the ability to spatialise things in order to reveal assemblages that are implicitly design-oriented.

This is undoubtedly a creative use of Easterling's reasoning, which, however, is not intended to be specious. In describing the characteristics of these active forms, she speaks of “constantly evolving elements [...] identifying just a few of the many active forms that could be manipulated, redesigned or rewritten means simply beginning to decipher the code, making the provisions that influence it more tangible and providing some tools for regulating the political character of the infrastructural space”.²⁶

2.2 Method of inquiry

The approach adopted here can be defined as a critical spatial reading that integrates specific analysis – of the chosen sample – and more general reflections on the city and its urban development, based on both scientific literature, documentary sources and fieldworks.

The basis of the map is a reworking of official documents collected from both local and non-local databases – in particular geospatial agencies, geographical institutes, land registers and information systems –, which is integrated with quantitative and statistical data. On this “framework”, already oriented according to specific themes, different representations and scales are layered, defining the particular reading of the sample.

More specifically, the maps are a reworking of a base obtained by integrating the most up-to-date file provided by the local cadastral agency with satellite and fieldwork surveys and. This integration was necessary because, as is often the case in the Balkans, technical documentation can differ significantly from the actual situation. Geoportals and satellites were useful in surveying the morphology (both territorial and fabric), while only cadastral data allow us to understand the geography of the plots and properties, which are constantly evolving. The maps were therefore processed using GIS, CAD and Illustrator software. GIS was also used as a basic tool to extrapolate orography and volumes, even on an architectural scale, using polygonal meshes and architectural data meshes. In this case too, the designs were then refined using CAD and Adobe software.

Though the work is entirely digital, it is partially based on a quasi-analogic approach, especially for the three-dimensional visualisations and the more speculative ones. This stems from the intention to use the map in an *investigative* way. In this sense, the work aims more at the critical definition of the research objectives than on the search for possibilities offered by a specific software. This is an important point to emphasise, especially since the reflection on the potential of mapping seems today to be absorbed by an unbridled exploration of what technological implementation has to offer, resulting in an increasingly acritical application of this tool.²⁷

3. Qyteti Studenti and the search for active disposition

What are the infrastructural metrics²⁸ that structure urban space as infrastructure – what it does rather than what it is – i.e. the set of performances that make the city an object comparable to an operating system?

This is a complex question that draws attention to the *hidden* or barely visible substrates that make up the built environment as an infrastructural device. It is not simply a matter of connections, networks or transport systems. There are other elements to consider: plot systems, property, interactions, uses of space, leftover areas, public-private thresholds, accessibility systems, ex-aptated buildings, cabling, parkings, road junctions, ATMs, playgrounds and regulations, to name a few. While at first glance these may not appear to be infrastructural objects, they should be viewed in a performative sense. Beyond its physical form, how does a boundary wall delimiting a private lot interact with other components? Does it conceal improper uses of space? Does it affect the mobility? Does it obstruct or facilitate the provision of basic urban services?

To intervene in this area – where there is a need for increased capacity and services, and an undervalued potential due to the disjointed sequences of thresholds between the informal areas and the Student City itself – more than a masterplan will be needed. It will take a lot of thought to understand what kind of actions need to be developed. Thus, instead of defining boundaries, it is crucial to investigate the forces that can be generated between the zone to be intervened upon and its surroundings. If in infrastructural space, discrepancy can be a better teacher than certainty²⁹, reading this space as a sequence of problematic but significant thresholds can be particularly revelatory from a design-oriented perspective.

This is the approach underlying the proposed map, conceived as a single visual that interconnects various cartographies, drawings and diagrams (Fig.1). In the following paragraphs, the map will be

unpacked into four components, in order to explore how each portion responds to specific objectives, while still working together with the other ones through intersections between layers.

