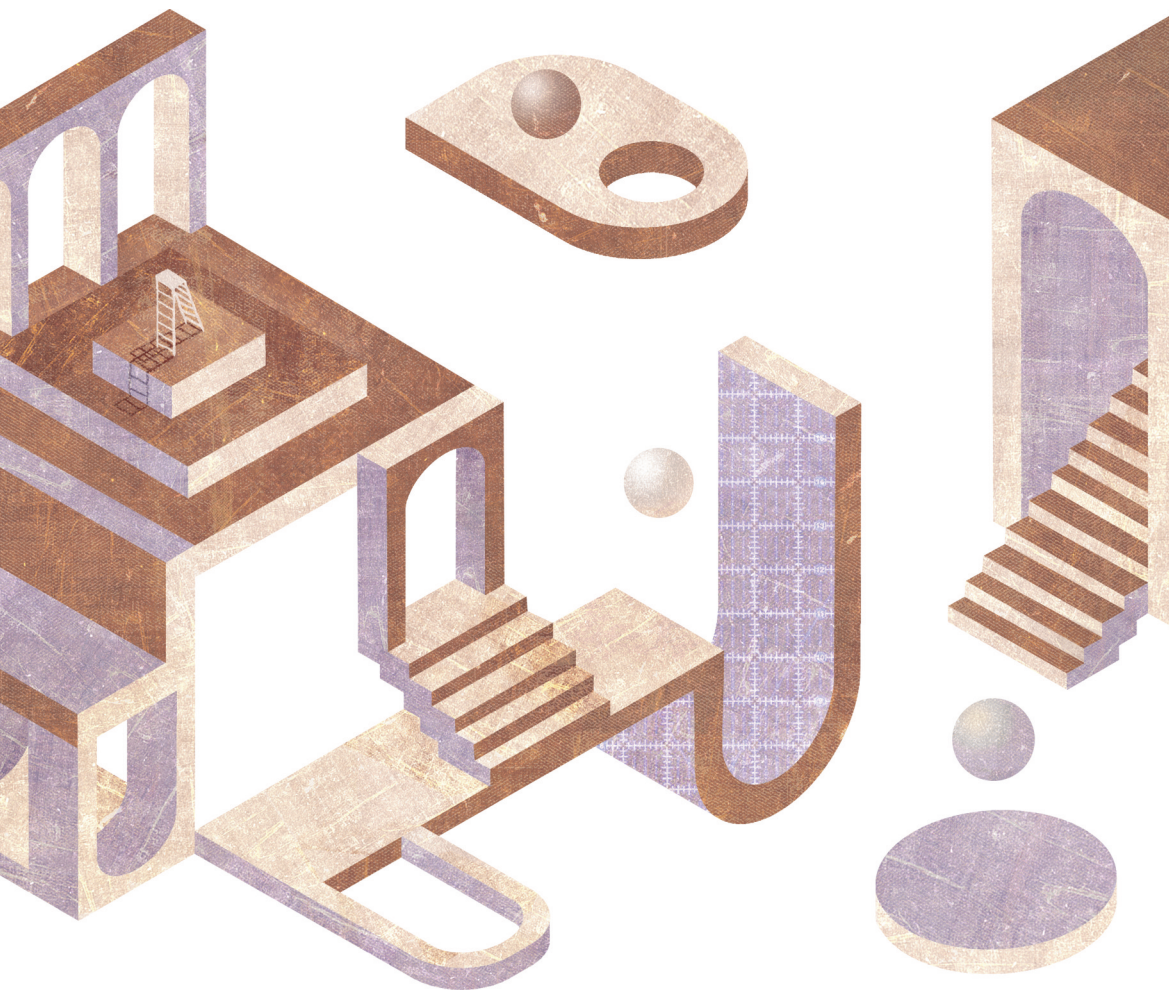
MULTIPLE-SCALARITIES

Environmental systems as a combination of interior design, services, communication and technologies

edited by Giulia Gerosa, Andrea Manciaracina



D.I. FrancoAngeli
DESIGN INTERNATIONAL

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Content

Introduction

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Interior design is less and less reduced to the mere physical component of space. It is instead increasingly projected towards an 'environmental system' made up of space, services, communication, and technology, capable of illustrating a multi-scalarity and trans-disciplinarity typical of a project devoted to innovation. This change of focus, from the prevalence of the interior physical component to the dominance of a polyvalent system, has generated a series of changes, including those affecting the project's area, which shows a progressive rise of the informational-cognitive component where the control of the net of human interactions involved becomes extremely important.

The theme of scalarity runs through the studies on the relationship between man and space, from representation to design, and helps interpret environmental systems differently by relating practices and techniques from different disciplinary fields. Through multi-scalar and multi-disciplinary approaches, it is possible to understand that the design of an environmental system (be it a room or a university campus) must establishing a relationship with the the context in which it is inserted and that at the same time, the relationships between user, environment, technology, and services are a lens through which to interpret space and its shapes.

The concepts of scale and measurement are indispensable for correlating, from a systemic perspective, the particular with the general, the detail with the whole (De Giovanni & Sposito, 2020), for interpreting and representing, for discretising and recomposing elements and parts with each other in a hierarchical or interconnected relationship, for investigating the physical and the social, for outlining criticality and potentiality (Russo, 2015).

