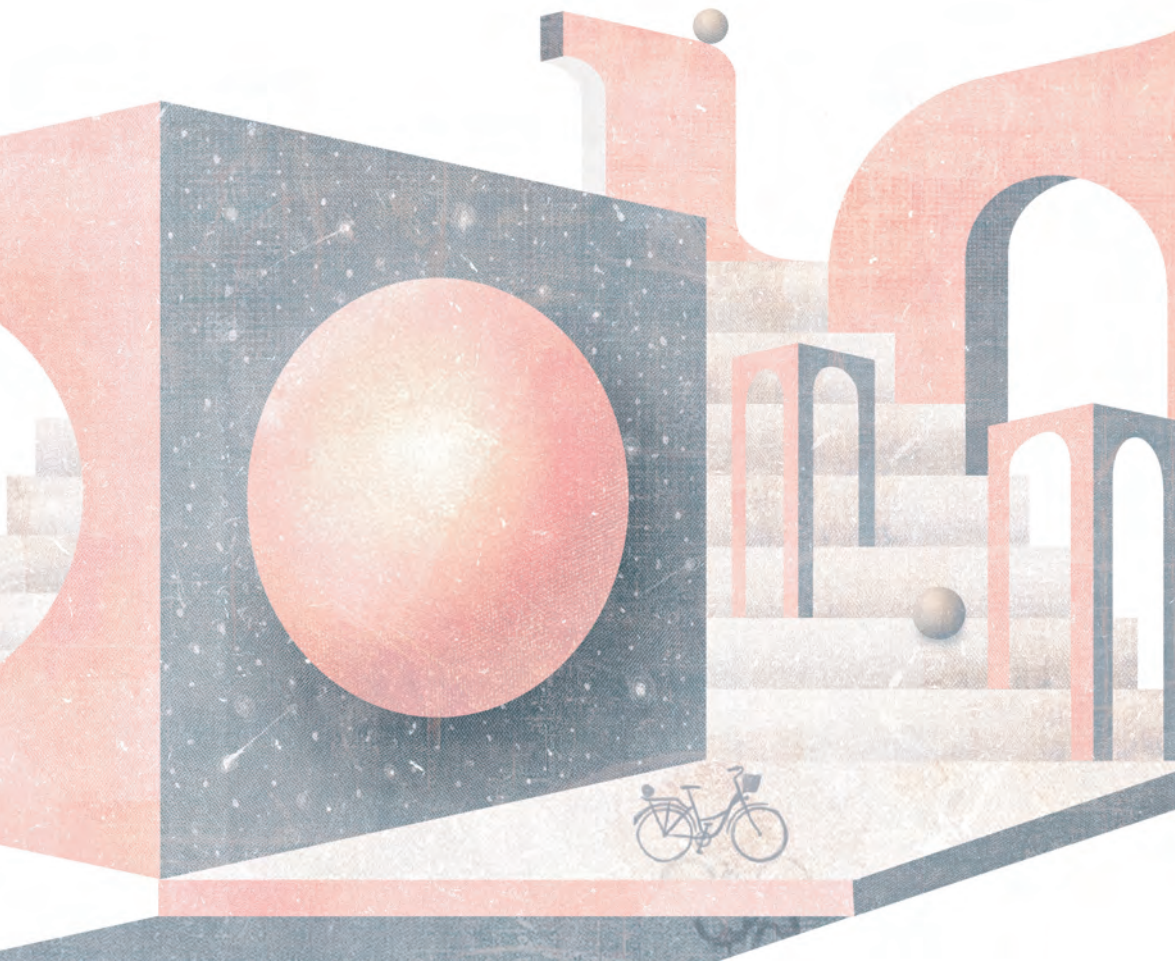
DESIGNING BEHAVIOURS FOR WELL-BEING SPACES

How disruptive approaches can improve living conditions

edited by Annalisa Dominoni and Francesco Scullica



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Foreword

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The radical transformation of living and working spaces, in which the hybridization of interior and exterior requires a new vision able to interpreter renewed people's behaviours and needs, is a challenging issue for the design discipline that has a multidisciplinary nature as well as a multiscale approach for both research and practice.

Spaces and their views are changing. The perception of physical and mental wellness is also shifting, especially as a result of the pandemic. We are experiencing a transitional time when new needs and requirements emerge, affecting human behaviour and the space definition at macro and micro level. New dynamics and perceptions are recognized, leading architects and designers to focus on studying and applying innovative methods. The aim is to enhance overall life quality at urban and personal living level.

The meaning of well-being and comfort are modifying their characteristics, addressing the shape and personalization of the spaces. Urban hybrid spaces are for public and personal use; boundaries between indoor and outdoor are fading after the rise of optional work and living practices. Also, various studies highlight the importance of biophilic design in internal spaces, factually bringing the outdoors inside the space, benefiting the psychological and general wellness of users through greenery and natural light.

For the first time, cities have been included among the key players of sustainable development, considering that sustainability involves not only environmental issues, but also social aspects and their influence on the quality of life. A great responsibility of the design approach is identifying quality solutions for the design of spaces, services, and

technology in a contemporary and future urban context, building a welcoming and intimate dimension for the community, trying to improve dwelling conditions and to implement care into different well-being dimensions.

There are many expressions that describe the emerging models (city of neighbourhoods, city of 15 minutes, multicentric cities) but they refer in a general way to the aim – of long tradition in the practice of urban planning – of removing urban space from fast vehicular traffic to promote a slow and alternative mobility and a free use for pedestrians. The adoption of strategies towards slow mobility is recognized as crucial in the sustainable development of urban quality of life as well as solutions to the needs of comfort, liveability and attractiveness of public spaces.

The relevance of the relationship between place and well-being has been highlighted from different perspectives. People can become anxious and uncommunicative in places perceived as unpleasant, for example, with endless expanses of asphalt, a persistent noise and smell of cars, sucking up energy; on the other hand, in clean and well-kept places, they can find the feeling that the world is in order or stable and achieve greater psycho-physical well-being. In relation to environments and in response to health problems, regulations have been issued to improve the quality of air, to protect habitats, but still little attention has been paid to the effects that projects have on the mental health of the people. Ethics of care and the practice of "caring" for the citizen are part of a new thinking that is becoming tangible in many countries.

Pandemic and transformations lead to more mental health problems, included anxiety, depression etc. Also, exponential incorporation of technology in our daily lives has caused profound changes in the way we work, live, and communicate. This is likely to have significant impact, both positive and negative, on mental health. Several studies showed that those who are frail, tired, or ill are more subject to the action of stress, and environmental international research has now shown how the well-being of those who live the structures dedicated to hypersensitive people (care homes & hospitals) can affect factors related to both architectural dimension to the artistic. There are many examples today that demonstrate the importance of the therapeutic contribution of architecture, art and design, to redevelop places of hospitality and care, and create environments in which there is a deep harmony of

space, light and beauty. The transversal aim of book is to affirm the fundamental role played by design in supporting the well-being process increasing the quality of the environment for a new cultural welfare, in which emerges the central contribution of culture and art to our mental health and our capacity for social cohesion.