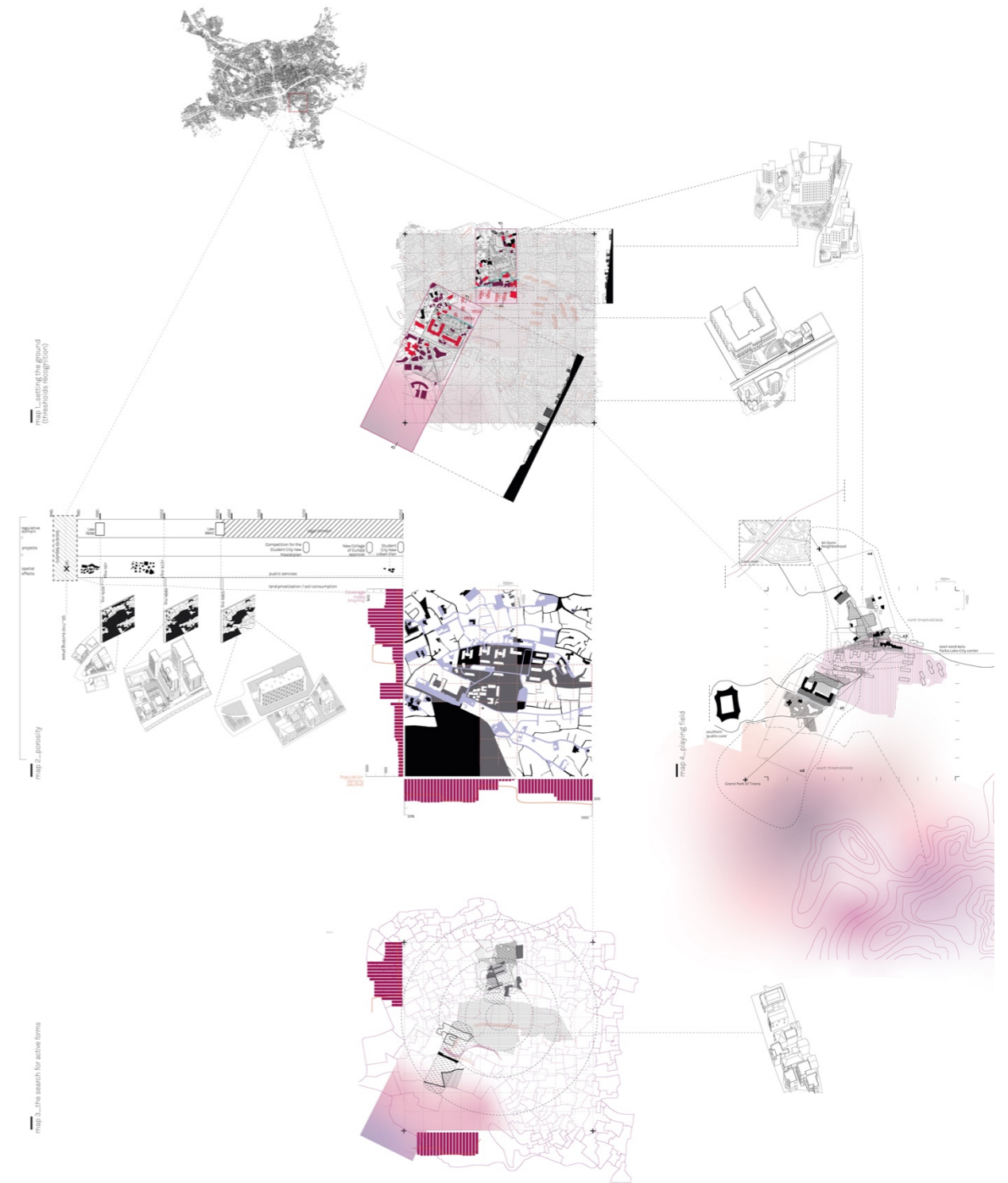


Fig.1

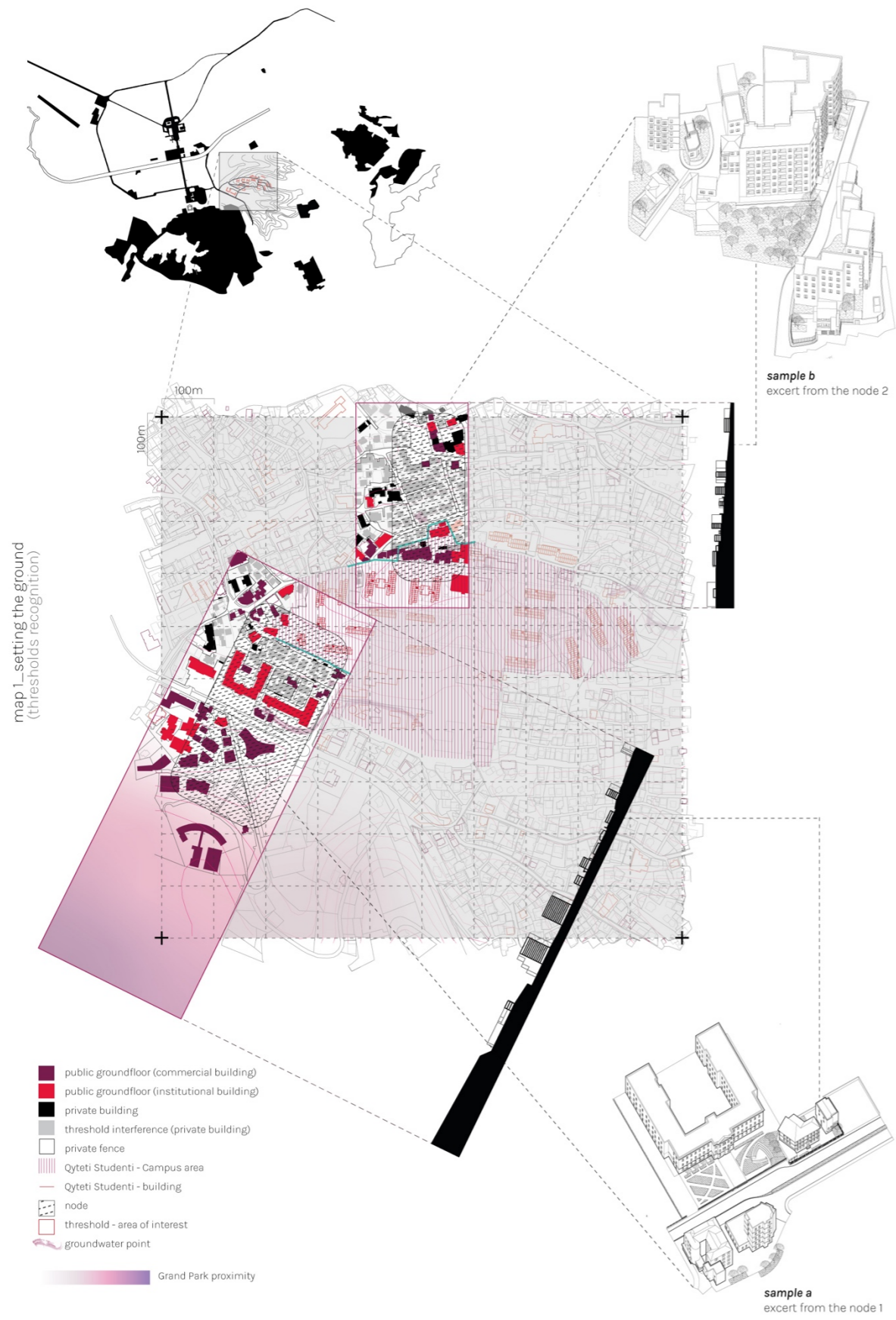


Fig.2

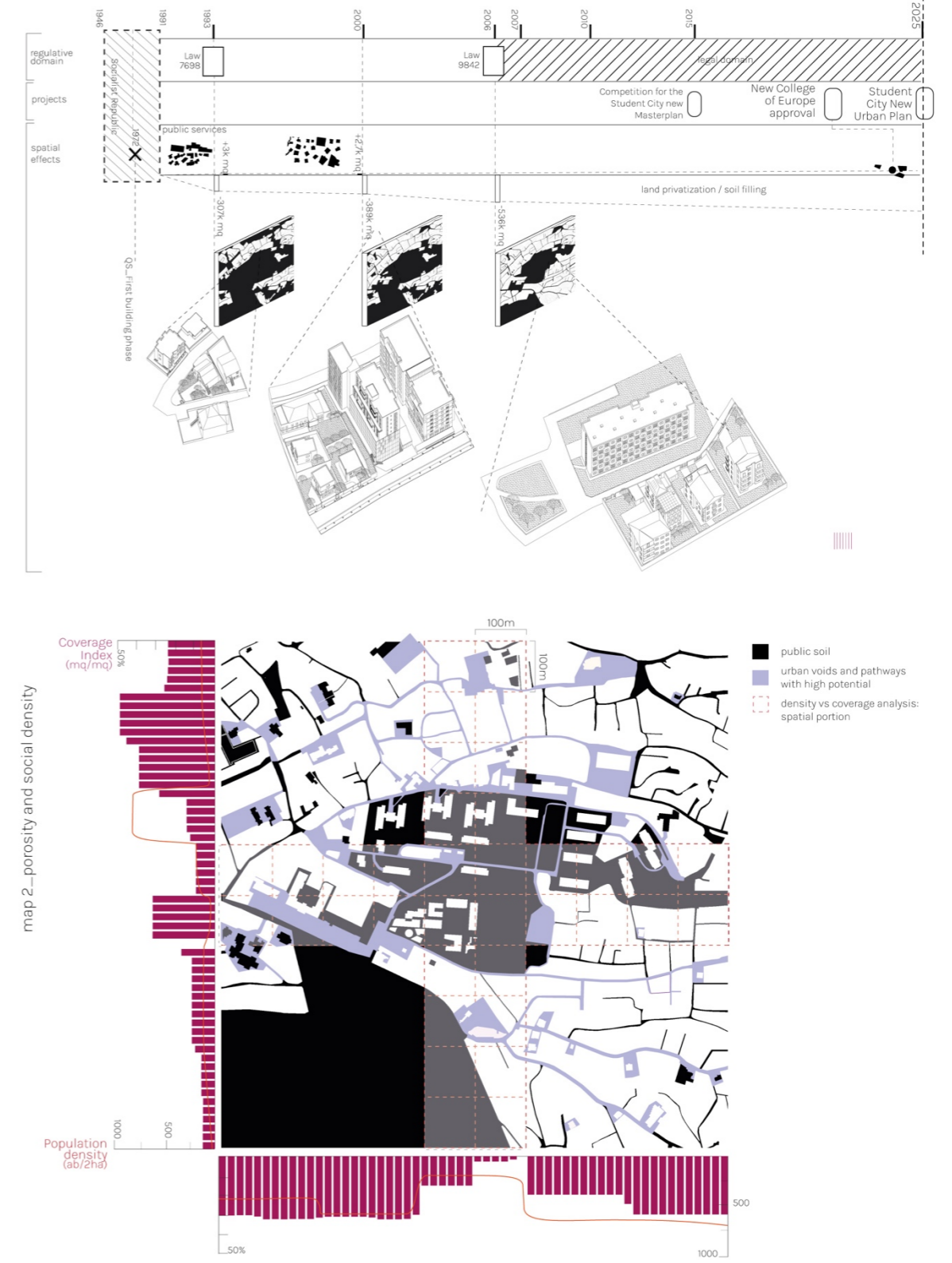


Fig. 3

3.1 Layer 1: setting the ground

The first portion of the map (Fig. 2) aims to identify some of these thresholds in order to reveal nodes that simultaneously manifest a problematic fragmentation of space and potentialities for a different outcome. In order to grasp this potential, the spatial reading systematises and relates the following: the morphology of properties and how it affects space – for example in terms of accessibility and horizontal connections; public services; streets system; public-private relationships; elements that constitute the University District; underground water system; a plot clusterisation.