Multiscalar applications are connected to an adaptive concept of design make places and make deeper connections between spatial form, usage, and meaning, framed within a process of hybridization (Leveratto, 2019). Through a multi-scale approach, it is possible to interpret an ecology of the project in which, through the multiplication of the different scales of intervention, it is possible to generate relationships between space and user, not only placing them within complex systems but recognising them in mediated design "patterns" from technology.

Technology and its use made of it are essential elements of a complex environmental system. Through technology, it is possible to help the user to use the space; it is possible to expand the space beyond its physical boundaries, it is possible to interconnect different services, and it is possible to create networks of spaces. The design scale affects the design outcomes, and "thanks to the progress of technology in the field of design at all levels, it is probably the component of the project on which the designer works the most, simultaneously coordinating real and virtual relations" (De Giovanni & Sposito, 2020).

The volume collects various design experiences within heterogeneous research groups of the Design Department of Politecnico di Milano and talks about experiments in designing spaces and services on a different dimensional scale that have impacted various types of users. Through the recounting of these experiments, the book highlights the close interconnections between the design of spaces, the creation of services, the application of communication systems, and the exploitation of technologies, allowing us to reveal the tensions and interactions that are unleashed depending on the prevalence of one or another design discipline and the scale (from XS to XL) at which they take place.

The different chapters focus on a design process aimed at users both as individuals and as communities. We can find evidence of disciplinary and design specificities and recurrences of particular approaches, methods and tools regardless of the specific themes, contexts and scale of intervention. These specificities are explicitly linked to the thematic, contexts and scale.

What emerges here is a rich and varied picture of examples of possible modes of intervention by the discipline of spatial design in dialogue with other design disciplines, including services and communication, as well as a comprehensive set of disciplinary approaches and

tools, each time punctually selected, adapted, hybridised, combined and, finally, adapted to the individual cases narrated in this publication.

The first chapter (XS), dealing with the smallest dimension of the multi-scalar project, namely that of the space delimited by a portion of an exhibition environment, describes a single installation with extreme care; on the other hand, it introduces a vast richness of reflection and perspective, influencing not only functional but also environmental and social dimensions. The Norman Foster Foundation and the Guggenheim Museum Bilbao invited students from 15 design and architecture schools on four continents to envisage the future of mobility on the occasion of the exhibition "Motion. Autos, Art, Architecture". Responding to this call, Politecnico di Milano has designed "Autofficina Futuro", an interactive exhibit that responds to people's presence and gestures with multimedia content.

The second chapter (S) switches its emphasis to public interiors by describing the "Salone del Futuro" design created for the Milano-Monza-Brianza-Lodi's Chamber of Commerce. The initial premise of the project is that the digital world is radically altering how services are given (constantly becoming more efficient, accessible, and swifter). Chamber of Commerce and Politecnico di Milano collaborated using systemic and spatial co-design methods that blended diverse roles, characteristics, sizes, and contexts to propose how public interiors may be modified in response to new tendencies in the digitisation of public services. The subsequent pandemic intensified shifts in the demand for and types of physical presence, allowing for new and enlarged uses of spaces and meanings of public services and jobs.

The third chapter (M) addresses the topic of the spatial redevelopment of abandoned structures in cooperation with the municipality of Lentate sul Seveso and with the involvement of the local administration, the principal stakeholder, and private sector players. The old military park requalification project detailed in this chapter exemplifies a concept of sustainable urban transformation based on building renovation and civic engagement. The concept offers the construction of student houses combined with multipurpose spaces for local populations to preserve the territory's resources and history and foster educational and economic growth. It adheres to the ideas of the National Recovery and Resilience Plan, beginning with the relocation of innovative processes from large cities to smaller communities.

The fourth chapter (L) examines how spatial and technological innovation change learning environments to foster active pedagogical approaches. The future of design education will trigger new reflections due to the changing needs of users and the introduction of updated learning approaches. Moreover, the efficacy of universities revolves around the equilibrium of three fundamental elements: pedagogy, space, and technology. This chapter addresses the concept and development of four unique classroom pilot projects. Four spatial solutions to experiment with and engage all users in a participatory implementation of the University's (Engineering, Architecture, and Design) new requirements. Innovative classrooms are dispersed over the campus through a fluid multi-scalarity that connects interstitial spaces to shared spaces, thus promoting social and active learning strategies through technology.

The fifth chapter (XL) examines the synergy of several entities (physical, functional, and human relationships) that have emerged in the decision to relocate the science faculties of the Università Degli Studi di Milano to a new location – the 2015 Expo Area. Spaces can become symbolic sites of belonging for the community that inhabits them, where hopes, fresh aspirations, and future possibilities might fester and grow. Nevertheless, when confronted with a substantial change, they might symbolise their members' and potential communities' concerns and resistance. The study project conducted at the Politecnico di Milano attempted to balance the correct size of a forthcoming community based on quantitative analysis and the appropriate atmosphere due to inclusive co-design methods. The outcome was to function on a meta-design level. As a technique, the approach created a "conversation space" for future campus residents, where participants were free to disengage from current limitations and begin imagining possible alternative outcomes.