A new approach in this field looks at the good practices and behaviours of astronauts on the International Space Station (ISS) that inhabiting an unknown environment with characteristics other than those we are accustomed to experience on Earth can be considered hypersensitive subjects in all respects. The astronauts' experience living in confined environments can be compared to the domestic space and office interiors – in which people live and work without a great attention to the quality of light, air, and more in general, a lack of comfort – and become an inspiration to design new living and working spaces more attractive and healthier.

The interest in research concerning the quality of life indoors has also increased a lot of studies on the complex question of the physiological effects of light and color in interiors on the health of human beings, which have been scientifically proven in the last twenty years. Even though extensive neurophysiological research has demonstrated the importance of proper non-image-forming (NIF) management for human health, this is virtually absent in the design practice. Concerning these physiological effects, we also introduce the application implications that this scientific innovation is starting to have on the design methodology of residential interior design and office spaces, in the delicate balance between natural light, artificial lighting, and colors.

Nowadays, the design of the office space is a key element to frame the employee value proposition since satisfaction and happiness are strictly related to the quality of spatial experiences. Its functions deserve to be challenged to create purposes that bring people in, a place people want to travel to. The hybrid working model, that allows employees to co-locate and work remotely (at home or elsewhere), seems to be prevailing, according to recent studies and the future projections developed in the post-pandemic new normality. The assessment of the two models has revived the debate over a new hybrid model between physical and virtual of the office workplace and the experimentation on its spatial design. Besides a certain continuity detected between the issues addressed before and after the pandemic, the emerging perspec-

tive assigns a new centrality to the human being – understood in its complexity which goes beyond the user-centred approach involving physical and mental well-being – to create the employees' sense of belonging and unique experience.

These considerations lead to a general innovative concept of physical and mental wellness linked to spaces we permanently or temporarily habit, for both urban and personal physical/body spaces. In addition, a new understanding of "shelter" is outlining, linked to notions of portability and personalization. Architecture and Interior Design implement adaptable models to ensure and enable wellness. Proving a wide flexibility of spaces is an applied response to several spatial solutions and configurations that meet the needs of different users.

The book analyses these spatial modifications in relation to well-being and mental health on various scales (the city and the human scale in different contexts such as cities, commercial and hospitality, personal space), through several international examples. The aim is to present different testimonies of researchers and designers who propose new and disruptive point of views and methodologies to improve the well-being, looking at the new people's behaviours, or even, generating new behaviours, through design. Our ambition is to re-launch an aesthetic, sustainable, design-based approach to improve dwelling conditions, trying to implement care into different well-being dimensions: mental, physical, social and global.

Part I

Sustainable cities and urban transformation

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1. Care and design of places in the urban context

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Abstract

The pandemic emergency has brought to the surface, in an extreme way, some latent issues in the socio-economic field affecting our ecosystem. Towards an advanced meaning of well-being in the urban contexts, the emerging topic of care highlights its potential relevance for the future generations and outlines the contribution that design, with a specific focus on the interior design approach, can offer to post-industrial society. For the first time, cities have been included among the key players of sustainable development, considering that sustainability involves not only environmental issues but also social aspects and their influence on the quality of life. A great responsibility of the design approach is identifying quality solutions for the design of spaces, service and technology in a contemporary and future urban context, building a welcoming and intimate dimension for the community, trying to improve dwelling conditions and to implement care into different well-being dimensions.

1.1 Introduction

The urban environment and the dynamism of the 21st century city require a design that is able to approach the built space from a holistic humanistic point of view. The way we shape our dwelling places arise from an unresolvable tension, peculiarly human, between nature and culture and involves both the tangible dimension of physical spaces and

their mental representation. Interior design, whose mission is to define the relationship between people and spaces, addressing psychological and physical aspects, has a fundamental role to play to improve the quality of life, considering that natural, built and social environment have a critical influence on health and well-being (Fig. 1).

Fig. 1 – Natural, built and social environment have a critical influence on health and well-being dimension (Aloi Lorenzo, Deng qingyuan, Di Francesco Marta, Florenzano Federico, Pernisa Andrea Luca, Vallar Sara, Interior Design Studio, Politecnico di Milano, A.Y. 2020/21).

In reflections on the contemporary situation of cities, there is a growing interest in the concepts of "interior" and "interiority" as a critical factor in the urban environment and as a necessary consideration in the design of public space. Understanding the effect that public interior space can have in influencing culture, social behaviour and people's sense of identity is considered essential for designers (Pimlott, 2018).

For the first time, no. 11 of the Sustainable Development Goals[1] has included cities among the key players of sustainable development

1. UN Sustainable Development Goals. Goal 11: Make cities inclusive, safe, resilient and sustainable, www.un.org/sustainabledevelopment/cities/.

where sustainability must no longer be understood only with reference to environmental aspects – i.e. the impact of the built environment, the consumption of energy, water, soil, etc. – but it should also include a rethinking of the social aspects and their influence on the quality of life (Mace, 2015; Dal Borgo *et al.*, 2016).

A convergence on the relationships between sustainability, well-being, public space and care seems to come from different points of view and different actors: a holistic and ecological concept of health (WHO), the relationship between sustainability and urban dimension (EU), the ethic of care in its traditionally female meaning and its relationship with the urban dimension, the design of public spaces and placemaking, a psychological and social dimension of mental well-being. These different concepts will be analysed in the following paragraphs.

1.2 A broad reaching definition of well-being

In the WHO constitution of 1948, health is defined as a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity. Within the context of health promotion, instead of the object of living or an abstract state, health has been considered more in functional terms, as a resource for everyday life which permits people to lead an individually, socially and economically productive life (Ottawa Charter for Health Promotion, 1986).

In keeping with the concept of health as a fundamental human right, today the spiritual dimension of health is increasingly recognized, a holistic understanding of health being central to the definition of health promotion.

In the literature, the concept of ecological public health has also appeared, in response to the changing nature of health issues and their interface with emerging global environmental problems: these include global ecological risks such as the destruction of the ozone layer, uncontrolled and unmanageable air and water pollution, global warming and recently the pandemics (Pileri, Biondillo, 2015). Ecological public health emphasises the common ground between achieving better health and sustainable development, focusing on the economic and environmental determinants of health, on the economic investment which could

produce the best equity in health and sustainable use of resources. Besides, according to WHO, mental health and many common mental disorders are largely influenced by the social, economic and physical environments in which people live: social inequalities are associated with an increased risk of many common mental disorders; therefore, acting to improve the conditions of daily life before birth, during early childhood, at school age, in the family, at work and for the elderly offers opportunities to improve the mental health of the population and reduce the risk of mental disorders.