On this first cartographic level, other representations are layered reflecting the materiality of the highlighted thresholds – in this case, two – focusing on the urban objects that compose them in a three-dimensional key. Therefore, the analysis is already strongly oriented, even though the selected nodes does not necessarily coincide with the most relevant clots; rather, it seeks to suggest a replicable method.

Drawing helps to grasp the fragmented nature of space – which is the result of the radical redefinition of the relationship between public and private space that took place in the 1990s – clearly showing the frenzy that turned the city into a mosaic in which to insert one's own tile as soon as possible. The closer one gets to the perimeter of the Campus – the area of minor resistance, due to uncertainty regarding the actual boundaries of State property – the more evident is the erosion of public space and open areas, which are still substantial at the core of it.

Similar issues continue to arise in an isotropic manner, as shown by the map depicting current building developments adjacent to the Campus: elements that could potentially add value if included in an urban redefinition perspective – such as the large southern public park or the Ali Demi neighbourhood to the north – are compressed by an intense densification, in the lack of resonance between spatial components and of any organic reasoning about the potential of the territory as a system.

Conversely, the purpose of the proposed mapping is to shed light precisely on these nodes, even the most calcified ones, using drawing tools to evaluate how they can be part of a redefinition of the area, without resorting to a tabula rasa or a mere parcelling-out approach. This objective is achieved by highlighting those elements that can be considered organically: by superimposing different graphic codes, elements that can become “active forms” emerge, suggesting different urban assemblages. The plot clusterisation, for example, constitutes an overlay of the plot system that associates areas with certain similarities in terms of morphological characteristics, density, land use, and function. This analysis aims to identify areas suitable for compensation operations, in cases where partial replacement of buildings could lead to the implementation of the urban system, an aspect that will be explored through maps 3 and 4.

3.2 Layer 2: a dynamic sequence of stabilisations

For a better understanding of the case study – preparatory to projective reflections – the second layer provides a diachronic diagram on the evolution of the area over time (Fig. 3). The scope of this map portion is to associate certain inertia and resistance inherent in the space with the processes that determined them.

The time frames considered are only some of those that will actually be included in the final version, and refer to key moments in the development of the area, while also taking into account the information that can actually be mapped. Structurally, the diagram is divided into four different lines, summarised as follows:

- 1) *Spatial effects (land privatization vs public services)*: The lower part of the diagram spatialise the evolution of the illegal land occupation. It is an analysis of the form taken by the abusive land parcelling process – encouraged by the restitution of properties in 1993³⁰ – and how it has transformed the area, changing its very destination from an end-zone to a transitional, intermediary, and connecting one between different stratifications. This process has forced urban mechanisms, filling the space to such an extent that it has become almost impossible to change the current configuration without radical and particularly invasive interventions. In fact, after a phase of exponential increase in gross floor area and land occupation, the degree of “oscillation” of the space has rapidly decreased, approaching 0.

Closely linked to the previous line, an abacus is then introduced showing the surface area of services and public buildings constructed during the same period, in order to comparatively analyse the exponential asymmetry that has characterised not only this area, but many areas of the capital with relation to this specific spatial relationship.

- 2) *Projects*: the massive scale of this sprawl and the invasion of surfaces with permanent reinforced concrete structures created another challenge for the city's functioning that is still present today, also due to the 2006 Law “On the Legalization, Urbanization, and Integration of Informal Constructions”. In the context of the concept of spatial infrastructure, this legalisation played a very significant role. On the one hand, the recognition of property status has changed the framework of rights, thereby strengthening the resilience of specific areas of

space, i.e. redefining the balance of power in the relationship between the state and individual owners. On the other hand, this has consolidated the status quo of the physical space; and this, in conjunction with a fabric that has arisen in total deregulation, means fixing a configuration which is at the origin of the difficulty of adequately urbanising the territory.

Today the pressure on the Campus is increasing. In recent years, the surrounding areas, especially in the southern part of the city, have been densified, redefining the boundary with the urban park. Today, some construction sites are beginning to reshape the area within the district itself. The new College of Europe and other adjacent construction sites (whose function and design are not always clearly specified) are examples of this.

- 3) *Regulative domain*: the upper and last section contains relevant moments in the regulative and legislative frame, with regards to the area under investigation. The scope is to show the relationships between the articulation of the formal framework and urbanisation. In this way, the material effects of these intersections could be highlighted, understanding how some of them have led to the decay of the urban structure, despite the aim of normalising building activity.

Eventually, the diagram converges into a second map, which provides additional information compared to the first one, such as the publicly accessible surface area and the social density in relation to the land use index.

