Teaching methods for sustainable urban and territorial design: the case study of the Prato Ready Laboratories

Carlo Pisano
Department of Architecture, Università degli Studi di Firenze, Florence, Italy
carlo.pisano@unifi.it
orcid.org/0000-0002-8377-0128

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Designing is a complex, personal, creative, and open-ended process of exploring and deciding, often seen as implicit (Schön, 1985). In teaching urbanism, we frequently need to make this process explicit and transferable. To do so, this paper uses a conceptual framework based on Elise van Dooren's model (2013, 2020), which identifies five key elements: (1) experimenting/exploring and deciding, (2) guiding theme or qualities, (3) domains, (4) frame of reference, and (5) laboratory or (visual) language. This paper evaluates

1. Critical design approach in urban planning

The ontology of the project historically stems from our dissatisfaction with the current state of reality regarding our basic needs and prospects. In other words, design exists because the world around us does not satisfy us (Gero, 1990, 27), and this leads us to create artefacts to supply our needs or expectations. This makes design an activity – decisional, exploratory, learning-focused and goal-oriented – based on the hope that the world is perfectible (Bloch, 1959) and therefore in need of being transformed through design.

Since the 1960s, research on design theory and process has made significant progress in our understanding of design thinking. During the modern movement, design thinking was mainly understood in technical-rationalist terms: it was seen as the search for the optimal solution to a problem, based on a complete set of data and parameters (Rowe, 1987, 49). The process was conceived as a linear sequence, beginning with problem analysis and followed by synthesis, eval-

the application of this framework in the Prato Ready Laboratories, a multidisciplinary program at the University of Florence (2024/25), involving nearly 150 students from four design labs in Architecture and Planning master courses. The program focuses on sustainable urban and territorial design, addressing climate change, disaster response, and energy resource challenges. Through comparative analysis, it aims to make explicit the teaching methodologies for resilient urban design in multi-hazard environments.

uation, and the selection of the best design solution (Asimov, 1962, 42–46).

This positivist view of the design process, however, immediately clashed with the highly subjective nature of some of the steps that characterise the process itself, such as the definition of the problem and its objectives or the constraints that characterise its development, which are often linked to the specific context, the client's perception or the designer's sensitivity (Gero, 1990); steps that make the process difficult to model and abstract in a general theory.

Moreover, contemporary design, and in particular urban planning, is increasingly called upon to deal with problems characterised by high levels of complexity, uncertainty, multiple actors involved and the absence of unambiguous solutions. In the literature, these conditions refer to the so-called "wicked problems", a concept introduced by Rittel and Webber (1973) in "Dilemmas in a General Theory of Planning" to describe problems that are difficult or impossible to solve because the requirements underlying their solution are contradictory, incomplete and constantly changing. Migration, energy transition or climate change are often included in this category of problems.

According to Rittel and Webber (1973), urban planning constantly faces wicked problems, as planning involves diverse interests, clashes with structural uncertainties and generates effects that are often not immediately visible. Traditional problem-solving methods, based on deterministic scientific models, have proven insufficient in these contexts.

For these reasons, the evolution of studies and research related to the design process and the methodologies connected to it have often had to be commensurate with the intimate dialectical nature of the project, in the constant search for a mediation between a technical-scientific intelligentsia and a plethora of assumptions that are, by their very nature, arbitrary (Maldonado, 1970, 57). All design-related sciences are strongly characterised by this irremediable dialectical nature in which even the most refined techniques of system analysis or problem solving cannot make them-

selves perfectly neutral to arbitrary choices and contingency.

Precisely based on the imperfect nature of the design process, the second half of the 20th century saw numerous studies on different models and cognitive processes, with an attempt to interpret the linearity of technical-rationalist models in various ways.

Concerning the different approaches developed towards the design problem, in his famous Design Methods (1992 [1970]), Jones identified three main models, classifying the process leading to design as a black box, a glass box and a self-organising system, according to the different ways in which the relationship between analysis, synthesis, evaluation and decision is articulated.

In the first model, design is understood as a subconscious activity in which creativity is fuelled by intuition and sudden moments of rupture. This makes a rational explanation of 'what happens inside' the black box (Jones, 1992, 46), the designer's mind, impossible.

The second approach, in line with what has been described concerning the technical-rational model (Asimov, 1962, 42-46), is based on the positivist premise of design as a rational solution to problems, inevitably supported by the flow of information from the outside world, in which the process proceeds according to a rational and linear sequence.

The third way described by Jones (1992 [1970]), that of Self-organising Systems (SOS), envisages a flexible cognitive structure in which the design process is seen as a self-reflective activity that responds to the actions of the designers themselves. Consequently, the designer can control the design process by monitoring his or her actions through the constant evaluation of intermediate and partial solutions.

This third way thus appears as a mediation between a hermetic approach to design as a work of art and a transparent and rational one. Similarly to what occurs within Von Foerster's (2003) famous non-trivial machines, self-organising systems are understood as open and dynamic systems, capable of modifying their internal structure and/or function in response to external circumstances.

This model seems to be reflected in the "swampy plain" that, according to Schön (1993, 68), constrains the positivistic epistemology of practice. In his famous "The Reflective Practitioner: How professionals think in action", the American philosopher clarifies that in situations where goals are defined and clear, the decision to act presents itself as an instrumental problem that can be solved through technique. But when the ends are confused and contradictory – a condition that is quite common in urban planning and even more so when dealing with wicked problems – there is still no clear goal to solve. A conflict concerning ends cannot be resolved using techniques derived from applied research; rather, it is through the non-technical process of structuring the problem situation that we can organise and clarify both the ends to be achieved and the possible means to achieve them.

In this reflexive conversation, the practitioner's effort to solve the restructured problem

Approach / Model	Main Authors / References	Key Features	Interpretive axes			
			Rationality/ Linearity	Creativity/ Intuition	Adaptivity/ Reflexivity	Complexity/ Wickedness
Technical-rational (Positivist)	Asimov (1962); Rowe (1987)	Linear sequence of analysis–synthesis–evaluation–choice; assumes complete data and optimal solutions.	High	Low	Low	Low
Black Box	Jones (1970/1992)	Design as subconscious, intuitive activity; creativity emerges from intuition and sudden insights.	Low	High	Low	Low
Glass Box	Jones (1970/1992); Asimov (1962)	Transparent, rational process; linear and information-driven.	High	Low	Low-Medium	Low
Self-Organising Systems (SOS)	Jones (1970/1992); Von Foerster (2003)	Flexible, adaptive, self-reflective design process; iterative evaluation of partial solutions.	Medium	Medium	High	Medium
Wicked Problems / Argumentative Planning	Rittel & Webber (1973)	Design as negotiation of contradictory, incomplete and shifting requirements.	Low-Medium	Low-Medium	High	High
Reflective Practice	Schön (1983, 1985, 1993)	Spiral of appreciation–action–reappreciation; learning-by-doing and reflection-in-action.	Low-Medium	Medium	High	High
Designerly Ways of Knowing	Cross (2007)	Distinct cognitive mode of design; iterative and abductive reasoning.	Low-Medium	High	Medium	Medium

The table compares theoretical approaches to design by summarising their defining features and situating them along four interpretive axes. "Rationality/Linearity" indicates the degree to which design is conceived as a logical, sequential process. "Creativity/Intuition" highlights the role of tacit knowledge, intuition, and imagination. "Adaptivity/Reflexivity" refers to the capacity of the process to self-adjust through iterative feedback and reflection. "Complexity/Wickedness" captures the extent to which an approach acknowledges uncertainty, multiple actors, and the open-ended nature of design problems.

Tab. 1

produces discoveries that require further reflection during action. The process spirals through stages of appreciation, action, and new appreciation. The unique and uncertain situation comes to be understood through the attempt to transform it and is transformed through the attempt to understand it.

This reflexive process – in which the project assumes the characteristics of a complex, personal, creative, and open-ended process of exploring and deciding (Schön, 1985) – in professional practice is often kept implicit and under-recorded (Schön, 1985), reduced to an instrumental action in the definition of the design deliverables. Even the argumentative approach (Rittel, Weber, 1973) – in which urban planning decisions are publicly discussed and negotiated between the actors involved, recognising the complexity and plurality of perspectives – does not completely overcome this step as the discussion/participation phase is often unconnected to the one in which choices take on an operational character by landing on a design solution or a rule. Only in some co-design experiences is this iterative and reflexive process manifested and made observable, although these experiences remain limited and difficult to convey through the scientific literature.

In teaching urban planning and design, it is essential to make this process as explicit and therefore transferable as possible. It is during the didactic and interdisciplinary workshops, now widespread in all schools of architecture globally, that this process of "designerly way of knowing" (Cross, 2007) is absorbed by the students in a learning-by-doing process.

In his studies on the practice of architecture, Schön (1985; 1987) emphasised the paradoxical character of design education. He stated that the student is expected to "immerse himself in the studio, trying from the beginning to do what he does not yet know how to do, in order to obtain the kind of experience that will help him learn what it means to design" (Schön 1985, 57).