From an Interior Design and Architecture perspective, it worth mentioning a WHO long-term development project denominated Healthy Cities, which seeks to place health on the agenda of cities around the world, and to build a constituency of support for public health at the local level. The healthy cities concept is involved in a process of achieving better health and quality of life for its people, and healthier physical and social environments in the context of sustainable development. A healthy city is one that is continually creating and improving those physical and social environments and expanding those community resources which enable people to mutually support each other in performing all the functions of life and in developing to their maximum potential (WHO, 1995).

A practical example can be found in the concept of community empowerment, in which individuals and organizations apply their skills and resources in collective efforts to address health priorities and meet their respective health needs. Through such participation, individuals and organizations within an empowered community provide social support for health, address conflicts within the community, and gain increased influence and control over the determinants of health in their community.

This is closely related with the multi-faceted approach to planning, design and management of public spaces known as placemaking.

1.3 Environment and well-being

The relevance of the relationship between place and well-being has been highlighted from different perspectives. People can become anxious and uncommunicative in places perceived as unpleasant, for example,

with endless expanses of asphalt, a persistent noise and smell of cars, sucking up energy; on the other hand, in clean and well-kept places, they can find the feeling that the world is in order or stable and achieve greater psycho-physical well-being. In relation to environments and in response to health problems, regulations have been issued to improve the quality of air, to protect habitats, but still little attention has been paid to the effects that projects have on the mental health of the people.

Assuming a psychological lens, according to Hillman the way to improve people is to improve their city (Hillman, 1999), allowing them to meet their past walking through the city, to recognize themselves in it and to look at their future. In the city, tradition and progress are opposite and interrelated poles, both essential (Pignatelli, 1978). Jung and Freud described individuality on the base of the collective, the herd instinct, the primary horde, the need of the agora. For the psychology of depth, the care of the interior requires an attention to the exterior: "most of the soul is outside the body", therefore changing the outside world can be just as therapeutic as changing the subject's feelings (Hillman, Truppi, 2004).

If a design lens is assumed, sprawl and poorly planned growth have resulted in unwalkable communities, poor air quality due to traffic congestion, and unsafe streets for walking or bicycling; therefore, it has become increasingly clear that the way we design our built environment has a direct impact on our health and well-being.

To address the unique health challenges of the 21st century, integrative and innovative solutions are needed. The idea of placemaking could be used as a framework for describing how transforming public spaces can improve health outcomes. It is well documented that one's zip code can be a more reliable determinant of health than a genetic code. Placemaking strategies and projects on a community's streets, in parks and open spaces, in housing projects, and in diverse public settings have proven able to contribute to improving people's mental, physical and social health.

Built and natural environments that facilitate human connectivity and reduce isolation can foster equitable access to the social and economic determinants of health, directly supporting human flourishing. While underpinning economic prosperity, placemaking can plan inclusionary strategies to reduce displacement of lower income and vulnerable families as property values increase.

However, placemaking is not just about the outcome of an improved place, it is grounded in the process itself of observing, listening to, and asking questions to the people who live, work, and play in a particular area in order to understand their specific needs and aspirations for the place.

The connectivity and contingency that shape a place are not at all limited to the scale of that place. People experience places at many different scales simultaneously: they experience the concrete, material dimensions of place affectively and cognitively (Entrikin, 2003), but their understandings of place are also constructed, and especially communicated, through social negotiation, including conflict and difference.

If the new logic of co-design is an important bottom-up process which tries to create a project activity that above all is attentive to the needs of the users, on the other hand it could be accompanied by a design action that does not renounce to the competences of a multidisciplinary specialized team. One of the crucial abilities of the latter should be appropriately listening to the users' demands and translate these into spaces, services and mobility infrastructures.

1.4 Ethics of care and urban space

Over time, many feminists' papers and books have dealt with the question of care. A series of investigations on an intricate and contradictory tangle of tasks, roles, obligations but also powers, desires, and feelings have developed on the idea of care which was strongly related with the role historically played by women (Morini, 2021).

In 1990, at the Faculty of Architecture at Politecnico di Milano, three professors and a researcher (Sandra Bonfiglioli, Marisa Bressan, Ida Faré, Gisella Bassanini) founded a group denominated Vanda who worked over a period of ten years (1990-2000) to shed light on the theories and works of women in architecture; the aim was to search fragments and sparks that would contribute to the idea of a female city. One of the most important topics was care in relation to the city, which ended up putting at the centre of the attention the living bodies that inhabit it and an observation of the city from the body and its everyday practices.

This may seem obvious, since from the very beginning the neighbourhood, the village, the city were born and structured as communities of living bodies; but if we look at large-scale urban planning, to the functional, infrastructural metropolis, planned from above, we get lost in immense abstract drawings where bodies no longer exist. They are users, identified in a single stretch of their lives. It is in the contemporary metropolis that female knowledge, trained in the art of care and domestic intelligence, can turn a vicious circle into a virtuous one, where technology can be measured against the time of history, bodies and their natural limits.

In the Vanda group, the care system as a female knowledge was studied, considering a society where well-being was no longer defined as "having", i.e. as simple possession of goods, houses, things (a paradigm of industrial society that was also expressed as an architecture of quantity, as demonstrated by the metropolitan suburbs) but rather as taking care of things: homes, cities, bodies, nature.

In 2002, Marinelli wrote a book on the ethics of care and the project. The word "ethics" derives from an ancient Greek word that carries the meaning of behaviour, of action linked to the common good; even if its moral character has been lately accentuated, it is interesting that its meaning has never been separated from action. Therefore, it is not an abstract good, but a good that is close to the living body, to the word care. The word "care" is full of sometimes controversial meanings: while on the one hand it means a work done with skill and commitment, on the other hand it also means fatigue and concern; care is that added value to action that makes the actions good, of quality. In the disciplinary debate on welfare, exploring new models and new interpretations, a link with "quality" has been looked for: the link between "quality" and "welfare" is precisely care.

In more detail, the world of meanings suggested by the term care constitutes a behavioural model, a paradigm of thought, an ethic. Its most proper model, perhaps the most usual, but certainly the strongest, is that of caring work, i.e., the set of activities carried out mainly by women in the home and family, which Marinelli calls "domestic intelligence" (Marinelli, 2002).

The association between the city and such an intimate practice as caring shouldn't be surprising. Plato already argued that teaching people to take care of themselves meant teaching them to take care of

the polis, to assume responsibility for the social and political city life. From the experience of domestic intelligence, it is possible to translate a code, a syntax that can leave the home and become a female competence in the world. This competence, which is accessible to all, men and women, can be applied in work, in politics, in the governance of things, in planning, in relationships, in projects.

The decline of welfare policies is partly attributable to their foreignness, to their illiteracy with respect to the code of care. The greater the distance that has separated welfare strategies from a culture of care, the greater the failure of those policies, services, "urban frameworks" and of public culture. This is demonstrated, by contrast, by the resilience in the Scandinavian countries where, although the role of the public hand has been diminishing for several years, this has not undermined the deep-rooted culture of service built up over a long period of time, and the practice of "caring" for the citizen is tangible in all the territory.