The sixth chapter (XS > XL) discusses the subject of multiscalarity in cultural heritage valorisation projects. The design field and practice have a well-established history of valuing cultural heritage, referred to as Design for Cultural Heritage. Some years later, it is given that Design-typical concepts, processes, and tools (e.g., co-design, participation, scenarios) may be successfully implemented in the cultural sector. Interaction design is no less involved in this process, and the human-centred perspective to incorporating digital technology in the cultural arena is now regarded as standard practice. Five initiatives are reviewed

critically, beginning with an interactive exhibit and progressing to a citywide interactive experience. This chapter aims to highlight the constant and variable features of the design-driven method at various intervention scales.

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5. XL: Metadesign for the Relocation of Università degli Studi di Milano (the Milan State University)

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Abstract

Spaces can become iconic places of belonging for the communities that inhabit them, in which hopes, ambitions, and future scenarios are embedded. However, they can also embody individuals' and future communities' fears and resistance when faced with significant change.

This chapter focuses on the synergy of different entities (physical, intangible, and human interactions) that have emerged from the decision to move the Università degli Studi di Milano's science faculties to a new location – the 2015 Expo Area. This unexpected change presented the challenge of imagining spaces and facilities appropriate for current and future interdisciplinary cooperation in research, teaching, and learning practices. What happens when the successful planning of a physical space is intrinsically related to the consent of its inhabitants?

As the chief consultant, Politecnico di Milano was interested in researching high-level project criteria, expectations, and needs of a cohesive and successful organization of the various entities and activities. The aim was to balance the future settlement's spatial dimension, based on quantitative analysis, and the appropriate mood, through inclusive co-design processes. The result was to work on a metadesign level. The approach generated a "space of discussion" for future campus inhabitants as a strategy where participants had the freedom to distance themselves from current constraints and start imagining future scenarios with a whole new mindset.

Introduction

Spaces play a crucial role in shaping the sense of belonging for the communities that inhabit them. They can inspire new hopes, ambitions, and future scenarios but they also embody fears and resistance towards significant change.

The relocation of the science faculties of the Università degli Studi di Milano (abbreviated to *UniMi*) to the 2015 Expo Area is an example of how a significant change can challenge individuals and communities to imagine new spaces and facilities appropriate for present and future interdisciplinary cooperation in research, teaching, and learning practices.

The headquarters of the science faculties are in *Città Studi*, a district in the northeast of Milan, close to the city centre. It developed through a stratification process over a century ago, but it currently presents several problems. These include high levels of degradation of its buildings and equipment; strong fragmentation of university structures; non-rational organization of research departments; widespread duplication of research infrastructures; inefficiencies in the exploitation of space due to a policy of development of departmental systems based on contingent needs; and lack of synergies typical of a university campus. In addition, the low flexibility of the existing structures does not encourage future development and expansion in conjunction with the university's objectives.

Ten years ago, the Rector of *UniMI* recognized that meeting the challenge of international competition required a new and radically innovative design.

However, the opportunity to start a process to improve the campus spaces was challenging due to the need for a physical apparatus to meet the requirements for an innovative revision of the environments. The lack of spaces necessitated the university's architectural reorganization looking to other urban sites that could meet this need. The project stemmed from the need to follow a current European trend to have more interdisciplinary and intersectoral spaces, and to aspire to more sustainable and efficient infrastructure solutions. A comparison with the current university site's space allocation also revealed a significant deviation of the net and gross surfaces, which should be optimized in a new campus into new and innovative spaces for study, research, and work.

The university's design solution to this challenge was, at the time right after *Expo Milan 2015*, to build a new campus on the Expo site. This is an area located in the northwest of Milan, more suitable for constructing a campus from scratch and ready to promote effective operation and possible expansion of the university in the near future. The decision to move to *Area Expo* was therefore able to meet the following requirements, such as: the availability of infrastructure for attractive and competitive study and research environments; a strategic location for transport; the possibility of creating an entire campus with sports facilities, residences, and services; and to develop synergistic relationships with the surrounding area and institutions, and with international companies.

The general plan for the site conversion of *Expo 2015,* operated by *Arexpo SpA*, was to establish a Science, Knowledge, and Innovation Park; the goal was to achieve an integrated strategic renovation of the area, which could also exactly fit *UniMi'*s goals. This innovation was a valuable opportunity for radically regenerating spaces and their relationships, and innovative approaches in science and education (Camocini *et al.*, 2017). Moreover, as both private and public scientific and technical research institutions were invited to design a vibrant and potentially stimulating environment for collaborative studies and cross-cutting connections, there was huge potential for new collaborations to be forged.

Hence, the real challenge was: how to combine the ambition of creating a successful planning of a physical campus space with the consent of its inhabitants?

Scope of the work

The fundamental purpose of the new campus project was to provide the necessary physical spaces and digital services to facilitate cutting-edge technological innovation and exploration. In addition, the project aimed to promote interaction within and beyond the campus boundaries. Therefore, its name, *Science for Citizens*, underlines the university's pivotal role in enhancing the welfare and health of society (Chatterton, 2000) through the continuous dissemination of research

findings, and it suggests the concept of a borderless and open campus integrated into the city. A Scientific Cooperation Agreement was signed at the beginning of 2017 between *UniMi* and the *Politecnico di Milano* appointing a multidisciplinary team of *Politecnico di Milano* (from design and technological architecture)[1], as the chief consultant, with a specific interest in researching high-level project criteria expectations and the requirements for a cohesive and successful organization of the campus's various activities.