More recent contributions extend these trajectories. Paola Viganò's work, particularly "*I territori dell'urbanistica: Il progetto come produttore di conoscenza*" (2010), foregrounds the epistemic role of design, conceiving the project not merely as the production of artifacts but as a generator of situated knowledge about territories, societies, and their transformations. Andri Gerber's "Handbook of Methods for Architecture and Urban Design" (2018) provides a comprehensive repertoire of methodological tools – ranging from mapping to scenario-building – emphasising methodological pluralism as a necessary response to the complexity of design problems. Simon Kretz's "The Cosmos of Design" (2020) deepens our understanding of design cognition, articulating how iterative experimentation, speculation, and reflection constitute the core processes of creative practice. Marcel Smets's "Foundations

of Urban Design" (2022) reframes the conceptual apparatus of urban design through a dialectical vocabulary that juxtaposes pairs of notions, enabling designers to reflect on urban form and intervention critically. Finally, Carlo Pisano and Giambattista Zaccariotto's "Urbanistic Projects. The Next Generational Paths: A European Perspective" (2024) highlights the contemporary evolution of urbanistic projects in Europe, interpreting them through the lenses of issues, tools, and alliances, and framing them as situated practices that mediate between theoretical innovation and operational governance.

To make the design process in urban planning explicit, and thus replicable and transferable, this paper uses a conceptual framework based on Elise van Dooren's (2013, 2020) model, which identifies five key elements: (1) experimenting/exploring and deciding, (2) theme or guiding quality, (3) domains, (4) framework, and (5) laboratory or (visual) language. This paper evaluates the application of this framework in the *Prato Ready Laboratories*, a multidisciplinary programme of the University of Florence (2024/25), involving almost 150 students from four design laboratories of Master's degree courses in Architecture and Planning that address one of the most evident wicked problems of the contemporary world, climate change and its repercussions in the urban environment.

The next section will describe the conceptual framework based on Elise van Dooren's (2013; 2020) model; the third section will evaluate the application of this framework in the *Prato Ready Laboratories*; the fourth section will compare the results obtained in the four Laboratories using van Dooren's framework; and the final section will elaborate on some conclusions and possible implementations.

2. Methods

Designing is a complex, personal, creative, and open-ended process of exploring and deciding (Schön, 1985). Design is an exploratory practice, referring to this term as a process of being open, playful, and curious, of generating alternatives and options, both intuitively and rationally (van Dooren, 2020). It is especially during interdisciplinary workshops that this "designerly way of thinking" (Cross, 2007) is absorbed by students in a learning-by-doing process. To improve the quality of architectural design education, Elise van Dooren elaborate a vocabulary to make the design process, at least to a certain extent, explicit. Her model (2013; 2020) identifies five key elements: (1) experimenting/exploring and deciding, (2) guiding theme or qualities, (3) domains, (4) frame of reference, and (5) laboratory or (visual) language.

While several models could have been adopted, the choice of Elise van Dooren's framework (2013; 2020) is consistent with the pedagogical approach traditionally cultivated in design studios, conceived as laboratories of inquiry rath-

er than as spaces for the production of a single correct solution. The framework provides a clear and transferable structure for making the implicit processes of design more explicit, particularly the dialectical tension between exploration and decision, the articulation of guiding themes, and the role of visual language in shaping knowledge. The innovation introduced here lies in integrating this model with the school's long-standing emphasis on situated design research, collective discussion, and interdisciplinary collaboration. In this sense, the *Prato Ready Laboratories* not only apply an existing method to a case study but extend its scope, showing how van Dooren's categories can be mobilised within a pedagogical culture that treats the design process itself as an object of research and as a producer of knowledge.

2.1. Design process

According to van Dooren (2020), the design process is inherently dialectical, characterised by a continuous oscillation between divergence and convergence. It alternates between opening to new ideas – through observation, association, and proposing alternatives – and narrowing down by applying criteria, testing, and assessing outcomes. This dynamic movement is central to design thinking and forms the backbone of her framework.

Other scholars have elaborated on this dynamic. Schön (1985) described experimentation as a form of reflective dialogue or "conversation with the situation," in which the designer's iterative moves constantly reframe both problems and intentions. Similarly, Cross (2001) and Dorst (2015) conceptualised design as a co-evolution of problem and solution spaces, underlining the interdependence between exploration and evaluation.

2.2. Guiding themes

In van Dooren's framework, defining a guiding theme or "guiding quality" is a key step in structuring the design process (2013; 2020). The theme acts as both anchor and compass, providing coherence to design development and supporting decision-making in complex contexts. It frames what matters, filters competing options, and lends identity to the project.

This resonates with Schön's (1985) idea of "naming and framing" as a central act of design, where designers construct the lens through which they engage with a situation. By articulating guiding themes, especially in educational settings, students learn to structure their work conceptually while maintaining openness to emerging insights.

2.3. Domains

Van Dooren (2013; 2020) synthesised Schön's (1985, 1987) original twelve domains of architectural design into five overarching categories: (1) form and space, (2) material, (3) func-

tion, (4) physical context, and (5) social, cultural, historical and philosophical context. These domains provide the conceptual scaffolding through which designers explore and test their guiding themes.

This categorical thinking enables the articulation of diverse aspects of the built environment. By shifting between domains, designers move across disciplinary boundaries and integrate multiple perspectives, making the process both structured and flexible.

2.4. References

Van Dooren (2020) also emphasises the role of references as part of the designer's toolkit, underscoring how precedents and exemplars inform new design work. References are not neutral but shape the way designers interpret situations, make choices, and develop solutions.

This idea aligns with Cross (2007), who highlights that design knowledge is embedded in the artificial world and transmitted through exemplars, images, and diagrams. Schön (1985) similarly stresses that designers build a repertoire over time, enabling them to interpret new contexts by varying familiar patterns .

2.5. Visual language

For van Dooren (2013; 2020), visual language is not a mere representational tool but a constitutive element of design cognition. Sketches, diagrams, and models function as a laboratory of thought, where ideas are externalised, tested, and transformed.

According to Lawson (2004), sketches externalise elements of the design situation, allowing the designer to stand back and examine them from a new perspective. They reduce complexity, simplify relationships, and clarify decisions. As the designer sketches and models, they become aware of the implications of each move, shaping and reshaping the problem and the potential responses.

In this iterative process, what Schön (1985) calls "moves" are expressed through changing configurations, sketches, and words. The traces left by these moves – in lines, forms, or virtual representations – carry meaning and influence further development. Thus, drawing and modelling become active forms of reasoning within a "web of moves."

3. Materials

Building on the reference model proposed by van Dooren (2013; 2020) to clarify the often-implicit nature of design processes, this section offers a comparative analysis of the pedagogical approaches and outcomes of four design laboratories conducted at the School of Architecture, University of Florence, during the fall semester of 2024/25.

The *Prato Ready Laboratories* were developed as an integrated, multidisciplinary teaching initiative aimed at rethinking the northern periphery of the city of Prato as a coherent syn-

Articulation of the 4 laboratories

Tab. 2

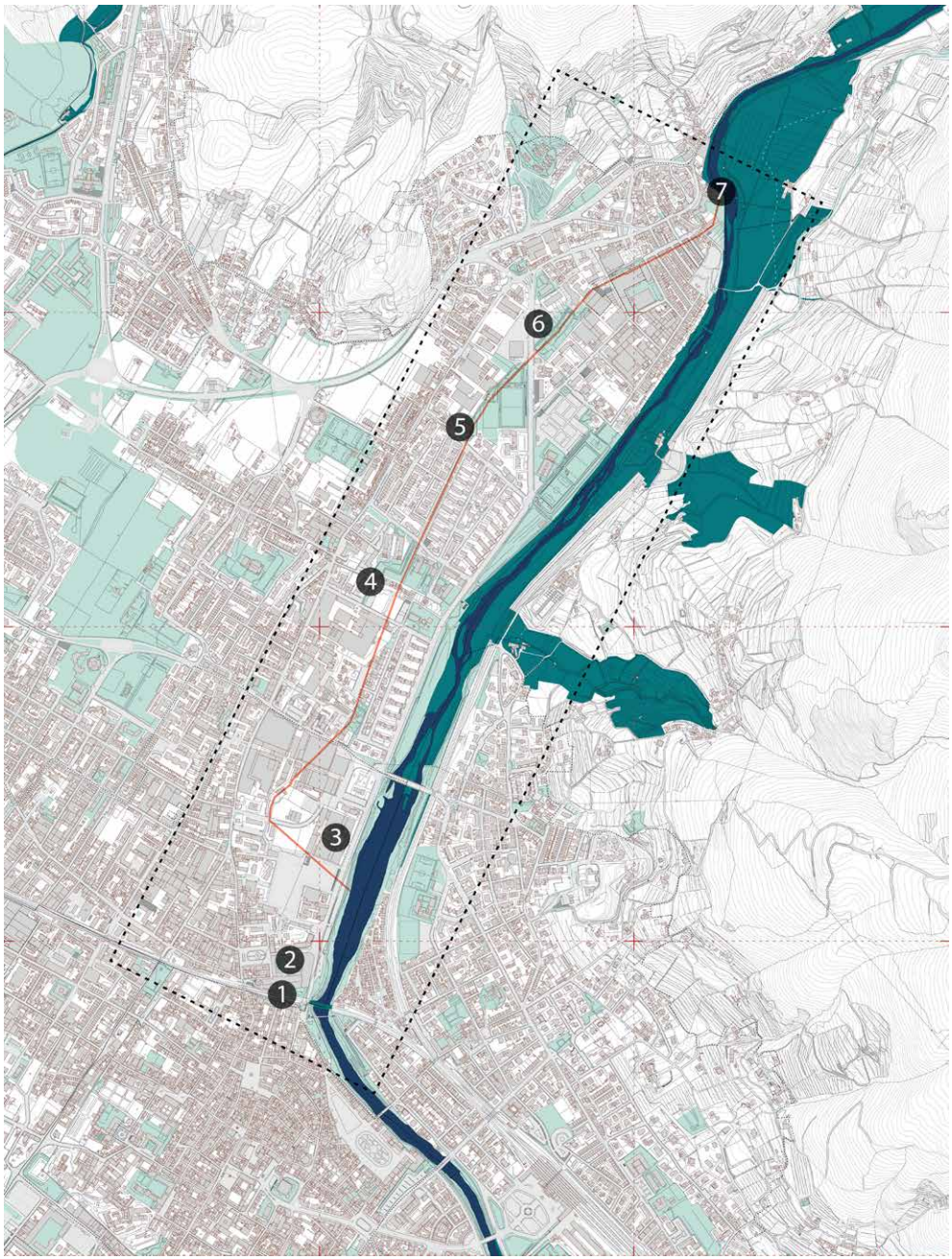
	Lab. A	**Lab. B**	**Lab. C**	**Lab. D**
Full Title	Architecture and Town Lab.	Architecture and Town Lab.	Lab. of urban metabolism and resilience	Lab. of urban metabolism and resilience
Master course	Architecture	Architecture	Planning and Design for Urban and Territorial Sustainability	Planning and Design for Urban and Territorial Sustainability
Language	Italian	English	Italian	English
Total Credits	18 ECTS	18 ECTS	12 ECTS	12 ECTS