Therefore, studying this code and acquiring its tools, is useful today to understand and convey the complexity of our time. Complexity often becomes an alibi for irresponsible action in which the loss of common purposes and the acquired awareness of the impossibility of controlling the infinite repercussions of one's actions, endorse neglect even of the immediate context, the forgetting of memory, the closure in security i.e., the absence of care (Marinelli, 2002).

The paradigm of care articulates in complexity, flexibility, management of the unexpected, sense of responsibility, ability to listen and adapt to the context, valuing relationships, authority, sense of proportion. All these characteristics together constitute a formidable piece of equipment that women have handed down from mother to daughter over the centuries. Today, this knowledge can be capitalised to become a skill that can be used outside the home.

The benefits that the adoption of the ethics of care could produce in the actions on the city and the territory are extraordinary. There are two levels of interaction that can be identified, one a consequence of the other.

In the first, care is the symbolic order that informs professional ethics: the product of this level of interaction is a change in perspective capable of overturning meanings and scales of values that seemed stable and acquired. Consider, for example, the disruptive power that the relationship with the ephemeral, experienced in care, can exert in a

profession in which the relationship between designer and created work has always been central. The architect's fascination with the eternal, identifying himself with the work he creates, has often led him to underestimate the importance of the relationships for which that space is conceived.

On a different, more disciplinary level, addressing care issues means giving voice to whole parts of reality that we do not normally get to talk about. In urban planning, care is usually seen as one of the aspects of welfare and of the needs to be satisfied by means of urban facilities, in the cases of the most enlightened administrations, where the needs for care are not abandoned entirely on the families' shoulders. However, the qualitative leap is only possible if care becomes the matrix of actions on the city and the territory.

To give an example, in Sweden the question of living is an integral part of welfare policies, where "living" is a need that goes beyond housing and involves the quality of urban space. The issues linked to the transformation of the physical space of cities are not distinguished from welfare actions.

In sustainable planning, the problems of urban life cannot be dealt with as separate objects: nature, technology, transport, materials, production, consumption, care. What matters are the relationships between them in respect of their different natures and temporalities.

The citizens quality of life is closely linked to care, but this, not being a quantifiable and monetizable activity, does not become part of the inputs of planning. It is necessary to mend this gap and this can only be done by taking care as a matrix of professional action, an effective paradigm in the management of complexity (Marinelli, 2002).

According to Bonfiglioli, women have brought the experience of a living body and the practice of daily life in the integrity of the spatial and temporal aspect, and this challenges the city. To test the city, the body of a little girl should be taken as the measurement unit, because this measure can reunite all the differences in the inhabitants' bodies (Fig. 2). And not only because spatial dimensions, created starting from the smallest, work for everyone, old, young, able-bodied, disabled; but because all this introduces us into a bodily and cyclic space/time which is out of the so-called standard user, fatigued by the grip of the timetable, and brings us back to the slow pace of walk, stop, rest, leisure and life (Faré, 2013).

So, children's playgrounds, open gardens, protected paths, slides and railings, small architectural devices can be re-designed, that all together can renew the whole urban design discipline.

Many cities have adopted micro-architecture of everyday life, for example Bolzano with the opening of schoolyards outside school hours, Pesaro with home-school routes and many other projects of minute things, simple and useful solutions strangely never thought of before. The pilot experience of Stockholm can also be mentioned, a real "city of care" where the metro stairs have comfortable rails for wheelchairs, buses are equipped with platforms that extend out and descend to pavement level for wheelchairs, all bars have corners with tables for changing babies, bottle warmers and breastfeeding chairs, and residential backyards are equipped with play areas for children.

Fig. 2 – To test the city, a child body should be taken as the measurement unit dimension ((Aloi Lorenzo, Deng Qingyuan, Di Francesco Marta, Florenzano Federico, Pernisa Andrea Luca, Vallar Sara, Interior Design Studio, Politecnico di Milano, A.Y. 2020/21).

This face of the city opens up to an advanced idea of welfare, which does not correspond to the construction of separate places, enclosures, kindergartens, shelters, closed places still based on the

model of the old asylum. The kind of welfare of a hospitable city that accommodates among its ancient stones and new concrete the spaces/times of all its inhabitants is quite different. For example, if a young woman can go to the bar with her friends and heat up a meal or breast-feed her baby, if a grandmother or grandfather can effortlessly get on and off all public transport, if the children in a block of flats can play in the courtyards, then it is clear that the child, and not only the child, is no longer someone to be transported from one protected place to another, but becomes a full-fledged inhabitant of almost all of them (Faré, 2013).

1.5 The role of design and care

Living in cities activates a dual process, since the built environment influences people's mental health but also their mental state impacts on the health of the cities (Evans, 2003). Light, topology, organisation and use of space, geometry, rhythm, texture and matters, sounds and smells, prior separately and then through their integration, concern the physiology of the human sensory system. Therefore, a designer of public spaces has the responsibility to think not only in aesthetic terms, but also to make projects capable of responding to the basic needs of the people who will inhabit them (Landry, Murray, 2017).

Housing needs and relationships with places change during the different stages of life – childhood, adolescence, adulthood, middle age, old age – and this can affect our homes and places, and the city in general: children arrive, children grow up, new technologies and new ways of living arrive, the body ages, and so on. Therefore, it is useful to think of living solutions that are in the process of becoming flexible and can be modified by those who use them. The case of the lockdown dictated by the Covid-19 pandemic, which forced us to stay at home for a long period of time, demonstrated this. Suddenly, we had to restructure our lives: children and teenagers had to be home-schooled, adults had to work remotely, the family unit experienced a new cohabitation. Those who were lucky enough to live in a house that was sufficiently large, flexible, with modular and interchangeable spaces, were better able to cope with the novelty imposed by the emergency (Inghilleri, 2021).

Designers interpret needs, translate them into spaces, products and services able to support and comfort users, and suggest new approaches and more sustainable behaviours (Fig. 3). An emerging strategy is that of a functional and typological hybridization, i.e. the integration and overlap of spatial typologies that previously were very different, to determine new solutions that fit the evolved conditions of contemporary living. In biology, hybridization is the process of combining distinct living organisms to create a new entity with characteristics that differ from the ones of the starting organisms. The combination of different functions, in collective spaces both public and private, represents a significant trend in the field of interior design because it defines "a specific place between a generic solution and a hyper-specialised one" (Scullica, Elgani, 2019).

The functional hybridization of different types of spaces, i.e. the coexistence of different activities that were previously located in traditional spaces and performed in definite times, is spreading in various parts of the world, as well as the connection between interior design and service systems. The synchronisation of distinct cultural elements with finishes, colours and materials has become the foundation of contemporary design.