In sum, what this second portion emphasises is the variation and variability of transformative potential. Taking into account this nature of the space, and the degrees of inertia it determines, can become decisive in approaching future transformations: the offer of flexibility in time and the possibility of adaptation over time is another way of arguing for a territory.³¹

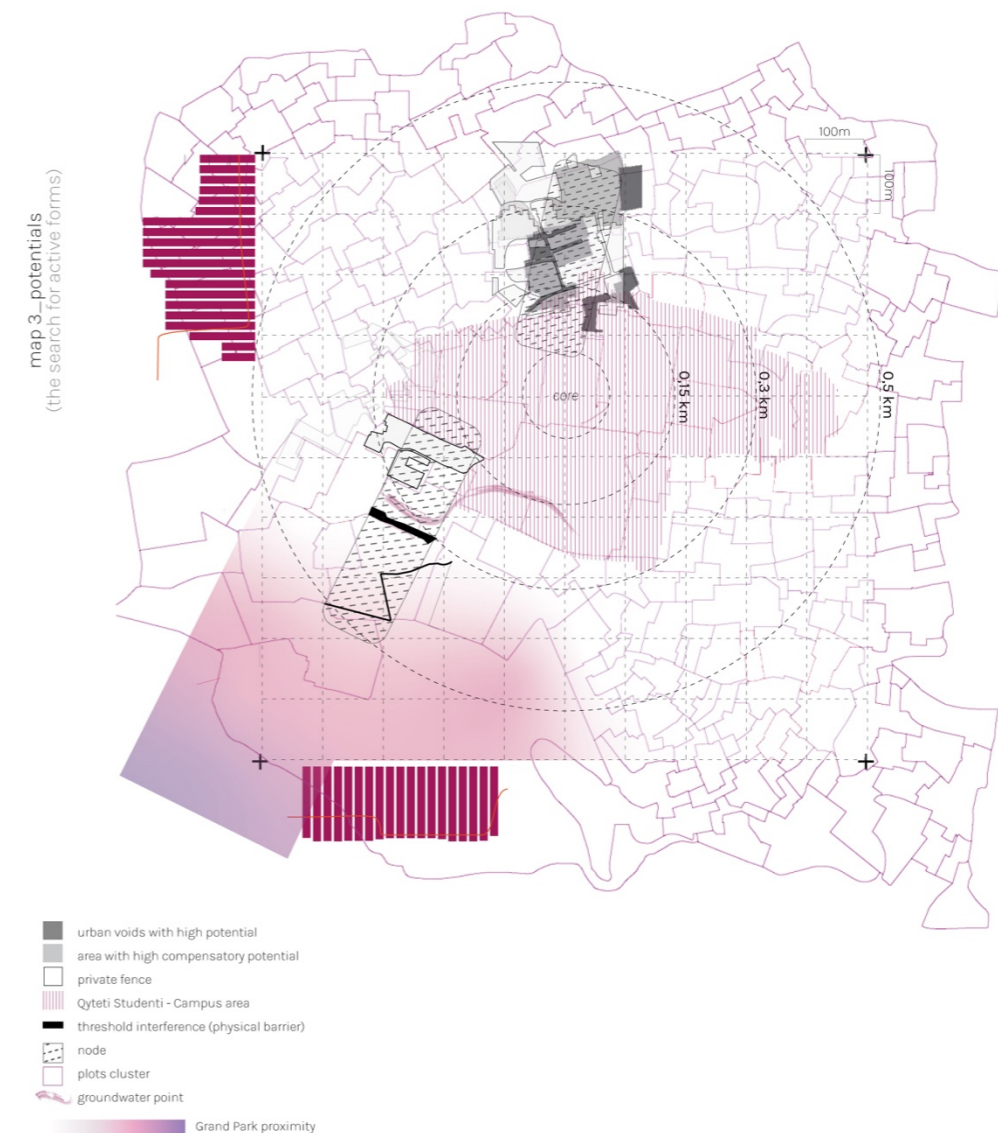


Fig. 4



Fig. 5

3.3 Layer 3-4: the playing field

Physical space thus becomes the transformative material that enables a *playing field* which can only emerge through a careful observation and understanding of the territory. This approach shifts the view of space from being merely a generator of architectural form and real estate value, towards a field of unfolding relationships between potentials.³²

The third map (Fig. 4) summarises the findings of the previous ones, highlighting only those areas – within the two selected thresholds – that can be considered as active forms: the drawing highlights the interference that exists in areas that could be particularly fertile for the reconfiguration of the relationship between the Campus and the surrounding city. It is, in fact, a preliminary basis for the last map, which ultimately aims to give materiality to this *playing field* (Fig. 5). Here the graphic code becomes more selective, less bound to an objective dimension. The image aims to emphasise some guiding principles in the definition of a possible intervention strategy; but this strategy is not conceived as a unified project or masterplan, rather as a series of intertwined spaces, transects, strips, paths that, configurable in a variable manner over time, can lead to a redefinition of the area based on the specific design *attitude* described so far.