The research objectives of *UniMi* were:

- To identify the elements and characteristics of physical space and services that can enhance interactions between users.
- To find tools for direct user involvement to gather insights into the conditions that foster new interactions or reinforce existing ones, and to support individuals and future communities in overcoming fears and resistance when facing such significant changes.
- To be in tune with contemporary and future innovation trajectories regarding spaces, services, and organizations of new university campuses and science parks.
- To maximize the use of surfaces as a limited and valuable resource, in contrast to phenomena of "academic private space acquisition" in forms such as single offices.

The goal was also two-fold:

- To generate a "discussion space" for future campus inhabitants, enabling participants to distance themselves from current constraints and start imagining future scenarios with a new mindset. By establishing this "discussion space", individuals were encouraged to think creatively and 'outside the box', without feeling constrained by pre-existing conditions or limitations. The hope was that this approach could lead to a more innovative and forward-thinking plan for the future campus space (Camocini *et al*., 2018).
- To define, based on desk research and co-design sessions, quantitative and qualitative parameters related to spaces and activities and their interactions (Collina, 2005). This outcome was relevant in

1. The team of *Politecnico di Milano* consisted of Luisa Collina (scientific lead), Barbara Camocini and Laura Daglio (scientific coordinators), Martina Mazzarello (operational coordinator) and Francesco Vergani (collaborator).

supporting implementation of contemporary international standards as well as of the existing structure's state, highlighting the campus's central functions and analyzing the complexity of activities and logistics that characterize different scientific disciplines: biology, food science, pharmacology, chemistry, geology, physics, mathematics and computer science.

This two-fold goal became part of the information package distributed to architectural firms and developers participating in the international competition for a master plan and an architectural proposal so that flexible analysis and groundbreaking typological and technical solutions could occur.

Approaches and methods

At the outset, the need was recognized to identify tools to facilitate communication between community members, collect quantitative and qualitative data, and interpret them correctly.

The *Politecnico di Milano* team decided to adopt the approaches of meta-design and participatory design, and to develop a comprehensive field research plan utilizing tools and methodologies from spatial and service design, and from architectural technology.

The first perspective was oriented towards understanding the situation: co-design sessions, workshops, and field interviews were employed to engage with the campus community and gain insight into their daily habits and routines. These sessions helped highlight the campus's critical issues and allowed the team to gather valuable feedback from the community.

In addition to these participatory tools, the team also utilized space analysis tools to gain a deeper understanding of the physical requirements of the campus environment. This allowed them to identify areas of improvement and develop targeted solutions to address the issues.

The second perspective was oriented to research innovative and futuristic models, supported by a concentrated desk research activity, benchmarking, and interviews with experts in the field at the interna-

tional level. The reason for using this method was related to the risk of this work's result being a simple re-proposal of a similar, although partly rationalized, model of the existing campus.

The team also leveraged specific tools and collaborative methods to develop scientific research and adapt to a broader disciplinary area between spaces and services. This interdisciplinary approach allowed them to identify and understand the complex interactions within the campus community, and to develop innovative solutions for a future way of working, studying, and living.

To improve communication and collect data accurately, the existing campus structure and central functions were analyzed for various scientific disciplines: biology, food science, pharmacology, chemistry, geology, physics, mathematics, and computer science. The existing complex building structure's spatial discontinuity and dispersed urban fabric had resulted in a sectoral approach to research, reducing innovation opportunities and technology advancement. To overcome these challenges, an novel, futuristic model was researched, with an interactive discussion model created to encourage imaginative and creative ideas for the future. The approach aimed to eliminate constraints and limitations and generate a forward-thinking plan for the campus space.

Four phases to tackle the challenge

The elaboration of the new campus project's generative principles at the former Expo Area of Milan has been articulated in successive research phases, starting in February 2017, and including different types of future campus inhabitants and stakeholders in each stage. A path developed according to sequential logic, starting from the territorial macro-scale. It then continued by defining the characters of the different functional categories of the campus and their connections, leading to the identification of requirements at the scale of the building and introducing guidelines concerning structural, technological, and plant design aspects. On the other hand, the research activity's specific task was combining top-down and bottom-up strategies, intending to investigate and improve a shared concept of a contemporary campus, where space is a complex social construction that is not merely built,

but produced and made productive through social practices (Lefebvre, 1991). This aim targeted academic staff and students, allowing them to identify needs and practical requirements to define the settlement's new organization.

The phases and related activities can be summarized in detail as follows.

Phase 1. The first phase of the research action combined quantitative and qualitative approaches to define spatial and services' requirements.

This involved collecting and verifying quantitative data to identify spatial and service requirements for the new *UniMi* campus at the former Expo site. Surveys were distributed to department heads to gather information on spaces, mobility habits, number of users, etc., and both interviews with international designers and bibliographical research were conducted. The proposals were presented and discussed in public sessions with the Academic Senate, departments, students, and administrative staff representatives. The primary outcome of this phase was the development of parameters related to spaces, activities, and their interactions.