Fig. 3 – Designers interpret needs, translate them into spaces, products and services to support and comfort users, and suggest new approaches.

Hybridization is not achieved only through tangible aspects but also by means of an intangible, sometimes virtual dimension. For this reason, the definition of hybrid spaces must include both the physicality of the spaces and products that are transformed and the immateriality of the system of services and digital connections, capable of generating new virtual environments of significant impact (Scullica, Elgani, 2019).

In recent years, spaces devoted to living, working, travelling have been characterised by a special interaction which they establish with the city at a spatial, perceptive and use level. Types of reciprocal hybridization took place which mix office typologies with those of bars, libraries, gardens, streets. The predisposition to travel in order to achieve better living and working conditions (Elgani, 2019), and even more the consequences of the recent pandemics, determines that "today we can work at home, learn in the workspace, live in the office while trying to keep our life balanced" (Murray, 2006).

Morphological crossings and an "inclusiveness" of contemporary spaces promote social relations, develop the "in-between areas" between the city and the office, reactivate abandoned urban spaces or disused buildings. Basically, non-territorial, open, democratic, low cost work spaces have developed. In these inclusive offices, the city becomes a part of the interiors of the service sector, whilst these are updated by borrowing the urban milieu (Fig. 4), as "the centrality of the physical space has decreased, whilst the interactions which transcend and take on life beyond the office walls have multiplied" (Duffy, 2008).

From an in-depth reading of the city, with its weaknesses, discrepancies and obsolescence, intermediate areas between public and private are constituted and a different living topography is defined: we work inside and outside the office, with and in the city. These interventions are not limited to restoring pre-existing spaces or to reactivating urban voids, but are generated by the social conditions of the location, and from the need to employ socially inclusive values in order to promote cohesion, sharing and a sense of belonging. The operating tools such as practices and rules, thus become additional elements of the architectural project, together with the impermanence, instability and discontinuity which now characterise the modern urban condition (Forino, 2019).

Fig. 4 – Non-territorial, open, democratic, low cost work spaces multiply life beyond the office walls (© S. Accorrà, Nagoya-shi, Aichi, 2017).

A great responsibility of the design approach is identifying quality solutions for the design of spaces, service and technology in a contemporary and future urban context, building a welcoming and intimate dimension for the community. Among the ideas derived from the pandemics emergency, also as a response to the climate crisis, there is the so called city of 15 minutes, which derives from historical concepts of proximity and walkability and suggests a return to a local way of life (Fig. 5).

The actors potentially involved in the improvement of people's relationship with their environment could be policy makers, psychologists, sociologists and people belonging to the public sector; in this sense the role of designers could become that of facilitator of connections, interpreter of languages and translator. The emergence and evolution of new fields of analysis, aided by advanced and innovative technologies, can intensify and make the scenario even more significant.

The most important role the designer should play today is to cultivate visionary thinking. Associative thinking, creativity and non-deterministic design can help us to be better prepared for future crises and catastrophic events. The overcoming of the linear cause-effect logic,

in favour of associative thinking, allows the brain to build relationships in which environmental constraints push towards creativity and at the same time the product of creativity generates new environmental constraints (Cucchi, 2020).

Considering a bottom-up perspective, the design approach could get important inspiration by considering the deep psychological link between people and the commons, i.e. all those goods that are the result of collective action or creation, such as the quality of the atmosphere, the climate, food security, but also peace, cultural heritage, cities with their squares, streets, buildings, technology, patents, the internet. Material aspects and relational and affective dynamics (e.g., our desire for peace, altruism or individualism, religion, the desire to live in a certain way) intersect with the commons (Inghilleri, 2021). In recent years, a broad debate has developed around this concept. Elinor Ostrom, an American political scientist, won the Nobel Prize for Economics in 2009 for her studies on the governance of the commons. Ostrom has shown, also through ethnographic and psychological studies, that many communities are able to avoid the loss of commons in the absence of public intervention and has studied the ways in which this is achieved.

Fig. 5 – In the city of 15 minutes, which derives from historical concepts of proximity and walkability, green areas should be reacheable in the urban context.

The main factors seem to be the direct participation of the community in monitoring the use of the commons, the fact that a norm can be based on the voluntary surveillance of the members of a community, the importance of the gradualness of sanctions to offenders, the effectiveness of face-to-face communication, and the absence of too rapid technical or social changes. Ostrom also showed how privatisation and public management can fail, documenting the failures of central authorities in their attempts to impose rules on local communities that had managed commons for centuries. The commons, in this perspective, constitute a real form of capital, a social capital, i.e., a system of relations through which information and cognitive resources can be transmitted, allowing people to achieve their goals in a simpler, faster and cheaper way. According to Elinor Ostrom, social capital is based on social relationships characterised by trust, confidence, mutual understanding, shared values and attitudes that unite the members of a community, making cooperative actions possible. The strength and importance of commons are based precisely on these psychological foundations capable of triggering relational exchanges, following the desires and motivations of the population and satisfying their needs; commons are cognitive artefacts that can give meaning, belonging, attachment, well-being.

By enhancing care to the commons, life in the urban context could maintain a central role in a different perspective, reconnecting to the historic identity which characterized many European cities. This would allow their citizens to recognize values, memories and meanings that are the base of a community and of place attachment and liveability.

1.6. Conclusions

In front of architecture and urbanism being dominated by capital, investment and speculation, austerity measures which have been disastrous for public infrastructure, the climate crisis and the pandemic which have increased the vulnerability of slum dwellers, older persons, persons with disabilities, migrants and refugees, women and children, the lessons learned is the need for global cooperation and solidarity to formulate the transitions to a healthier, more resilient and more sustainable world.

Trying to implement care into different well-being dimensions would allow to improve dwelling conditions: care involves an affective component, a benevolent predisposition to someone or something, a sense of respect and an awareness of the intrinsic value of objects and spaces. The concept is very close to the idea suggested by Inghilleri (Inghilleri, 2021) when he highlights that the level of psychological well-being intersects with the social level. Researchers who deal with flow and other psychologists have called it "networking flow" or "good work", meaning by this expression a human activity that succeeds in uniting the psychological well-being of the people involved, the social interest of the community and the success, also from an economic point of view, in achieving its objectives: this is a very important theme, which underlines how, in order to achieve democracy and development, it is necessary to unite social responsibility, ethics and good quality experience. The game is not played in abstract, but in real life: if I can feel satisfaction in activities that are useful both for me and for the group and the community – that give a psychological reward linked to the pleasure of doing that activity, but also an economic gain for me and for others – then I am the author of my own success and, at the same time, of that of the groups to which I belong or even of the whole society. This alliance between personal psychological well-being, the well-being of others and of the community, economic success and ethics can find examples in stories linked to Covid-19: groups of citizens who, in a passionate way, help other people in need by bringing groceries or prescriptions to the elderly; teachers who tutor those in need on line and experience this as totally engaging; psychologists and psychotherapists who spontaneously open a free helpline for those in need and, in particular, for doctors or health workers involved in the care and management of the suffering of the sick and their families. More generally, the possibility of having good experiences in useful activities both for oneself and for the community opens the way to a harmonious relationship between self-love, the ecological system and the economic-productive system. Therefore, the act of caring can become emblematic of a positive mode to cope with the risks we are running today both as individuals and as a species, addressing urban places with a special accent on ecological sustainability, on ecology of subjectivity and social equity.