These strategies can take various forms or – to use a widely used term – dispositions. To further simplify some of them, starting from existing urban materials: the path system as an opportunity to redefine open space and create an exchange threshold between public and private space; the ground floor as an opportunity to regenerate the relationship between building and public space and to create new urban pathways; the environmental system as an opportunity for the reconfiguration of permeable soil; the underground utility system (water, electricity, sewage, gas, etc.) as an opportunity for re-infrastructure open spaces; the system of leftover spaces as an opportunity for the grafting of active urban elements; the analysis of the relationship between buildings, plot system and density index as a basis for compensation hypotheses leading to a redistribution of urban relationships.

Each of these strategies, regardless of the form they may take, is based on specific epistemological principles that also orient the modes of representation; in particular, the concept of “space as infrastructure” that underpins this research. Today, urbanisation in Tirana is entirely absorbed by real estate development, and this leads to continuous fragmentation, not only at the level of cartography but also in the various ways space is divided in terms of dimension, materiality, and legibility. This inevitably shapes perception and the information that can be deduced, influencing whether activities develop in restrictive or inviting ways, and whether transformation is perceived as gradual or abrupt. This is a crucial aspect, since “complexity in planning and policy implementation is not only determined by the number of actors involved, but by their nature, by the different views they have of the situation, and on the various interests that have developed”.³³

Thus, reconfiguring analytical tools can be crucial for building a different approach to urban transformation. This is why concept such as “space as infrastructure” could make the difference, being itself an informative system.

4. Open issues and further considerations

As already pointed out, the work is still under development and based on an incremental approach. Therefore, no definitive assessments can be made regarding the actual usefulness and operability of the map, or the validity of the method. However, the modest aim of this article was not to provide definitive or established methodologies, but rather to use a particular object to condense critical reflections on the value of certain theoretical concepts that are particularly relevant with regard to the drawing sphere.

Speaking of the operational map itself, much remains to be done to enrich it, both in terms of content and data and possible layers to add. Furthermore, the more speculative portions are clearly still rough and partially cryptic, and require refinement of the graphic code. Another aspect must also be considered: as mentioned in the second chapter, this is a sort of meta-project, intended to critically define the objectives of the analysis itself. The possibility of integrating it into a broader work programme based on the capabilities of specific tools and software should therefore be explored.

However, these critical issues could also represent opportunities for further development if such an approach were actually considered as a possible aid in defining future urban strategies, not necessarily only in the case of Tirana.