In addition, on a broader scale, a systemic approach was taken to define the categories of campus spaces, their functions, and the hierarchy of importance between them. The information related to all the areas present in the future campus has been schematized into four different categories:

- *general characteristics of the settlement*: useful information for the definition of the overall morphology of the campus, energy-environmental requirements, location, information to quantify staff and users;
- *core functions*: requirements and necessary functions directly related to the project of the new campus and direct competence of the State University of Milan;
- *binding ancillary functions*: requirements not directly essential to fulfil the campus's mission but of significant support to the project's functionality and sustainability. These functions, fundamental for the activities of a campus, can be managed externally through solutions that have an agreement with the campus;
- *non-binding ancillary functions*: requirements to complete the primary infrastructure (campus), the development of which depends

on the interest generated. They enrich the settlement's urban quality by foreseeing the risk of desertification in the non-use time bands.

This categorization has been useful for organizing requirements based on importance. But it also ensured the premises would include both spaces and services in the meta-design definition of the campus. A graphic diagram was created to represent the different degrees of proximity of the three categories of functions (core, binding ancillary, and non-binding ancillary) within the Science for Citizens project (the future campus), the surrounding areas of the Arexpo site, and the external urban fabric. The diagram includes quantitative data concerning spaces and users.

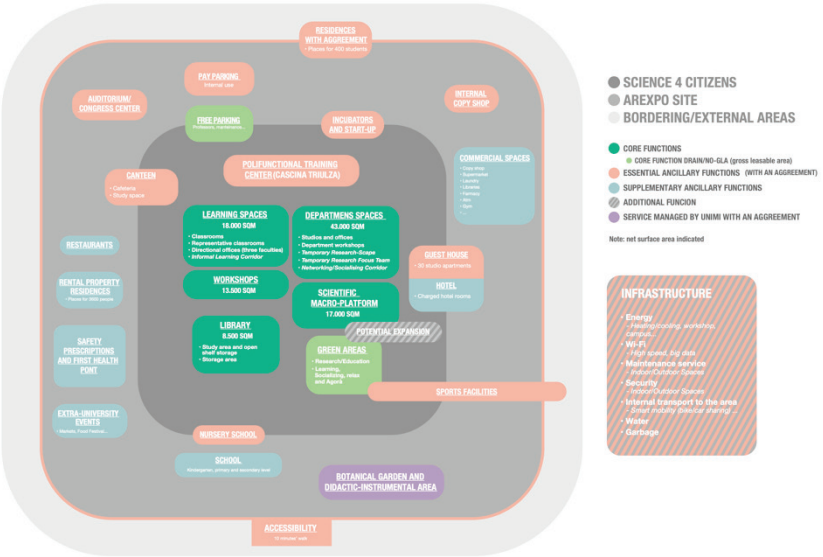

Fig. 1 – The functional scheme as outcome of the collaborative activity

The diagram has been helpful in communicating *UniMi*'s ambition of considering the campus as a model of a contemporary integrated campus, i.e., as a system of spaces and functions that solicits and consolidates relations with the urban context, facilitates spatial integration and incorporates the influence that innovative contemporary educational models exert on the design of spaces (Trapani *et al.*, 2018).

The idea behind the general project of the *Science, Knowledge and Innovation Park* shares the same vision as that of *UniMi* in guaranteeing the new theme park a porous and continuously connected system; as an urban campus where environments, activities, and people are integrated into a vibrant mutual cooperation system to replicate an urban dynamic.

In the first phase of the research, a meta-design document was created and published in April 2017 containing the information gathered during the activities. It identified the spatial and services requirements for the new campus, along with the necessary core and ancillary services (binding or non-binding) for its operation within the Masterplan of the ex-Expo 2015 area, which was then named *MIND – Milan Innovation* District[2]. Further meetings were held to obtain more detailed information about the spatial needs to be integrated into the project, which defined the second phase of the research.

Phase 2. The second phase involved collecting and organizing requirements for intra- and inter-departmental research spaces and surveying teaching spaces. Through meetings and analysis of departmental research space, an initial quantification of departmental and shared research spaces was developed. The focus then shifted to a more detailed analysis of the campus's core functions, particularly research facilities. The research aimed to have a better understanding of the practices and specialized equipment needed for laboratories in various disciplines. This step of the process required a specific, focused, participatory methodology for multiple reasons:

- the complexity of the activities, flows of people and logistics related to diverse scientific disciplines such as biology, food science, pharmacology, chemistry, geology, physics, mathematics and information technology;
- the current setting of the faculties, separated in different, and often historic, buildings where the upgrading of technologies and equipment was achieved, albeit temporarily and unsuitably; moreover, the scattered organization of the facilities required a thorough rationalization to reduce disused and misused space, to minimize distribution and ancillary spaces;

2. www.mindmilano.it.

- the same space separation between faculties and researchers generated a sectoral way of conceiving research and education activities, frequently leading to self-referential, insular attitudes, possibly restricting innovation and research advancements.

Hence, the intended role was to activate and facilitate interactions and relationships among the researchers and academic staff who occupy and experience the spaces, exploring and applying new collaborative design models. Therefore, academic staff were directly involved in the design process, questioning well-established models and behaviours, raising doubts about deeply ingrained habits, and conversely drafting the advantages of sharing spaces, working and meeting rooms and corridors, to foster multidisciplinary interactions. In consecutive meetings, representatives from different departments were gathered in focus groups according to existing or potential connections between disciplines. They were asked to envisage their new desired department facility organization. The general aim was to have them work on and rationalize the characteristics of the different laboratories and ancillary-related spaces and the relationships (level of adjacency or separation).