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2. Designing public spaces and transportation planning: a multilevel approach towards slow and sustainable cities

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Abstract

Mobility is a primary human need, and the reasons are many. We move for work, study, entertainment, and other regular activities. The pandemic situation that cities faced from 2020 has raised new questions and promoted new drives for change towards more sustainable scenarios in the management of their mobility systems. There are many expressions that describe the emerging models ("city of neighbourhoods", "city of 15 minutes", "multicentric cities" and so on) but they all refer to the general aim of freeing urban spaces from fast-moving vehicular traffic to promote a slow, alternative form of mobility and safer, quieter use by pedestrians.

The adoption of strategies towards slow mobility is recognized as crucial for sustainable development of the quality of life in the cities: the change towards global sustainability is strongly linked to the change of lifestyles by individuals or groups of individuals; this expression includes all the actions/concepts related to living, moving and producing. Moreover, slow mobility improves at least two essential elements: the quality of the environment (air pollution, noise pollution and CO_2 production) and the residents' quality of life.

In this context, two disciplines play important and complementary roles: transportation planning and design for public spaces. The first is aimed at defining plans and programmes for the regulation and management of transport modes for people and goods; the second is oriented to provide solutions to of the requirements of comfort, liveability, and attractiveness of public spaces.

From this point of view, the text will focus on the two complementary approaches and their relationships to the common goal of achieving sustainable cities. Starting from contemporary urban transformation in the mobility sector, the text will explore the main trends of the two disciplines, attempting to highlight the possible elements of convergence – of processes, tools, intervention scales and methods. The text will explore three main trends where an effective cooperation between the two disciplines for a more effective action is visible: slow mobility and public space reappropriation; smart mobilities and smart cities; accessibility and proximity.

2.1 Introduction

In the last 20 years, mobility and public spaces have played a significant role in the development of the sustainable city. Public spaces have acquired a renewed visibility in urban planning discourse as an essential ingredient for urban sustainability because they play a central role in the creation of inclusive communities, and more specifically in the formation of a public culture and in enriching cultural diversity (Low *et al.*, 2005). In particular, there is a strong interest in re-establishing the relationship between public space and urban mobility. The creation of high-quality public spaces, the improvement of innovative use of streets, sidewalks and bike lanes for daily mobility, and especially the accommodation and facilitation of walking in the majority of its public spaces, all constitute crucial challenges for the design of sustainable mobility systems and the creation of sustainable and liveable cities (Wheeler, 2013; Gehl, 2010; Jacobs, 1961).

Transport systems for the mobility of people and goods are considered essential for the economic growth and welfare of a country and for the quality of life in urban areas; in fact, transport (or mobility) is part of the social cohesion and demographic development of a territory. More generally, it is possible to say that mobility and public space design are key factors in our economic and social life, starting from the daily commute to work, meeting family and friends, and promoting tourism, to the management and operation of supply and distribution chains of goods in our stores and for industrial production.

Today more than ever, urban areas represent the engine of economic growth, employment and development of a territory: about 85% of the EU's Gross Domestic Product (GDP) is generated in European cities. Several of which, must face and manage transport-related issues such as traffic congestion, air and noise pollution and safety due to extensive economic activities in their urban areas.

For example, in 2010, about 73% of European citizens lived in urban areas; this percentage is estimated to increase to more than 80% by 2050. In addition to the direct impact generated by traffic (congestion), urban transport can also influence social development, social exclusion, and the accessibility of specific areas for people with reduced mobility. Thus, the need to plan, design and adopt sustainable transport systems emerges as a global goal that can no longer be postponed (European Commission, 2017a).

With regards to environmental impact and CO_2 emissions, the transport sector is second only to electricity production and heating; transport produces about 25% of the total carbon dioxide emissions, which have more than doubled in the last 45 years. From a quantitative perspective, carbon dioxide emissions from road, air and maritime transport are estimated to account for 74%, 12% (excluding non-CO_2 impacts, which are estimated to double the sector's heating impact) and 12% respectively. Today, decarbonization policies for the transportation sector offer an opportunity to combine climate and environmental protection while ensuring economic and social balance (Carnevale, Sachs, 2019).

From an economic perspective, in June 2019, the European Commission updated estimates of the social and environmental impacts caused by transportation. The environmental costs generated by transport and related to greenhouse gas emissions, local air pollution, noise, energy production, habitat damage, as well as the costs of congestion and accidents in the European Union amount to almost 1000 billion euros per year. It is estimated that about 50% of these costs are related to the urban environment. Road transport causes more than 80% of these costs, of which about 620 billion euros are caused by passenger transport and about 200 billion euros by freight (UNECE, 2021).

In recent decades, the awareness and attention of the political world towards the environment have certainly increased: from a regulatory

point of view, the European Council has approved an important goal that concerns the countries of the European Union: the goal is to become climate neutral by 2050 and reduce greenhouse gas emissions by at least 55% by 2030 (European Commission, 2017b; European Commission, 2018).

In the context of the 2030 climate goals plan, it is believed that increasing the percentages of collective transport use, walking and cycling, and automated, connected and multimodal mobility will significantly reduce pollution and congestion caused by the transport sector, especially in cities and will also improve people's health and well-being. Consequently, cities have an essential role to play in this regard: they are and should remain at the forefront of the transition to greater sustainability. To achieve these goals, the European Commission is also considering developing plans and programmes through the projects of Climate Neutral and Smart Cities as a strategic priority for joint action to achieve decarbonization in many European cities by 2030 (European Commission, 2021).

As anticipated above, the possibility of easy access to services, such as public transport or efficient telecommunications networks, can improve access to markets, increase the connectivity of regions or, more generally, of a territory, and thus promote its economic development. National and local efforts to reduce air pollution have therefore increased over the past decade, defining and adopting regulatory policies in the areas of transportation, energy and economic development (OECD, 2018).

At the same time, the development of sustainable mobility must go hand in hand with the project of liveable cities, where the quality of public space plays an essential role. The way in which people move in cities also determines the way they live, "stay", and behave in the same cities. In this sense, the project of a different mobility must be supported by the project of habitable, hospitable, inclusive public spaces. The slow and smart approach transforms not only urban services but also the way of using the urban environment: the non-built space, the space of everyone which – even more so after the Covid-19 pandemic – represents the value of a different socialization possible for the communities.