thesis of functions, spaces, infrastructures, and natural systems, across the scales of architecture, urbanism, and territorial planning.

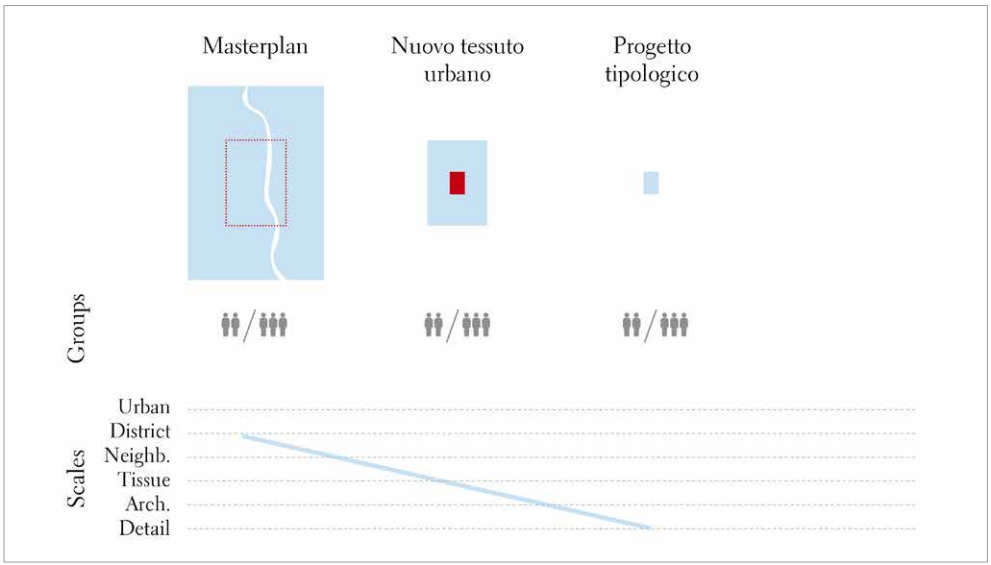
The primary objective was to engage students in sustainable urban and territorial regeneration, with a focus on climate change adaptation, disaster risk reduction, and energy transition, in line with the goals of the RETURN Extended Partnership, in which some members of the teaching staff were involved (see the Acknowledgements section for further details). To this end, the program aligned the activities of four laboratories: the *Architecture and Town Lab* (Italian – *Lab A*; English – *Lab B*) within the Master's in Architecture, and the *Resilience and Urban Metabolisms Lab* (Italian – *Lab C*; English – *Lab D*) within the Master's in Planning and Design for Urban and Territorial Sustainability. Altogether, the initiative involved nearly 150 students.

At the School of Architecture in Florence, design studios are often structured as pedagogical devices through which research projects are advanced and tested. What distinguishes this initiative is its systemic articulation: four interconnected laboratories that engage both students and faculty members from two master's degree programs, collectively involving twelve courses. This configuration not only fosters cross-fertilisation between disciplinary domains but also enhances the integration of teaching and research, positioning the studios as experimental arenas for knowledge production.

The design context is the area north of the city of Prato that extends from the historic centre



Design context of the northern area of Prato. 1) Porta al Serraglio train station; 2) PIN - University of Florence Prato Campus; 3) Calamai Wool Factory; 4) Niccolini Villa; 5) Coiano Fulling mill; 6) Abatoni park; 7) Cavalciotto Weir; Red line) Gorone canal
Fig. 1



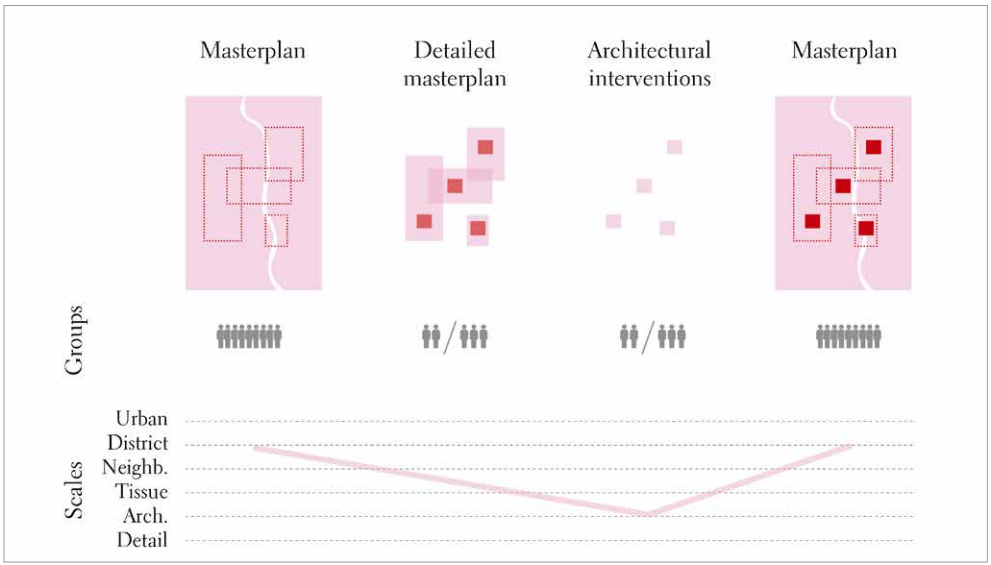
Design process of the Lab. A
Fig. 2

along the Bisenzio river to Cavalciotto. Located in the heart of Tuscany, just a few kilometres from Florence, Prato is the second-largest city in the region and one of Italy's most dynamic urban centres. Historically known as a textile and manufacturing hub, Prato has long been recognised for its industrious spirit, multicultural population, and deep-rooted traditions in craftsmanship and entrepreneurship. Over the centuries, the city has evolved from a medieval trading post into a modern industrial capital. Prato's textile district, among the most important in Europe, has played a crucial role in the city's development, both economically and socially. Today, this legacy continues to shape the city's identity, blending traditional know-how with cutting-edge technologies and a growing commitment to sustainability and circular economy principles.

Prato's peri-urban area stretches along the Bisenzio River, which was historically shaped by water infrastructure that supported its textile industry. Today, urban infilling has buried much of this infrastructure. However, the region's industrial, agricultural, and residential mix highlights its potential for urban regeneration strategies that revitalise Prato's industrial heritage and address modern living needs. The design context is part of a broad regeneration programme that includes the reopening of the Gore system – the complex system of canals that runs across the city – and in particular, the Gorone, the main canal of Prato that runs from Cavalciotto to Piazza del Mercato Nuovo, near the University of Florence Prato Campus.