To transform users into architects and designers as *experts of their experiences* (Visser *et al.*, 2005), specific collaborative tools and techniques were tested to guide them in this new role. From the diverse range of tools and techniques of participatory design (Sanders *et al.*, 2010), the creative-active card deck tool was chosen, although in an innovative way. During this phase a further methodology became evident and new tools employed to explore and incentivize the sharing of some emerged facilities, that were then explored in the third phase of the project.

Phase 3. The third phase involved defining a model for a macro-platform of highly advanced shared infrastructures for research a fundamental pillar of the future settlement. This model has been created in collaboration with working groups from different areas. During the previous research phase, it became clear that some spaces and equipment were used at a supra-departmental level. The macro-platform of shared infrastructures for research was further defined to understand these facilities and their relationship with research depart-

ments. The idea was to create a standalone building that could be used by different departments, providing an opportunity for researchers, faculty, and students to meet and share research.

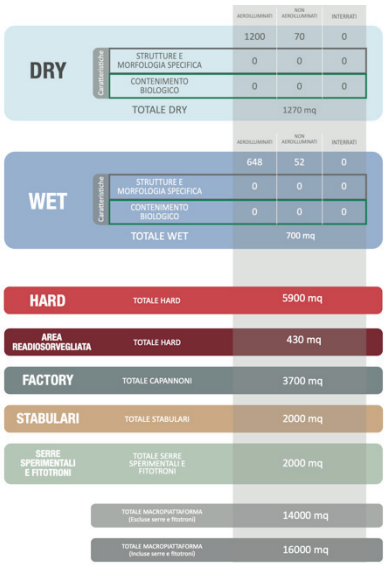

Fig. 2 – Diagram illustrating the categories and repartitions

To manage this campus model, design criteria had to be established that would go beyond the sectoral vision of spaces divided by discipline type. The departmental and shared laboratories' research spaces were initially quantified, which allowed for different equipment thresholds to be indentified, including hard, wet, and dry laboratories, factories, animal facilities, experimental greenhouses, and phytotrons. Also included in this structure were shared research infrastructures necessary for research activities at the campus level with logistical characterization.

The deepening of the qualitative and quantitative requirements of the macro-platform of shared infrastructures for research was necessary to rationalize all the spaces planned for the future campus. This phase of research has been essential for the development of the feasibility project of the new campus as activities will be concentrated in

these types of facilities that require particularly advanced technology requirements.

Within this phase, the macro-platform's methodology was developed by analyzing the spaces' requirements outlined in a further meta-design document. The co-design tables helped to define the specificities of hard laboratories and rationalize the categories of research laboratories. Working groups and contact persons were assigned to develop the scientific project and articulate activities and spaces for the future campus. Meetings were held with the developers and research services departments to collect qualitative and quantitative data on shared infrastructures for research, and the heads of the disciplinary groups were involved in this process. The information collected was fundamental to the elaboration of the campus feasibility project.

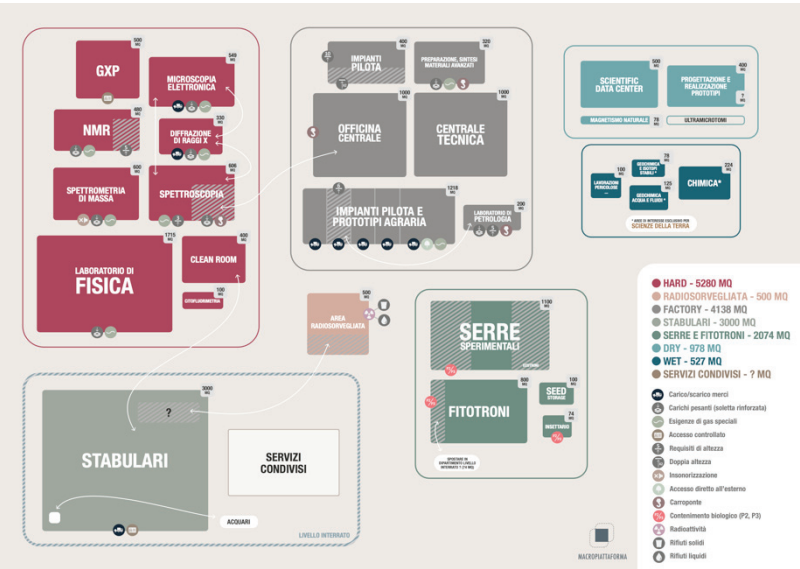

Fig. 3 – Diagram of the result of the activity, representing the macro-platform

The groups proposed sets of laboratories/accessory spaces for the macro-platform, highlighting possible aggregations according to common plant and structural characteristics and integrating activities

(as defined in Fig. 6). The qualitative-quantitative data included the surface area and the list of departments using each type of laboratory.

The most important result was the prefiguration of a complex and articulated qualitative-quantitative system of specific structures recognized by collaboratively researching about spaces and activities. Visual representations of relationships between spaces were useful in simplifying complicated plant requirements for designers and users. The strategy was also helpful in foreseeing the performance needs of scientific activities and the new possibilities of sharing generated by the unique conformation.

Phase 4. In the fourth phase, the research team played a crucial role in comparing the requirements outlined in the *UniMi* Campus documents with the proposed Technical Economic Feasibility Project edited by Boston Consulting Group. The team leveraged desk and field research, as well as critical reading and collaboration with the university's general management, real estate management, and directorate of research services, to identify deficiencies and generate proposals for future implementation to be included the tender. They also engaged in continuous dialogue with Arexpo S.p.A., the owner of the area and proposer of the Integrated Plan of Intervention.