2.2 Reclaiming the relationship between urban mobility planning and public space design

There are many necessary and interconnected ingredients required to promote sustainable urban development. The project of sustainable mobility has certainly been at the heart of the debate over the last 20 years, but so too has that of public space, due to its key role in promoting shared values, inclusive communities and liveable cities (Low, Taplin, Scheld, 2005; Coppola, De Fabiis, 2020).

In fact, the relationship between the design of public space and urban mobility planning looks increasingly vital: the need to provide cities with high-quality and attractive space is all the more necessary in order to improve soft and smart mobility measures. Urban mobility affects public spaces and vice versa. The way in which public roads are used and the transport that travels on them (fast or slow cars, bicycles, people on foot, …) define the perception of the space itself (both of the road and of the surrounding area). Conversely, the way in which public spaces are equipped (with seats, or stalls for bicycles, …) supports specific modes of use and behaviours of daily mobility.

If Europe can boast a very long and authoritative tradition of designing city squares and public spaces, it is nevertheless true that during the last century there have been decades of urban development based on models that are no longer sustainable, which all favoured vehicular traffic. It is necessary to aspire to cities where public space is no longer the place where user and citizen simply travel by car and to consume, but it returns to being a space that hosts planned and spontaneous interactions among the people. According to a report published by the EU

> a sustainable city must have attractive open public spaces and promote sustainable, inclusive, and healthy mobility […] (European Union Regional Policy 2011) (Ravazzoli E., Torricelli G.P., 2017).

2.2.1 Mobility and places: from transport system to territory

What is a transportation system? What relationships are there between a transportation system and its territory? How do we plan

the mobility of people and goods in an area? With these 3 questions we want to try to initially analyze some useful elements to know and understand the relationship between transport, mobility and territory.

It is difficult to provide a single definition of a transport system: it can be defined as a set of elements and their interactions that generate both the travel requirements (mobility need) within a given area (territory) and the transport services to satisfy this demand (need).

It is immediately clear that when we talk about transport and mobility it is also necessary to introduce the concept of territory: transport and territory are in fact strongly connected and particularly interdependent. The territory influences the transport system and vice versa.

From a theoretical point of view, the transport system is made up of two main elements: the demand and the supply of transport as shown in Figure 1.

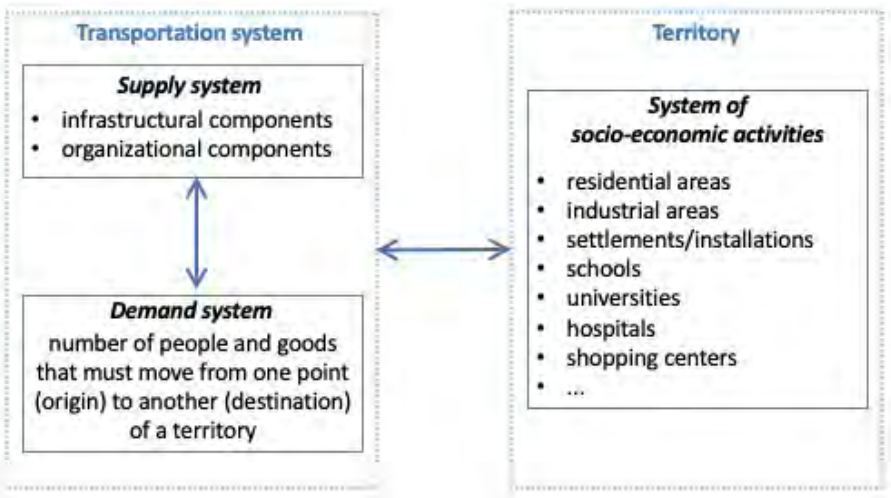

Fig. 1 – Relationships between the transportation system and the territory (adapted from Cascetta, 2009).

Transportation demand is closely related to the mobility needs of a group of people in an area (e.g., neighbourhood, city, etc.). These people make mobility-related choices such as:

- the reason for moving (work, study, entertainment, etc.);

- the destination (choosing to go to a cinema rather than another, or to a shopping centre);
- the mode of travel (using one's own means of transport such as a car or bicycle, or public transport);
- the time of travel (it is reasonable to assume that travel for study and work will be within specific time bands, while travel for entertainment or other essential purposes (medical visits etc.) are distributed throughout the day at different times.

These choices become transportation demand flows, i.e., the journeys made by people from the point of origin (e.g., home) to the point of destination in an area. These trips are made using the transport network and services.

The same is true for the transport of goods: these are moved from the point of production to the point of sale or delivery (destination): their movements constitute the demand for goods transportation and traffic flows.

Transportation supply is primarily comprised of infrastructure (roads, raillines, tramlines, parking lots, ports, airports, etc.) and services (regulations, transit schedules, fares, parking fees, road tolls, etc.).

The movement of people and goods from a place of origin to a destination may involve the use of different infrastructures and/or services depending on the distance and reason for the movement. For example, people may travel to their workplace by car or bicycle, and then complete the journey by using the train. Similarly, goods may be transported by truck or train to a port and then transferred by ship to a more distant destination.

The features and performance of a transportation system, such as travel time, monetary costs, service reliability, comfort and safety, influence the accessibility of an area; we talk about active accessibility when it is easy to reach other areas of interest from an area of origin, while we talk about passive accessibility when an area is easily accessible from other areas.

For example, a person might choose an area of residence, considering active accessibility with respect to their workplace and other services (hospitals, shopping centres, schools, etc.).

In a complementary way, economic activities are located by considering passive accessibility from their potential users.

More generally, a user's choice of destination can be influenced by the travel time and cost required to reach each alternative destination; the choice of departure time depends on the travel time to the destination and the desired arrival time; and the choice of mode of transport is influenced by the time, cost and reliability of the available modes. It follows that the accessibility of an area, even as a function of the transport systems available, has a strong impact on the socio-economic activities of the area itself and vice versa.

The system of activities is in fact the set of individual, social and economic behaviours and interactions that give rise to the transport demand (reason for travel).

The study and analysis of the system of activities is addressed in other disciplines, including sociology, economics and urban planning. Having said that, it is useful to report some elements that are essential for understanding interactions with transport systems. For example, the number and type of people living in different areas of a territory may depend on job opportunities, distribution and type. The amount type and price of housing, and the presence of stores and schools can also influence this kind of choice.

Transport and territory are therefore strongly interdependent: the study and planning of transport systems for people and goods cannot disregard a territorial analysis. It is therefore necessary to introduce the concept of transport and mobility planning as a continuously evolving process that considers on the one hand the mobility needs and on the other the development of a specific territory. The main goal of transport planning is to identify and provide useful indications for the decision-making process aimed at:

- managing an existing transportation system taking into account criteria of effectiveness and efficiency;
- improving and/or optimizing an existing transport system;
- planning a new transport system.

It is clear that within the planning process there are several subjects involved who play a key role in a variety of ways: technical subjects, political subjects, public and/or private bodies and institutions. In this way it is possible to identify different solutions and alternatives, also with regard to the costs and the expected benefits for the community, but above all to define the priorities of intervention

considering the available resources. Figure 2 shows the six phases of the transport planning process.