Notes

1. Easterling Keller. *Extrastatecraft: The power of infrastructure space*. London: Verso Books, 2016: 72
2. *Idem*.
3. *Ibidem*: 80
4. Abrams, Janet., Hall Peter. *Else/Where Mapping*. Minneapolis: University of Minnesota Design Institute. 2016.
5. To quote some of the most notable examples in the scientific field: MACOSPOL (MApping COntroversies on Science for POLitics), a project led by the French university Science-Po and Bruno Latour in collaboration with sociologists, philosophers, architects, designers, and web experts., the work carried out by Eyal Weizman and Forensic Architecture; the Atlas of Uncertainty developed by the African Centre for Migration and Society; the mapping manual "Terra-Forma" edited by Frédérique Aït-Touati, Alexandra Arènes, Axelle Gregoire and Bruno Latour; Mapping Controversies.
6. Schoonderbeek, Marc. *Mapping in Architectural Discourse. Place-Time discontinuities*. London: Routledge. 2021: 5
7. An inter-university research funded under the PNRR TNE (Trans National Education) call for proposals promoted by the Italian Ministry of University and Research., which involves the Department of Architecture & Design of the Polytechnic of Turin, the Faculty of Architecture of Belgrade, the University of Montenegro, the Ss. Cyril and Methodius University of Skopje and the Polytechnic of Tirana. The project focus on the complex relationship between the socialist urban legacy, the postwar transformation processes and the current phase of strong real estate pressure that the four capitals are facing.
8. In the case of Tirana, the project team include also (apart the author) Professors Roberto Dini (Polytechnic of Turin) and Irina Branko (Polytechnic of Tirana), and the work combines academic research and educational programmes focused on the analysis of certain areas of the city
9. Bornstein, Lisa. 2010. "Mega-Projects, City-Building and Community Benefits". *City, Culture and Society*, no. 1(4): 199–206.
10. Aly, Hend. 2020. "Global City Mirage: Depoliticising Urban Transformation in Belgrade and Tirana". *Annals of the Austrian Geographical Society*, no.162: 43–63.
11. Branko, Irina. "Preservation of a Porous City; Strategies for Tirana urban fabric" en (eds), AAVV, *Advanced Studies in Efficient Environmental Design and City-Planning*. Berlin: Springer: 279-290, 2021.
12. On these topic, see: Gjokutaj, Eduart. *Are we on the verge of a FINANCIAL BUBBLE?*. Tirana: Altax. 2025. + Kripa, Dorina., Korbi, Alban., Kufo, Andromahi. „Is there a bubble in the Albanian housing market?“. Paper discussed at the 9th international ASECU conference on "systemic economic crisis: current issues and perspectives", University of Skopje. 2013.; Kripa, Dorina., Muriqi, Drijton. "The Impact of Real Estate Market in the Albanian Economy" en (eds.) AAVV, *EIRP Proceedings*, vol.10. Galati: Danubius University Press: 409-423. 2015.
13. Data on the real estate market can be consulted in the Financial Stability Reports provided by the Bank of Albania. In particular, the reports show the ratio of nonperforming loans for real estate, compared also to the house index price. See: https://www.bankofalbania.org/Financial_Stability/Financial_Stability_Reports/Financial_Stability_Reports/
14. Despite the many plans produced, from the so-called "French Plan" made in 2003 by Architecture Studio to the much-discussed "Tirana 2030" (Boeri's green vision of 2016 strongly supported by Rama), through to the plan drawn up by Grimshaw in 2012, no instrument has been actually implemented. On the contrary, onto the green belt area – a key element of Boeri's project – which was supposed to provide a countermeasure to urban expansion by redefining the environmental system, totally different intervention are undergone, such as the massive residential developments near Lake Farka.
15. Data on construction are available on the website of Instat, Albania's main statistical institute; see: <https://www.instat.gov.al/en/search/?query=urban+permits>. In this case, reference is made to the following two reports: Sipërfaqja e lejeve të ndërtimit miratuar për ndërtesa të reja sipas bashkive, T1/2018 - T1/2025; Numri i lejeve të ndërtimit miratuar për ndërtesa të reja sipas bashkive, T1/2018 - T1/2025.
16. Arkivi Qëndror Teknik i Ndërtimit, Tirana (Central Technical Archive of Construction).
17. Pulti, Elta. "Student City": *A City Within The City of Tirana*. Master Thesis, Azrieli School of Architecture & Urbanism. Ottawa. 2022.
18. Buzan, Tony. *Le mappe mentali e le relazioni personali*. Milan: Sperling & Kupfler. 2008
19. Guattari. *Schizoanalytic Cartographies*. London: Bloomsbury (english translation version). 2013.
20. Mason, Andrew., Singh, Chandralekha. "Using Reflection with Peers to Help Students Learn Effective Problem Solving Strategies". *AIP Conference Proceedings*: 41-44. 2010.
21. A recurring statement in publications such as: *Art and Visual Perception*. Berkeley: Unoversity of California Press. 1974.; *Visual Thinking*. Berkeley: Unoversity of California Press. 1969.
22. Schoonderbeek, Marc. *op. cit.*
23. On this, see: Baudrillard, J. *Simulacra and Simulation*. Ann Arbor: University of Michigan Press. 1994; Pickles, John. *A History of Spaces: Cartographic Reason, Mapping, and the Geo-Coded World*. London: Routledge. 2004.
24. Lobo-Guerrero, Luis. "On the epistemology of maps and mapping. De la Cosa, Mercator and the making of spatial imaginaries" en (eds.) Bargues-Pedreny, Pol., Chandler, David., Simon, Elena. *Mapping and Politics in the Digital Age*. London: Routledge: 21-36. 2019.
25. Lobo-Guerrero, Luis. "On the epistemology of maps and mapping. De la Cosa, Mercator and the making of spatial imaginaries" en (eds.) Bargues-Pedreny, Pol., Chandler, David., Simon, Elena. *Mapping and Politics in the Digital Age*. London: Routledge: 21-36. 2019: 29.
26. Schoonderbeek, Marc. 2017. A theory of "design by research"; Mapping experimentation in architecture and architectural design. *Ardeth*, no.1: 63-79.
27. Easterling, Keller. *op.cit.*
28. Schoonderbeek, Marc. 2021. *op. cit.*
29. Easterling, Keller, *op.cit.*
30. The official restitution to former owners start in the 1993, with the Law 7698 "On the restitution and compensation of property", in a context of growing demographic movements, then stimulated the phenomenon of the right to development.
31. Rieniets, Tim., Kretschmann, Nicolas., Perret, Myriam., Christiaanse Kees. (eds). *The City as Resource*. Berlin: Jovis. 2014.
32. Easterling, Keller, *op.cit.*
33. Zweifel, Christina., Van Wezemaal, Joris. "Drawing as a Qualitative Research Tool an Approach to Field Work From a Social Complexity Perspective." *TRACEY: Drawing and Visualisation Research*: 1-16. 2012.

Image Captions

Fig. 1. *Qyteti Studenti* crytical map: towards an active *Disposition*.

Fig. 2. Map 1_setting the ground: thresholds recognition. *The term "node" refers to areas where the intersection between the various layers is particularly significant, net of possible threshold transformations; **The clustering constitutes an overlay of the plot system, based on the association of areas that have certain similarities in terms of morphological characteristics, density, land use, and function.

Fig. 3. Diachronic diagram of urban development in the area in the post-socialist era; map 2_Porosity.

Fig. 4. Map 3_the search for active forms of interplay.

Fig. 5. Map 4_playing field: a new *Disposition*.