3.1 Design process

This section examines the evolution of decision-making processes across the *Prato Ready Laboratories*, focusing on course goals,



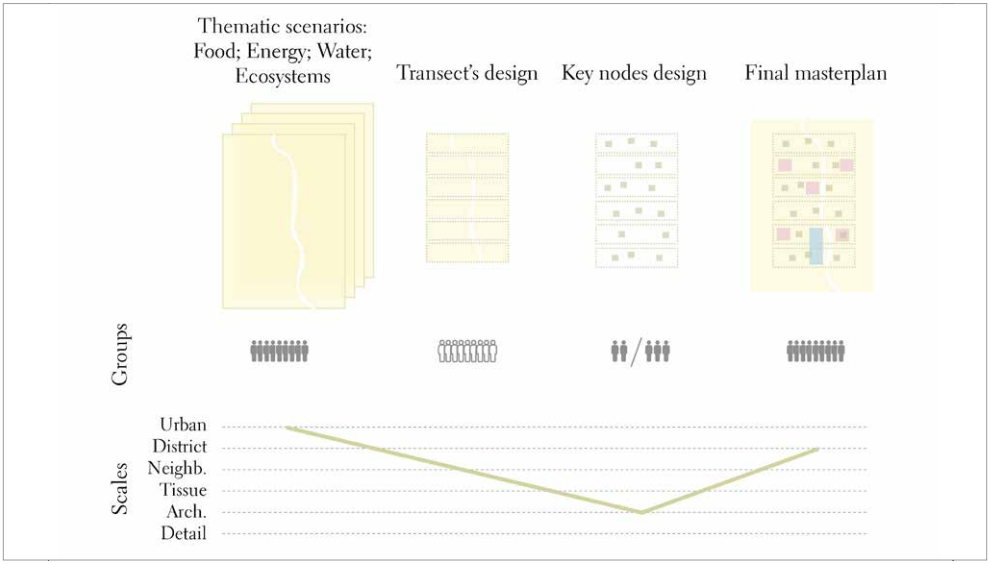
Design process of the Lab. B
Fig. 3

student composition, and the design process across multiple scales.

In *Lab A* (Architecture and Town Lab, Italian curriculum), twenty-eight primarily Italian students adopted a multi-scalar design approach. Working in groups of two to three, each team addressed the project at three key scales: a 1:5,000 masterplan, establishing urban and territorial relationships; a 1:500 detailed plan, articulating a new urban fabric through the integration of architectural, landscape, and urban elements; and a 1:100/200 architectural scale, focused on housing typologies and spatial detail.

In *Lab B* (Architecture and Town Lab, English curriculum), forty-five international students engaged in a circular design process structured in iterative phases. Initially divided into four macro-groups of 10–15 students, the class developed a shared masterplan. In the second phase, these macro-groups split into smaller units (1–3 students) to design individual interventions derived from the collective rules and strategy (Pisano, De Luca, Dastgerdi, 2020). In the final phase, the groups reconvened to re-integrate the detailed proposals into a revised and cohesive masterplan.

Labs C and D (Urban Metabolism and Resilience Labs, Italian and English curricula) worked as a single integrated unit, involving approximately fifty students from the Master's in Planning and Design for Urban and Territorial Sustainability. The design process began with a scenario-based thematic analysis, focused on key systems – water, food, energy, and ecosystems. In a second phase, students were reorganised into smaller groups (2–3 members) to develop site-specific interventions within strategic nodes along defined transects, applying an integrated and multi-scalar design approach.



Design process of the Lab. C
Fig. 3

3.2. Guiding Themes

Before the start of the semester, each laboratory defined a distinct set of guiding themes or design qualities, formally communicated to students through the course syllabi.

In *Lab A* (Architecture and Town Lab, Italian curriculum), the guiding focus was urban, architectural, and landscape regeneration within peri-urban contexts, spaces of transition and hybridisation between urban and rural conditions. Students were driven to reflect on themes such as historic memory, typological and functional heterogeneity, and configurational discontinuities, all viewed as opportunities for spatial and formal reintegration of fragmented urban areas.

Lab B (Architecture and Town Lab, English curriculum) approached the project through urban macro-functions designed to address local needs while promoting typological innovation. Design explorations included vertical parking as a response to impermeable surfaces, a covered market to reinterpret the weekly open-air market, vertical agriculture for environmental and social resilience, and inhabited bridges to reconnect fragmented urban fabric across infrastructural and riverine barriers.

In *Labs C and D* (Urban Metabolism and Resilience Labs), the design agenda was explicitly shaped by the climate crisis and the decline of material and energy resources. The concept of resilience served as a guiding principle to counteract soil consumption and soil sealing, intending to restore ecological functions such as rainwater infiltration, evapotranspiration, and temperature regulation.

3.3. Domains

This section examines how the *Prato Ready Laboratories* align with the disciplinary do-

Articulation of the different disciplines and credits in the 4 laboratories

Tab. 3

	Lab. A	Lab. B	Lab. C	Lab. D
Architectural Design	6 ECTS	6 ECTS	3 ECTS	3 ECTS
Landscape Design	6 ECTS	6 ECTS	-	-
Technology Design	-	-	3 ECTS	3 ECTS
Urban Design	6 ECTS	6 ECTS	6 ECTS	6 ECTS

mains outlined in van Dooren's framework (2013, 2020), reflecting the varied pedagogical structures across the four studios.

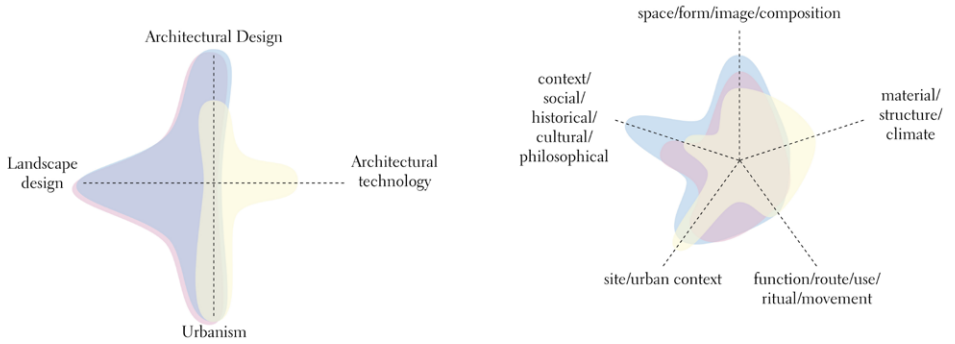
In *Labs A and B* (Architecture and Town Labs), the laboratories were evenly divided across three core domains – Architectural Design, Urban Design, and Landscape Design – each accounting for 6 ECTS credits (48 hours of instruction), thus promoting a balanced, integrated approach across spatial scales and design disciplines.

In contrast, *Labs C and D* (Urban Metabolism and Resilience Labs) were structured around Urban Design (6 ECTS), Technological Design (3 ECTS), and Architectural Design (3 ECTS), emphasising technical and environmental dimensions of urban transformation, in line with their sustainability-oriented pedagogical focus.

Despite sharing common disciplinary domains, the *Prato Ready Laboratories* showed distinct pedagogical emphases shaped by their design processes and guiding themes. *Lab A* placed particular emphasis on the specificity of the urban context, interpreted through social, historical, and cultural lenses, a focus reinforced by the requirement for each group to independently address all design scales.

Lab B, by contrast, concentrated on functional programming and the activation of open spaces, exploring how new typologies could catalyse contextual transformation.

In *Labs C and D*, the inclusion of Technological Design introduced a strong focus on climatic and technical performance, aligning with the labs' resilience-oriented agenda. The greater weight of Urban Design credits and the planning background of the students further oriented the design work toward large-scale territorial analysis, encompassing extended portions of the Prato urban region.



Disciplines (on the left) and domains (on the right) connected to the Laboratories: in blue the Lab A; in pink the Lab B; in yellow the Labs C and D.
Fig. 5

3.4. References

This aspect is closely tied to the individual pedagogical orientations of each lecturer, which often diverge significantly, even within shared disciplinary domains. The four laboratories reflect a broad diversity of teaching approaches, shaped by each instructor's research focus and professional background. The following comparative overview presents the main academic profiles by discipline and laboratory, based on information drawn from the University of Florence's institutional website.

3.4.1. Architectural Design

Lab A, led by Professor Francesca Mugnai, adopts a symbolically and historically grounded approach to architectural design. Her pedagogy draws on extensive work with spatial typologies – such as places of worship, social housing, and commemorative sites – through symbolic language and archetypal forms. Mugnai's research includes archival and critical studies on twentieth-century Italian architecture, with a focus on Edoardo Detti and Carlo Scarpa. She also explores sustainable housing, combining energy-efficient strategies with morphological analysis of traditional Tuscan typologies.

Lab B, led by Professor Michelangelo Pivetta, centres on architectural theory and contemporary design, emphasising the intersection of conceptual frameworks, compositional practice, and advanced visual representation. His research engages with international and multidisciplinary projects, particularly in historically and infrastructurally significant contexts across Italy, the European Union, and the United Nations. Pivetta's method foregrounds applied design research shaped by socio-political dynamics and collaborative processes.

Labs C and D, coordinated by Professor Luca Barontini, integrate academic research with professional practice. As a founding partner of *Eutropia Architettura*, Barontini has received recognition in architectural competitions, notably winning the international competition for

the Justice Park in Bologna. His research examines the work of leading figures in contemporary Italian architecture, including Francesco Tomassi and Adolfo Natalini, with a focus on the interplay between urban form and public space.

3.4.2. Landscape Design

In *Lab A*, Professor Tessa Matteini is specialised in the design and active conservation of historic gardens and archaeological landscapes. Her research integrates interpretative design with conservation practices to creatively preserve and revitalise heritage contexts. Matteini also contributes to international research networks and policy initiatives, promoting the cultural and scientific recognition of landscape heritage.