The outcome of this comparative work was produced and integrated in a final satisfactory meta-design document, as it enabled the development of a project that meets *UniMi*'s requirements and the management of some services of the new Scientific Campus of the University.

The four phases outlined and validated the importance of finding the appropriate language and modality to formalize the results of these interactive discussions. In this case study, it was essential to create a document that includes directions and guidance to foster a hybrid space and service model that incentivizes new collaborations on university campuses.

Although the free expression of ideas and opinions is essential, formalizing the results of these discussions is equally important. This helps to provide direction and guidance for the project and ensures that the ideas and opinions are preserved and remembered over time. One

such example is creating a meta-design document, which can serve as a reference point for the developers, the project team of architects, site planners, and stakeholders, outlining the key objectives, strategies, and tactics for achieving the project goals.

Specific designed tools and techniques

Some tools adopted in the phases mentioned above have been designed or adjusted for specific different purposes. The following section presents a few tools and techniques we used in the outlined steps.

The card deck tool. A card deck tool was improvised to provide feedback and helpful information in understanding the relationships between spaces and related services. The tool was used in focus groups to define departmental maps by revising every single working/research space and their potential clustering into families. The printed cards stand for typologies of spaces and their major synthetic quantitative and qualitative characteristics to be filled in as required descriptions. Participants were split into groups based on their department and asked to analyze and complete the information on the maps related to their department's spaces. The responses were pasted on a white sheet of paper to organize the corresponding functions according to their different spatial relationships. The card deck was prepared according to the lists of research infrastructures collected through the initial survey, and it was decided to opt for a thematic skimming that led to the diversification of environments into laboratory spaces, technical/specialized rooms, and subsidiary technical rooms. This classification helped simplify information processing by grouping the various areas in three macro units. The cards of technical/specialized rooms presented only the name of the space. On the front of the green laboratory cards, empty cells were filled in with data regarding the current and future situation on the actual number of laboratories and other technical information helpful in sizing requirements.

Ancillary tools were created to introduce additional descriptions regarding particular needs deemed essential to the campus's meta-design definition. Unique stickers were created to submit further available reports concerning a space's possible underground loca-

tion, the need for particular parking or logistics accessibility, and levels of possible sharing with other similar facilities at the department, faculty, or campus level. An additional sticker was provided to indicate the possibility of moving one's own space into the shared facilities macro-platform, an operational and state-of-the-art centre in terms of size and instrumentation that could be shared among all departments.

Fig. 4 – Using the card deck tool

Initially, most of the individual departments' representatives were disoriented by the tool. However, over time they turned out to be proactive and collaborative, mainly because of the valuable mental organization skills the game managed to promote. The playfully expedient cards activated relationships between different departments, leading to the independent collaboration of personal realities to optimize resources through a more cooperative future. The willingness to undertake a co-design process has served to help participants understand the entire system of relations of a possible foundation for the future campus, both for issues purely related to the calculation of surfaces and the activation of multidisciplinary connections between the various departments.

Development of departmental maps. A parallel in-depth study was conducted to gather quantitative data on various spaces' technical plants, dimensions, and structural needs. Thirteen maps, supervised by Politecnico di Milano and completed by individual departments, were compared and verified through meetings to identify possible connections with other scientific departments at *UniMi*. The mapping tool facilitated multidisciplinary collaboration, triggering discussions on new research possibilities and shared projects.

Using the meta-design approach, the representatives of the thirteen departments created a visual system that outlined the degrees of relationships between departments and identified areas available for sharing laboratory and adjacent spaces. The final result was a set of master datasheets containing necessary logistical information for future campus construction. Acting closely with future space users enabled a better understanding of the spatial conformations and formal requirements of environments that were complicated from a logistical point of view. The result was a greater community awareness of the value of its resources and the possibility of creating flexible collaboration dynamics through different degrees of sharing.

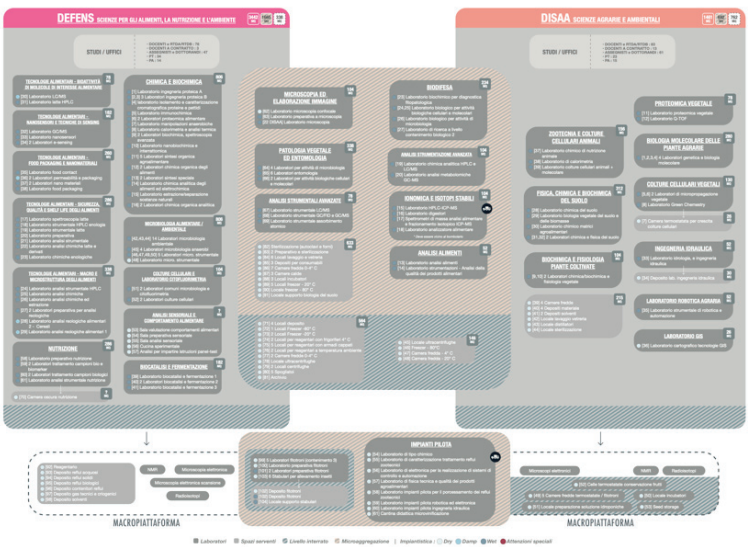

Fig. 5 – The departmental maps

Overall, the study involved the creation of thirteen maps, multidisciplinary collaboration, and the use of a meta-design approach to identify shared spaces and logistical information. Fig. 5 shows an example of two departments sharing some spaces in the middle and defining laboratories to be included in the macro-platform of shared infrastructures. The result was a clear vision of issues of absolute importance for the effective spatial design of the campus.