References

- Abrams, Janet., Hall Peter. *Else/Where Mapping*. Minneapolis: University of Minnesota Design Institute. 2016.
- Aly, Hend. 2020. "Global City Mirage: Depoliticising Urban Transformation in Belgrade and Tirana". *Annals of the Austrian Geographical Society*, no.162: 43–63.
- Amin, Ash. Thinking Urban Grammars - An interview with Ash Amin" en: (eds.) Lancione Michele., McFarland Colin. *Global Urbanism. Knowledge, Power and the City*. London: Routledge: 17-24, 2021.
- Arnheim, Rudolph. *Art and Visual Perception*. Berkeley: Unoversity of California Press. 1974.
- Arnheim, Rudolph. *Visual Thinking*. Berkeley: Unoversity of California Press. 1969.
- Baudrillard, J. *Simulacra and Simulation*. Ann Arbor: University of Michigan Press. 1994
- Bornstein, Lisa. 2010. "Mega-Projects, City-Building and Community Benefits". *City, Culture and Society*, no. 1(4): 199–206.
- Branko, Irina. "Preservation of a Porous City; Strategies for Tirana urban fabric" en (eds), AAVV, *Advanced Studies in Efficient Environmental Design and City-Planning*. Berlin: Springer: 279-290, 2021.
- Buzan, Tony. *Le mappe mentali e le relazioni personali*. Milan: Sperling & Kupfler. 2008
- Easterling Keller. *Extrastatecraft: The power of infrastructure space*. London: Verso Books, 2016.
- Gjokutaj, Eduart. *Are we on the verge of a FINANCIAL BUBBLE?*. Tirana: Altax. 2025.
- Göler, Daniel., Doka, Dimitër. "Busting the Scales: From Small-Scale Informal to Investor-Driven Urban Developments: The Case of Tirana/Albania". *Annals of the Austrian Geographical Society*, vol. 162, Bamberg: Otto-Friedrich-Universität, pp. 65–90. 2021.
- Guattari. *Schizoanalytic Cartographies*. London: Bloomsbury (english translation version). 2013.
- Kripa, Dorina., Korbi, Alban., Kufo, Andromahi. „Is there a bubble in the Albanian housing market?“. Paper discussed at the 9th international ASECU conference on "systemic economic crisis: current issues and perspectives", University of Skopje. 2013.
- Kripa, Dorina., Muriqi, Drijton. "The Impact of Real Estate Market in the Albanian Economy" en (eds.) AAVV, *EIRP Proceedings*, vol.10. Galati: Danubius University Press: 409-423. 2015.
- Latour, Bruno. 2012. "Introduction: Paris, invisible city: The plasma". *City, Culture and Society*, no. 3(2): 91-93.
- Lobo-Guerrero, Luis. "On the epistemology of maps and mapping. De la Cosa, Mercator and the making of spatial imaginaries" en (eds.) Bargues-Pedreny, Pol., Chandler, David., Simon, Elena. *Mapping and Politics in the Digital Age*. London: Routledge: 21-36. 2019.
- Lubonja, Otiela., Jançe, Admir. 2022. "Urban development and economic-financial indicators correlation in Tirana, Albania". *International Journal of Ecosystems & Ecology Sciences*, no. 12(2): 377.
- Mason, Andrew., Singh, Chandralekha. "Using Reflection with Peers to Help Students Learn Effective Problem Solving Strategies". *AIP Conference Proceedings*: 41-44. 2010.
- McFarlane, Colin. 2011. "The City as Assemblage: Dwelling and Urban Space". *Environment and Planning D: Society and Space*, no. 29(4): 649-671.
- Naselli, Fabio. "Tirana-Next: A Complementary Development Strategy (and Consequent Urban Tactics) for the Informal and Historical Urban Fabrics Within Tirana Super Blocks" en (eds.) AAVV, *Current Challenges in Architecture and Urbanism In Albania*. Berlin: Springer: 61-77. 2021.
- Okada, Alexandra., Shum Buckingham, Simon., Sherbourne, Tony. *Knowledge cartography: Software tools and mapping techniques*. London: Springer. 2008
- Pickles, John. *A History of Spaces: Cartographic Reason, Mapping, and the Geo-Coded World*. London: Routledge. 2004.
- Pulti, Elta. "Student City": *A City Within The City of Tirana*. Master Thesis, Azrieli School of Architecture & Urbanism. Ottawa. 2022.
- Rekacewicz, Philippe. "Radical Cartography" en (eds.) Schranz, Christine. *Shifts in Mapping: Maps as a Tool of Knowledge*. Bielefeld: Transcript Publishing, Bielefeld: 209-232. 2021.
- Rieniets, Tim., Kretschmann, Nicolas., Perret, Myriam., Christiaanse Kees. (eds). *The City as Resource*. Berlin: Jovis. 2014.
- Schoonderbeek, Marc. 2017. A theory of "design by research"; Mapping experimentation in architecture and architectural design. *Ardeth*, no.1: 63-79.
- Schoonderbeek, Marc. *Mapping in Architectural Discourse. Place-Time discontinuities*. London: Routledge. 2021.
- Zweifel, Christina., Van Wezemaal, Joris. "Drawing as a Qualitative Research Tool an Approach to Field Work From a Social Complexity Perspective." *TRACEY: Drawing and Visualisation Research*: 1-16. 2012.

Biography

Valerio Della Scala is an architect and Assistant Professor at the Polytechnic University of Turin (Department of Architecture & Design), where he teaches architectural and urban design. His research interest mainly concern the relationship between design and norm-making processes and innovation of architectural practices. Since 2018, he has been conducting research activities on Balkan territories, particularly Albania and Kosovo. Moreover, he work as a designer, both individually and as a freelancer.