Lab B, under the direction of Professor Ludovica Marinaro, focuses on urban landscape design and regeneration. Her work investigates the evolving relationship between city, port, and sea, emphasising participatory planning and the restoration of public and monumental spaces. As founder of SMALLStudio Architecture and Landscape, she leads interdisciplinary projects that integrate landscape design with infrastructural systems, including energy and water networks.

3.4.3. Technology Design

The Technology Design component is shared by *Labs C and D*, with an integrated teaching method. In *Lab C*, Professor Giulio Hasanaj focuses on sustainable architectural technologies and climate adaptation, contributing to the development of tools and strategies for environmentally responsive design. His research includes participation in national and international initiatives on urban resilience and environmental performance. He also engages in applied research on collective housing and university residences, with particular attention to the Italian regulatory framework (e.g., Law 338/2000).

In *Lab D*, Professor Antonella Trombadore brings expertise in innovative technologies for environmental sustainability. Her work emphasises the integration of green infrastructure, NZEB standards, and digital tools such as Digital Twin models. She also investigates energy-efficient renovation processes, especially within university campuses, employing Living Labs as platforms for participatory design and environmental innovation.

3.4.4. Urban Design

Professor Carlo Pisano is responsible for the Urban Design courses across *Labs A, B, C,* and *D*. His research focuses on regional design and multiscale strategic planning, with particular attention to the regeneration of transitional and peripheral urban areas. As coordinator of the Regional Design Laboratory, he promotes an action-research approach that combines visionary planning with context-specific, operational design practices. His work advocates

Examples of graphic materials produced by the students in the Lab A: A) Giuseppe Catalanotto, Federico Dondi, Jose Daniel Belaunde, Architectural reading; B) Irene Mereu, Marta Linguanti, Urban reading; C) Carolina Kuhl, Elena Moroni, Landscape reading
Fig. 6A-6B-6C

for integrated models of urban transformation that bridge long-term strategies and short-term, adaptive interventions.

In *Labs C* and *D*, Urban Design is co-taught with Professor Silvio Cristiano, whose research addresses sustainable and resilient urban and regional planning. He investigates spatial strategies and governance mechanisms that support low-carbon and socially equitable development. His work employs environmental accounting and socio-ecological metabolism frameworks to analyse urban resource flows and environmental impacts, with a focus on systemic sustainability transitions.

3.5. Visual language

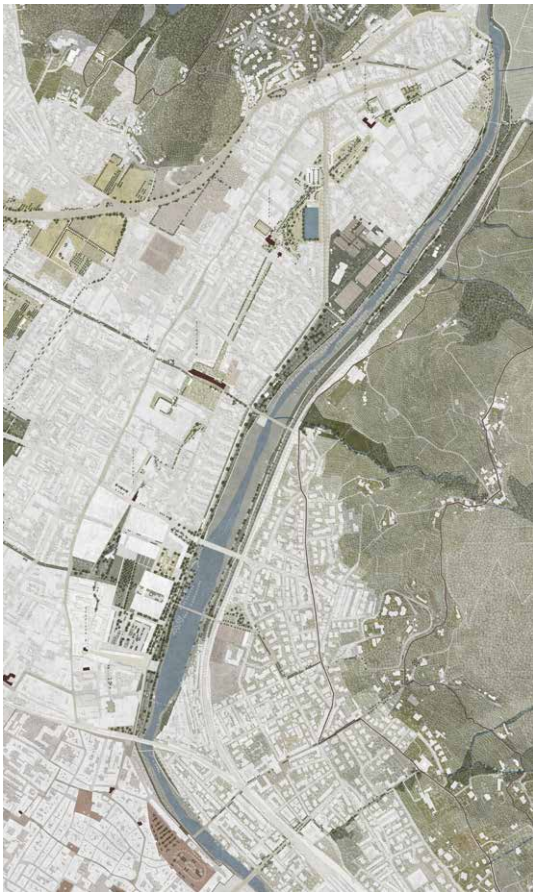
The structure and articulation of visual materials played a central role in shaping both the design process and outcomes across the four design laboratories. While all labs adopted integrated and interdisciplinary approaches, each defined a distinct set of deliverables aligned with its conceptual priorities, organisational model, and methodological framework.

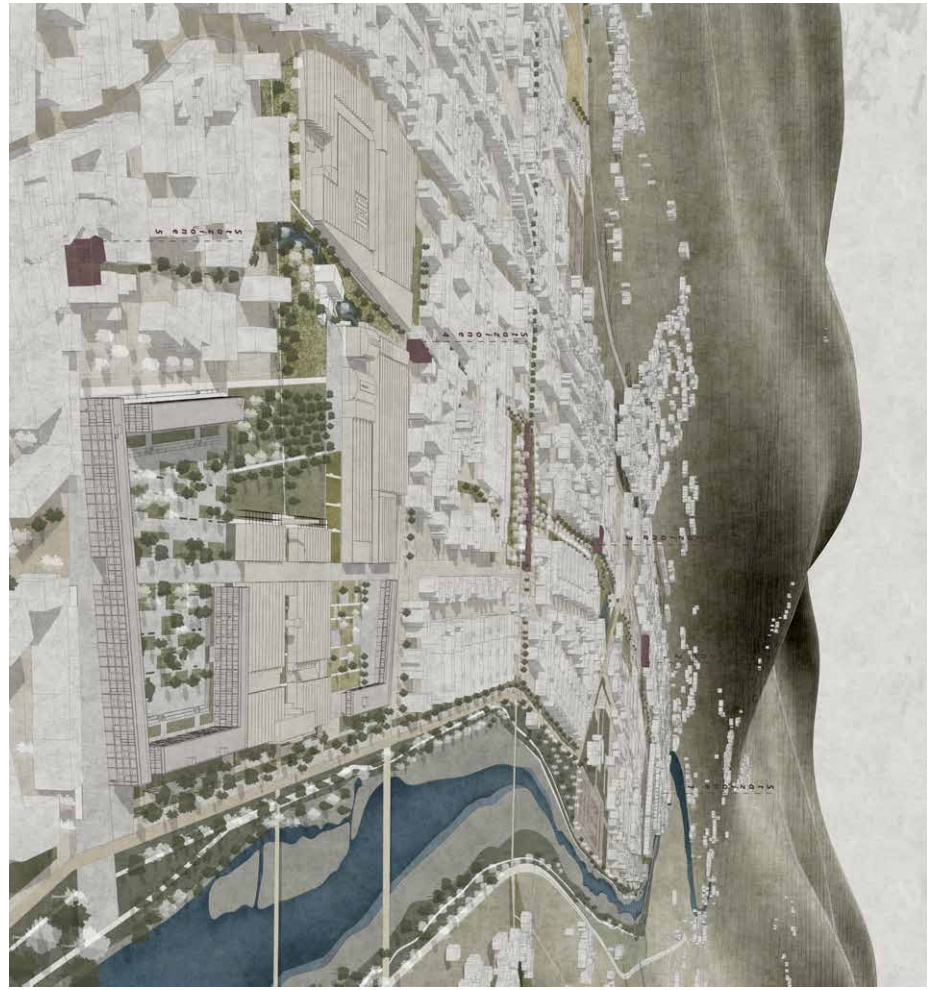
In *Lab A*, production was highly structured and uniform. All students had to submit a standardised set of outputs, including a 9-page A3 project dossier, seven A0 boards, and two physical models. These materials ranged from territorial and urban analyses to detailed architectural drawings of a residential block at 1:200 scale, emphasising clarity, disciplinary integration, and multiscale coherence.

Lab B adopted a more flexible structure, accommodating varied group configurations such as "supergroups" and "microgroups." Each group produced 3-4 A1 boards focused on urban and landscape analysis, while smaller teams developed 2 A1 boards with architectural proposals. Physical models at different scales complemented the graphic materials, supporting diverse representational approaches and fostering a tangible understanding of spatial interventions.

Labs C and *D* implemented the most articulated and hierarchical system of deliverables, organised across macro-groups, groups, and micro-groups. In the initial phase, macro-groups produced three thematic A0 boards and a synthetic masterplan (A0), addressing specific topics, such as water, food, energy, and ecosystems, through the transversal lenses of soil, built environment, and infrastructure. Design groups then developed an A0 study area project at 1:500 scale, while micro-groups contributed three A1 boards focusing on a strategic architectural node, climate-responsive strategies and Nature-based Solutions, and detailed construction drawings at 1:20. The process concluded with a standardised 3D-printed model (38.5 × 38.5 cm, 1:100 scale), highlighting the lab's focus on precision, innovation, and environmental awareness.

The diversity of deliverables across laboratories reflects the plurality of didactic strategies within a shared academic framework, offer-





Examples of graphic materials produced by the students in the Lab A: D) Irene Mereu, Marta Linguanti, Birdview of the design solution; E) Sara Ceccotti, Chiara Baggiani, Masterplan of the design solution; F) Sara Ceccotti, Chiara Baggiani, Renders.
Fig. 6D-6E-6F

ing students multiple modes of engagement with complex urban and architectural issues through drawing, modelling, and interdisciplinary synthesis.