Students' diaries. Great importance was also given to a particular category of users: the students. During two meetings, student representatives were informed about the research team's role as intermediaries between the Politecnico research group and enrolled students. The students were asked to fill in diaries, and a password-protected Pinterest board was set up to collect pictures and narratives of worldwide learning spaces suggested by Erasmus colleagues. In the second meeting, students discussed and interpreted the diary notes, reporting issues such as a lack of adequate study spaces, mobility concerns, and a need for social and informal gathering places. The feedback aimed to improve the campus system and enhance the students' university experience.

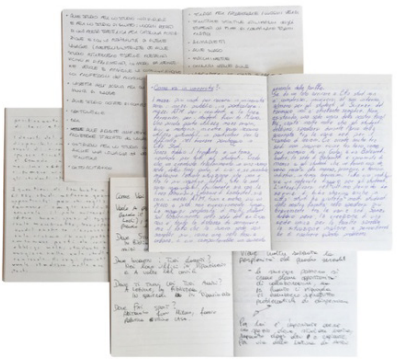

Fig. 4 – Diaries

Conclusion

The relocation of the science faculties of the Università degli Studi di Milano to the 2015 Expo Area was a significant opportunity for the creation of new spaces and facilities to support interdisciplinary cooperation in research, teaching, and learning practices. At the same time however, this considerable change originated fears and conflicts in the community.

It can be very challenging to balance the desire to create a successful and efficient physical (spaces and equipment) and digital (services) campus with the need to obtain the consent of its inhabitants.

This complex and comprehensive research activity has highlighted how design can play a significant role within complex real estate developments even in the early stages of the process. In this case, the combined competencies in space and service design applied through a participatory and meta-design approach have contributed enormously to designing a well-defined and shared brief for developers and architectural firms, even in a highly complex and conflicting situation.

UniMi doesn't have design and architecture disciplines inside its community. The necessity to involve Politecnico di Milano as the main external consultant has offered the possibility to play a neutral role within the broad debate of the *UniMi* community, building a relationship of trust with the different stakeholders, which included the Rector, General Director and their administrative and technical staff, the students, the heads of the departments and their units, the developer, etc.

The double role of experts in advanced innovative environments and services (such as university campuses) and neutral design facilitators of structured, open debates and codesign activities has brought about a successful, integrated approach.

This role has led to a set of activities intended to enlarge and strengthen the competencies of the community in the field of university campus design, new working, research, and education environments and services, and other collateral themes, bringing the community in contact with contemporary trends and advanced international case studies.

This transfer of knowledge to the community has permitted facilitators to get well-structured information and more advanced and reasoned feedback instead of just preconceived oppositional positions. To achieve this, it has been essential to involve the community in the planning

process from the beginning and to listen to their feedback and concerns throughout the process.

In more detail, the four different phases confirmed that when people are offered information transparently and are given the freedom and the means to express their ideas and opinions in a conducive environment, they tend to do so with great enthusiasm and interest. This is because it allows them to feel heard and valued and encourages them to be creative and imaginative in their thinking. This, in turn, leads to a greater sense of ownership and commitment to the project or initiative they are involved in.

Adopting a hybrid service/spatial design approach has contributed to enhancing user interactions and overcoming the current physical separation between faculties and researchers that have created disciplinary silos in the past.

The meta-design iterative method of data collection, review, comparison, and visualization supported the research team in managing complexity and engaging participants from a broad spectrum of categories, resulting in a cohesive and successful organization of the various entities and activities.

The necessity to design new tools and to customize already given ones has, in this case, confirmed the role of designers as *bricoleurs*, able not just to do but also to conceive the best process and the suitable instruments for doing.

These findings and confirmations conclude that the adopted approach offers a useful example of how successful planning of innovative spaces and services intrinsically relates to a well-defined, inspiring brief designed by experts and codesigned by its inhabitants. Advanced shared visions are essential for creating spaces and services that inspire new hopes, ambitions, and better ways of living.

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Interior design is less and less reduced to the mere physical component of space and is instead increasingly projected towards an 'environmental system' made up of space, services, communication, and technology, capable of illustrating a multi-scalarity and trans-disciplinarity typical of a project devoted to innovation. This change of focus, from the prevalence of the interior physical component to the dominance of a polyvalent system, has generated a series of changes, including those affecting the project's area, which shows a progressive rise of the informational-cognitive component where the control of the net of human interactions involved becomes extremely important.

The volume collects various design experiences carried out within heterogeneous research groups and talks about experiments in the design of spaces and services on a different dimensional scale and that have impacted different types of users.

Through the recounting of these experiments, the book highlights the close interconnections between the design of spaces, the creation of services, the application of communication systems, and the exploitation of technologies, allowing us to reveal the tensions and interactions that are unleashed depending on the prevalence of one or another design discipline and the scale (from XS to XL) at which they take place.

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La passione per le conoscenze