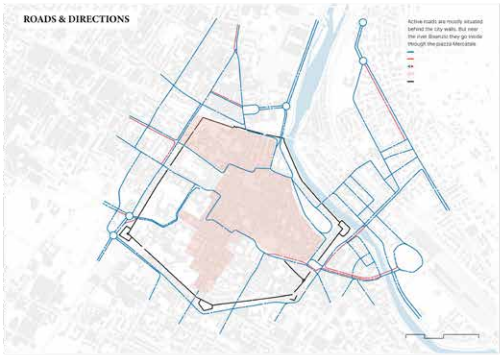
4. Discussion

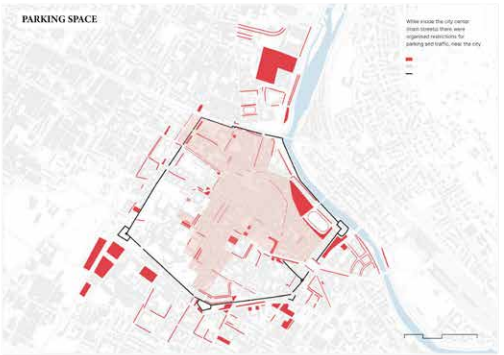
Although grounded in a shared design context – the peri-urban area north of Prato – and a common goal of urban regeneration, the four *Prato Ready Laboratories* adopted distinct pedagogical strategies in addressing themes of territorial risk, resilience, and sustainability. These differences were clear not only in the design processes but also in the disciplinary orientations, representational formats, and theoretical frameworks specific to each lab.

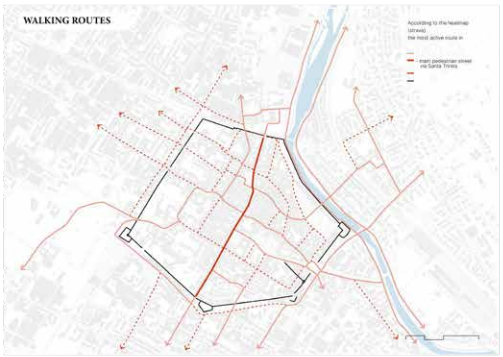
4.1. Lab A

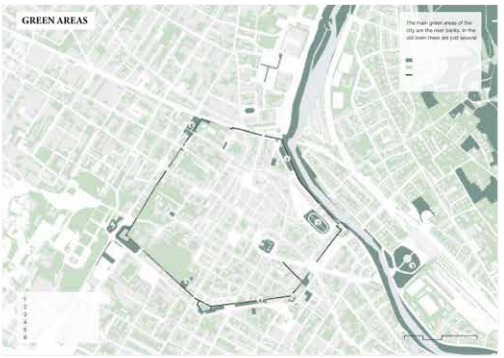
In *Lab A*, risk was primarily understood as a consequence of spatial and historical discontinuities caused by uncoordinated urban development and the neglect of infrastructural and landscape systems. Students adopted a transcalar approach that combined architecture, urban design, and landscape architecture. Through analytical and projective drawings, the proposals aimed to reconnect fragmented urban fabrics, reactivate the hydraulic heritage of the Gore system, and reinterpret residual spaces as new ecological and social linkages.

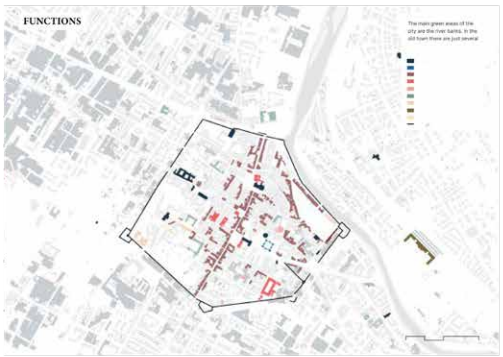
The visual outcomes from *Lab A* prove a strong engagement with territorial stratification, where design interventions mediate between the built environment and natural systems. The reimagining of the Gorone canal exemplifies an ecological strategy for risk mitigation, addressing issues such as flooding, impermeability, and urban disconnection. At the archi-

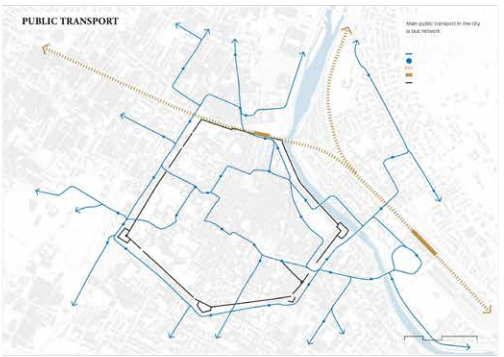






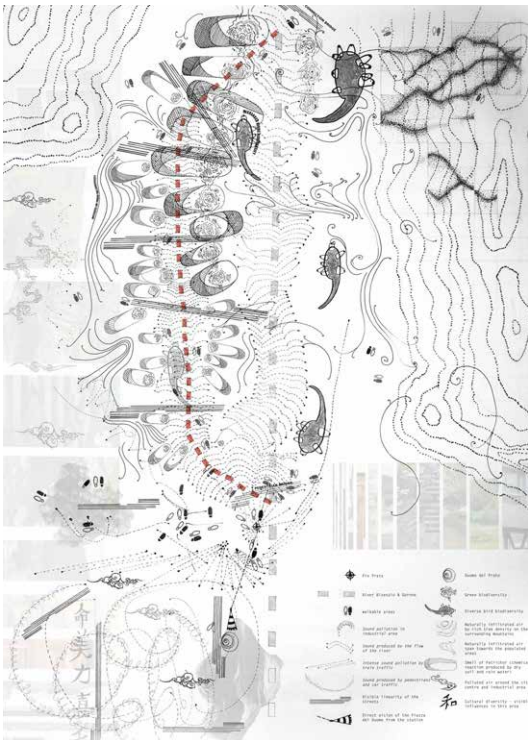


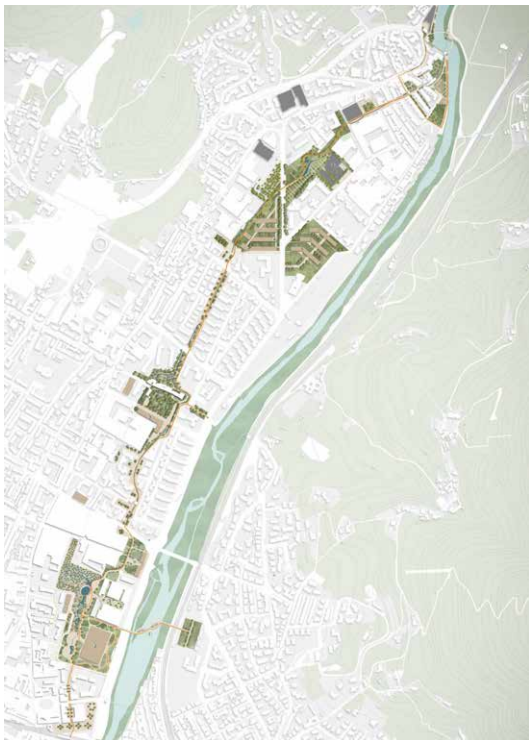




Examples of graphic materials produced by the students in the Lab B: A) Elizaveta Dvorshchenko, Boris Gusev, Urban reading of Prato historical centre; B) Orestis Hasikos, Sensitive reading of the urban landscape; C) Anastasia Lukash, Anna Yakubova, Eduard Asimolov, Foteini Ioannidi, Ilia Shapoval, Inna Korolevskaia, Juan Francisco Morejon, Letitia-Maria Boeru, Orestis Hasikos, Pinar Yalin, Vanda Antunovic, General masterplan of the super-group number 1; D) Francisco Morejon, Letitia Boeru,Orestis Hasikos, Detailed masterplan of the design proposal

Fig. 7A-7B-7C-7D



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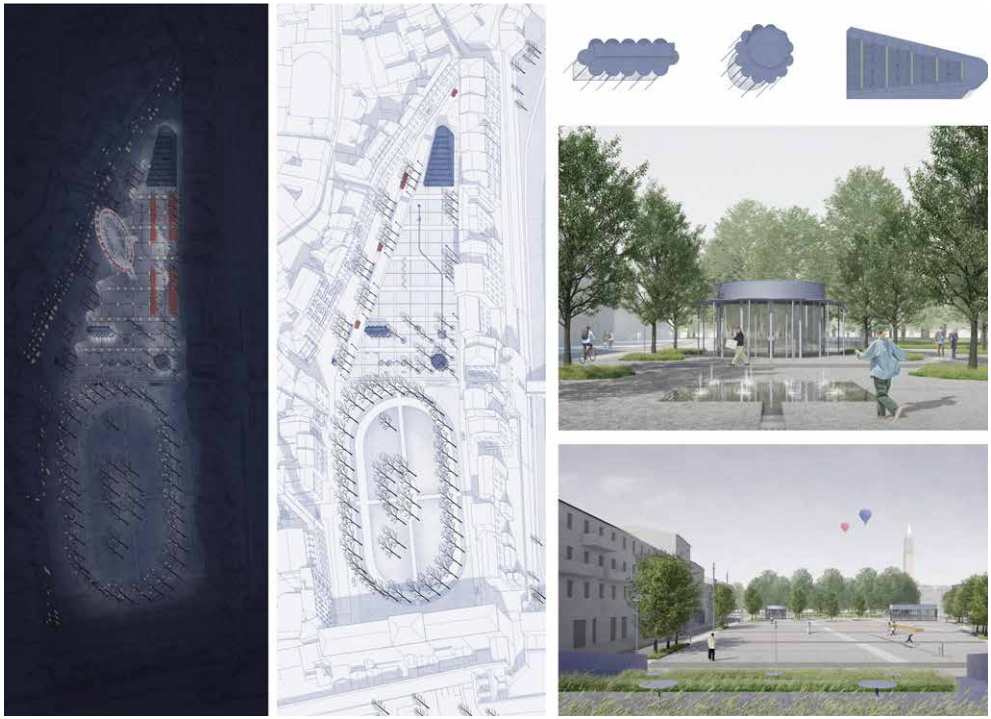


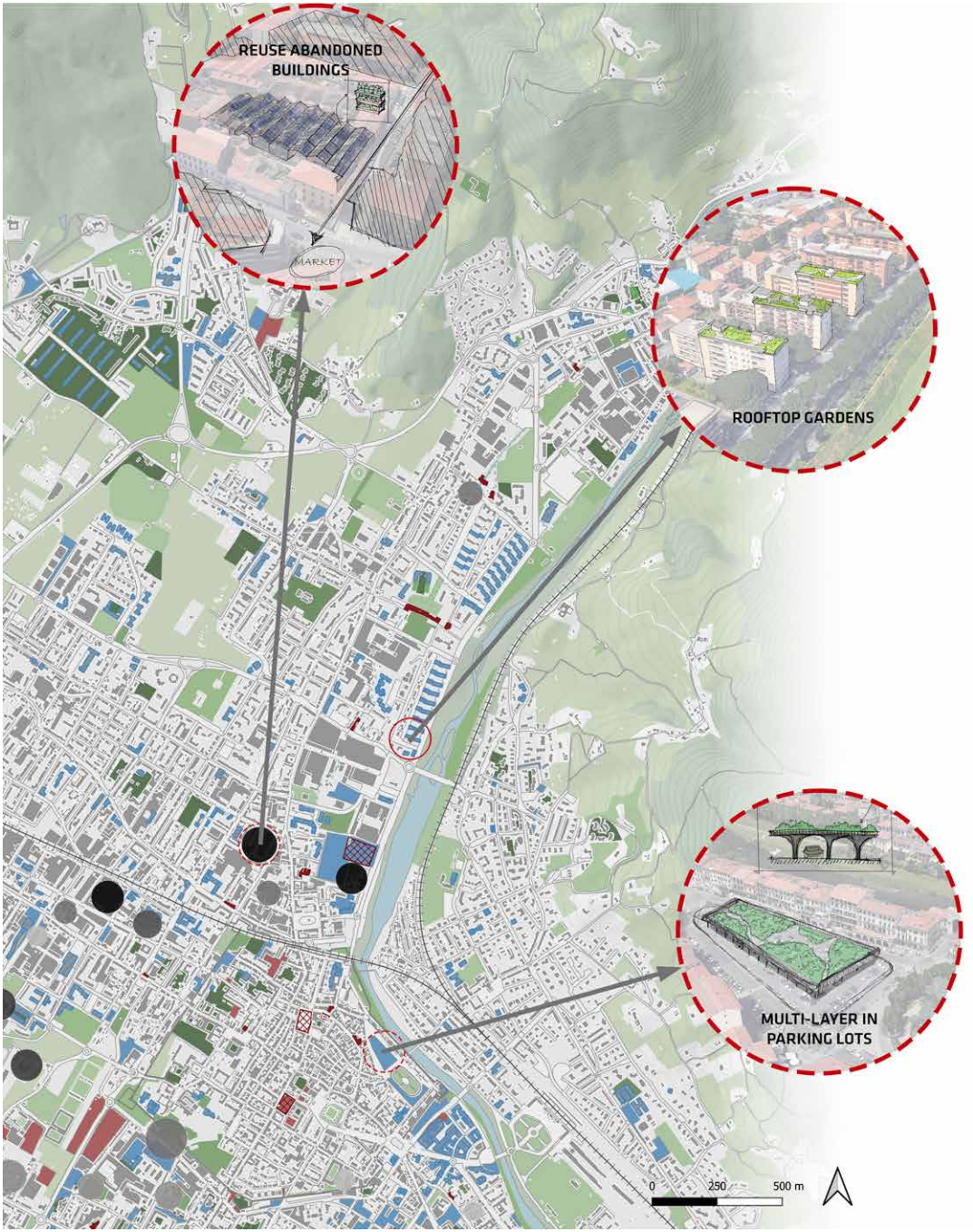
Examples of graphic materials produced by the students in the Lab B: E) Elizaveta Dvorshchenko, Boris Gusev, Detailed design solution.
Fig. 7E

tectural scale, new housing typologies incorporate public and semi-public spaces to foster socio-spatial resilience, framing sustainability as both environmental responsiveness and inclusive urban design.

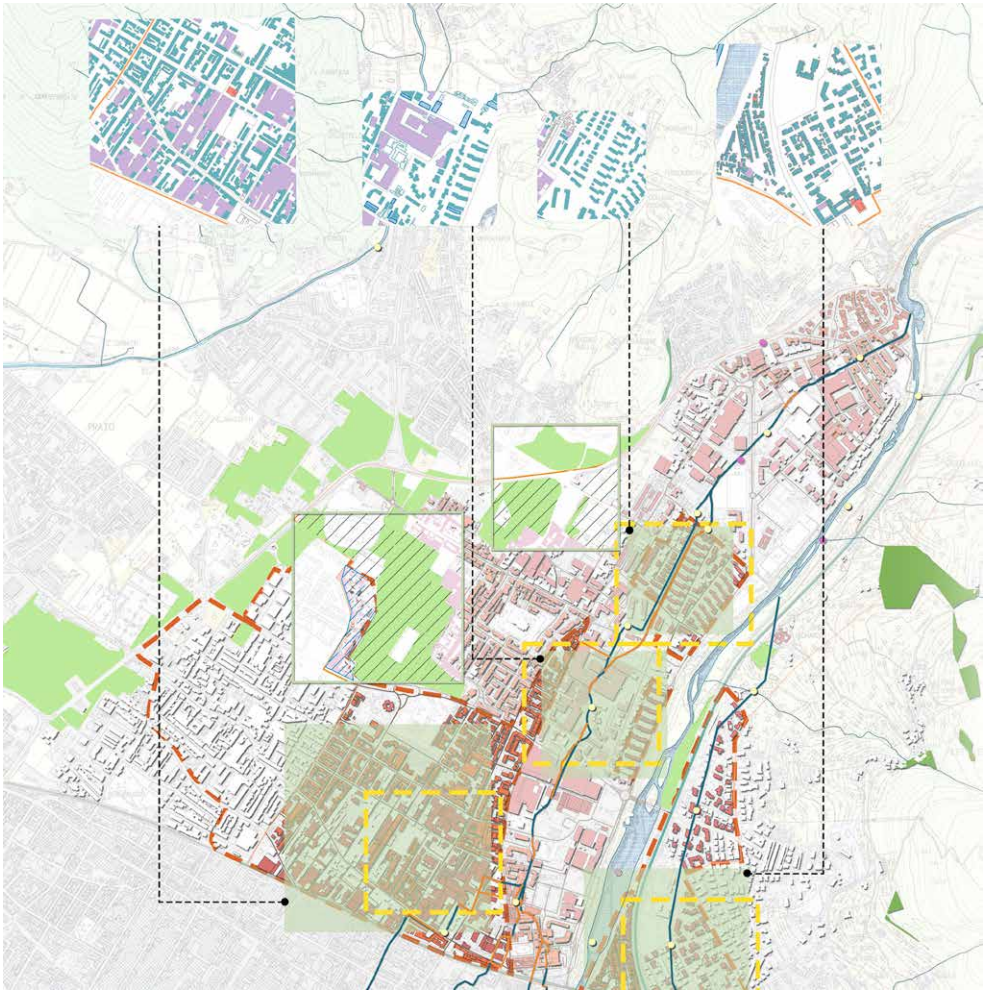
4.2. Lab B

Lab B approached risk through a programmatic and experiential perspective, interpreting it as the cumulative result of functional obsolescence, degraded public spaces, and disconnection across urban systems. The lab employed a circular design process that enabled students to alternate between collective and individual phases, fostering a dynamic, feedback-oriented approach to territorial transformation.

A key methodology was the creation of a "Sensitive Map," translating spatial analysis into multisensory readings – soundscapes, olfactory zones, and tactile surfaces – that revealed less visible forms of environmental and perceptual risk. In response, students developed adaptive typologies such as vertical farms, covered markets, and inhabited bridges, reconfiguring circulation patterns, and programmatic functions. The "Degli Abatoni Urban Farm & Community Hub" (Fig. 7D) exemplifies this strategy, combining minimal physical intervention with high social and ecological impact. Through selective demolitions, re-naturalisation of paved areas, and vertical reuse of existing structures, the project proposes resilient transformation

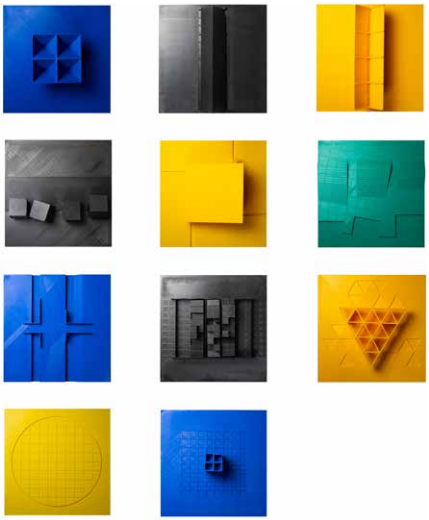


Samples of graphic materials produced by the students in the laboratory C: A) Macrogroup 1, Potential food production in the study area.
Fig. 8A



B) Macrogroup 2, Analysis of the consumption and potential production of energy in the study area; C) Duaa Osama Mohamed Abdelrahim, Noelia Patricia Ibarra Cáceres, Hanadi Ibrahim Ali Tashani, Render of the potential reuse of an abandoned factory for urban farming; D) Overview of the detailed design of urban pavilions to stock rainwater and produce energy through PV panels.

Fig. 8B-8C-8D



grounded in subtraction, reuse, and landscape productivity. In *Lab B*, sustainability is framed as a tactical recalibration of the urban system, addressing risk through programmatic adaptability and ecological restoration.

4.3. Labs C and D

In *Labs C* and *D*, the theme of risk was central to the design process and explicitly framed through the lens of the climate crisis, resource scarcity, and territorial metabolism. The methodological structure – organised into macro-groups, groups, and micro-groups – guided students from territorial scenarios (water, food, energy, ecosystems) to site-specific architectural and technological solutions at critical urban nodes.

Projects integrated Nature-based Solutions (NbS), passive climate strategies, and digital tools to enhance design performance and decision-making transparency. Environmental risks related to soil sealing, urban heat islands, and water mismanagement were addressed through spatially integrated, quantifiable interventions such as green roofs, permeable surfaces, and urban agroforestry systems.

The 3D-printed architectural models produced in the final phase of the lab reflect the emphasis on material systems and design logic. Resilience in *Labs C* and *D* is conceived as a systemic recalibration, combining spatial and formal innovation with performance-based metrics, policy sensitivity, and technical viability.

4.4. Final synthesis

A key moment in the final phase of the semester was a cross-laboratory workshop, coordinated within *Labs C* and *D*, which brought together students and lecturers from all four studios in a collective synthesis exercise. This initiative marked the pedagogical and conceptual result of the semester, aiming to translate diverse speculative proposals into a shared strategic vision for the transformation of the project area.

Through collaborative dialogue and critical

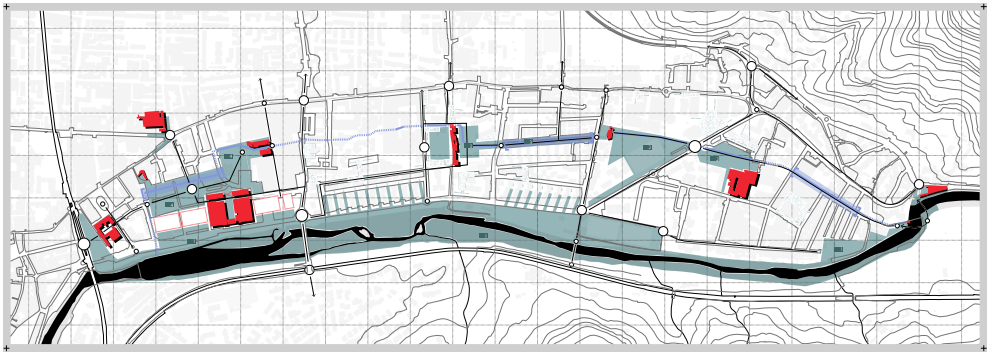


Fig. 9 Final synthetic map that integrates the most coherent, feasible, and impactful design actions emerging across the laboratories. In red, architectural landmarks; in blue the reopening of key segments of the Gorone canal; circles, urban nodes. In green are represented the vast regenerated areas: 1) Park along the Bisenzio river, 2) From Gualchiera to Abatoni park, 3) villa Niccolini and via Goldoni park, 4) New market.
Fig. 9

evaluation, the workshop generated a synthetic cartography that integrated the most coherent, feasible, and impactful design actions developed across the labs. Far from a formal summary, the map functioned as a planning tool for territorial resilience, oriented toward climate adaptation and risk mitigation. It reflects a collective effort to identify structural interventions capable of addressing environmental vulnerabilities while enhancing ecological and social performance.

Central to the synthesis is a redefined mobility framework, which reorganises traffic flows to reduce private car access in sensitive areas, lower emissions, and improve air quality. In parallel, the reopening of key segments of the Gorone canal is envisioned as both a cultural and ecological strategy, restoring Prato's hydrological identity, reducing flood risk, and improving water retention. The de-sealing of extensive paved surfaces, particularly former parking areas, supports increased permeability, evapotranspiration, and urban microclimate regulation.

The integration of new parks and ecological corridors, strategically positioned to link existing green spaces, contributes to a broader landscape infrastructure designed to support biodiversity, manage stormwater, and mitigate extreme weather events. These spaces are conceived not merely as amenities but as active environmental systems embedded in the urban metabolism and capable of adapting to long-term climate pressures.

The students' proposals functioned as instruments of situated knowledge, revealing local opportunities, vulnerabilities, and capacities. As such, the final cartography works not only as a design product but as a resilience-oriented territorial framework, where architecture,

open space, infrastructure, and ecological systems converge into an adaptive, systemic vision. The emergence of new mobility nodes, the activation of public spaces, and the valorisation of architectural landmarks reinforce the identity of the area while enhancing its capacity to absorb and respond to future risks. In this sense, the *Prato Ready Laboratories* culminate in a collective exercise in spatial intelligence, advancing a design culture attuned to the challenges of climate transition and urban sustainability.

The *Prato Ready Laboratories* culminated in a public event held in Prato on 14 February 2025, attended by leading representatives of the city's political and administrative institutions, as well as by a large group of academics from the Department of Architecture at the University of Florence. Within this framework, students presented their work in an exhibition that became a platform for dialogue with local stakeholders. The occasion not only enabled the discussion of aims and perspectives for the future of the area but also provided a tangible form of feedback to citizens and institutions, thereby reinforcing the laboratories' role as a situated exercise embedded in the dynamics of urban governance.

Conclusion

The *Prato Ready Laboratories* illustrate the potential of a structured yet open-ended pedagogical framework to make the urban design process – often implicit and intuitive – explicit, reflective, and transferable. Grounded in van Dooren's conceptual model, this paper enabled the articulation of five key dimensions of design learning across four laboratories, each with distinct disciplinary orientations.

First, the labs effectively supported students in navigating the tension between exploration and decision-making. Whether through iterative cycles (*Lab B*), transcalar synthesis (*Lab A*), or scenario-based strategies (*Labs C* and *D*), students were encouraged to test hypotheses, assess consequences, and transform abstract intentions into spatial proposals, interpreting design as a communicable process of informed choices.

Second, the identification of guiding themes or design values in each lab – ranging from historical continuity and typological innovation to systemic resilience and environmental equity – provided meaningful conceptual instruments that fostered coherence and depth across scales and outputs.

Third, the differentiation of disciplinary domains (Architecture, Urban Design, Landscape, and Technological Design) enabled a layered approach to complex urban challenges. The comparison among labs highlighted how variations in disciplinary emphasis shape distinct interpretations of risk, resilience, and sustainability, underscoring the role of curricular design in cultivating design thinking.

Fourth, the plurality of reference frameworks,

shaped by the diverse research backgrounds of the teaching staff, expanded students' conceptual toolkits. From symbolic and historical analysis to socio-ecological systems thinking and technological innovation, the labs exposed students to a range of interpretive lenses, promoting critical awareness and intellectual autonomy.

Fifth, visual language emerged as both a cognitive and communicative tool. The varied representational formats – multi-scalar deliverables, sensory mappings, and scenario-based visualisations – reflected and reinforced each lab's epistemological orientation. By making risk and resilience visible, students learned not only to design but also to build arguments, narratives, and communicative clarity around complex urban issues.

Sixth, the integration of these heterogeneous pedagogical models was not without challenges. Differences in disciplinary traditions, teaching methods, and epistemological assumptions sometimes created tensions in achieving a coherent narrative across the laboratories. Coordinating between analytical, symbolic, and systemic approaches required negotiation and continuous adjustment, and the ambition to converge toward shared frameworks occasionally clashed with the specificity of each disciplinary stance. Yet, these frictions proved pedagogically valuable: they exposed students to the realities of interdisciplinary collaboration, highlighting both its difficulties and its innovation potential. Acknowledging and working through these challenges was itself an exercise in reflective practice, making explicit the conditions under which design education can foster not only technical competence but also resilience, adaptability, and critical awareness.

Ultimately, the *Prato Ready Laboratories* affirm that teaching urban and territorial design in contexts of climate uncertainty and multi-hazard risk requires more than technical training. It calls for a pedagogical approach that cultivates systemic thinking, spatial imagination, and ethical responsiveness. Operationalising van Dooren's framework, the program clarified the structure of the design process while proving the role of education in preparing future designers to act with clarity, adaptability, and care in increasingly fragile and dynamic urban environments.

Acknowledgements

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