Fig. 2 – Six steps in the transportation planning process.

Today more than ever, it is important to ensure that any intervention in the territory considers various issues related to the sustainability of the project not only from an economic and/or financial but also from an environmental point of view.

Within the mobility planning process there are three interconnected dimensions:

- territorial;
- time;
- level of detail.

The first dimension, territorial, concerns the scale of the interventions to be implemented; for example, the national sphere concerns the choices and policies of a country or part of a country; the regional level concerns the strategies of a region or aggregations of parts of regions; and finally, the local level in which the interventions of a municipality, or province, or a part or an aggregation of municipalities or provinces are analyzed.

The time dimension relates to the time horizon of the interventions that are to be implemented in an area. Strategic planning occurs when the interventions in the transport system and territory are such as to require long periods of time and considerable resources to be planned and realized. The tactical planning regards realizable interventions in the short-medium period using available resources. Operational planning involves interventions that can be implemented in the short term and using limited resources.

Finally, the last dimension concerns the level of detail that relates to the level of progress within the planning process. There are also three different situations in this case: master plan, implementation plan and feasibility study. In the first case, the macro targets, macro policies and strategies to be implemented in a territory in future years are defined at a political level. The implementation plan makes it possible to better specify the ways of achieving the goals contained in a master plan. It can refer to the different modes of transport of people and goods. Finally, the interventions identified from a technical and economic point of view are analyzed in the feasibility study; in this way it is possible to provide indications for the subsequent planning phase of the transport and mobility system. Figure 3 illustrates the three dimensions of the transport planning process.

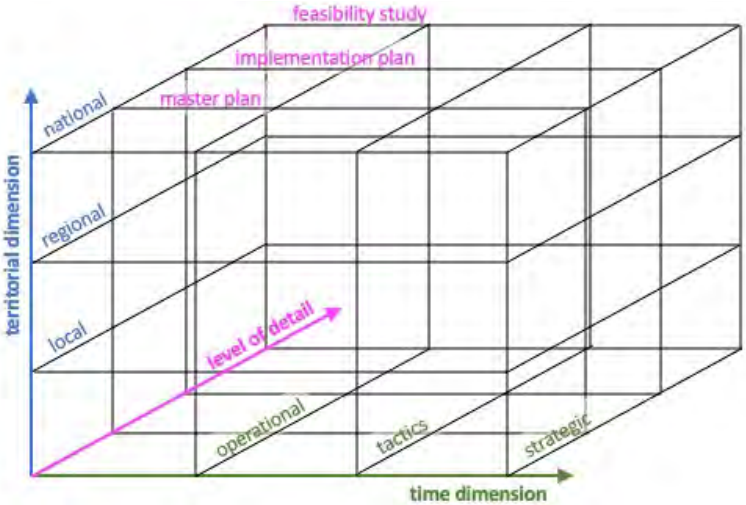

Fig. 3 – 3 dimensions of the transportation planning process. Adapted from Russo and Rindone (2007).

2.2.2 Designing public spaces: from moving to staying and playing

As mentioned above, the urban mobility project cannot be tackled without the necessary comparison with the design of the urban space. The way you move around the city also defines the way you live, and vice versa. On the one hand, it is a matter of managing the planning of urban development, mobility services and infrastructures, as we have seen in the previous paragraph. But it is also a matter of imagining how going and staying, speed and slowness, noise and silence, and solitude and gathering can coexist. In other words, it is about designing public spaces that can respond to various functional needs, and to grasp trends that are capable of anticipating changes, and that ultimately interpret a sustainable and inclusive future. In short, we need spaces that can interpret and promote a different culture of living in cities, with multi-faceted communities and in a perspective of environmental and social sustainability.

The pandemic we have been through has also highlighted the many contradictions that characterize the state of the art of the public space in

our cities and has made us questioned other potential emergencies: the need to enhance an open, public and valuable space that knows how to interconnect our homes and host not only movement from place to place but life itself; the need for proximity between spaces and services; and the need to share the transformation processes of places. These needs are especially relevant in cities, where socio-economic inequalities are the highest and where we can speak of the absence of a "right to space", regarding both the square metres in which we live and the resources of public and green spaces where we can stay still and feel healthy.

We can summarize by saying that we need hospitable places (Attiwill, 2011; Rebaglio, 2017; Di Prete, 2016; 2020), that is, places designed and equipped so that those who use them (passers-by, visitors, users, workers, residents) feel welcome and recognize in them what they need to carry out their activities but also to live positive experiences.

Since the mid-twentieth century, environmental psychology has theorized the conditions by which a place generates these feelings,[1] introducing concepts such as affordance, appropriation, attachment and identity:

> Appropriation, attachment, and identity refer collectively to the idea that people invest places with meaning and significance and act in ways that reflect their bonding and linkage with places (Altman, Werner, 1985).

Some models have been developed to schematize the characteristics of a "great place",[2] with sustainable, open spaces capable of enabling a vibrant urban life (Carr *et al*., 1992), building on the legacy of pioneering studies on urban space (including the forerunners Jacobs and White). These models essentially refer to the capacity of the spaces to:

– be accessible, i.e. they do not pose barriers to entry, either of a physical or a cultural nature. They are well connected to other places, enhancing the readability of the space, orientation and a sense of security;
– be able to offer a collective and an individual experience, interpreting the values, meaning and identity of places. They are full of

1. The main theories developed concern the "behavior settings" (Backer, 1968), the "environmental affordance" (Gibson, 1979), the "theory of place" (Canter, 1977).

2. See: Project for Public Space. www.pps.org/.

signs and symbols, of "monuments" in which to recognize a shared identity. At the same time, they guarantee freedom of use to the individual by offering positive and multiple ways of interacting with the space, through design choices regarding materials, furnishings, equipment and greenery, but also technology and what constitutes environments today, both interactive and augmented (walkways, organized group sessions, activities – permanent or temporary –, water and shade, comfort, etc.);
- be able to interpret explicit and implicit needs, to provide the opportunity for meeting, relationships and socializing. They are places that support the spontaneous promotion of activities, whether they are functional or playful, cultural or artistic. They are open to being set up and temporarily transformed for occasional events, experimenting with transitory furnishings and sets.

One of the parameters for evaluating the quality of places therefore becomes the experience they offer to people and, from this point of view, the experience of "being" in places is strongly connected to that of "moving" through them.

In the context of the design of hospitable places in the sense described above, design is able to refocus the decision-makers' gaze on the user and, adopting a user-centred point of view, promotes an approach to the project on the human scale, to that of the gesture, fixtures and human comfort. Design can thus contribute to innovating the shapes of our cities, relating to the individual's body and to the meeting of several 'bodies'. Above all, it can do so through a process of listening and conversing with the urban actors, reading their needs, and co-designing solutions together, which are site-specific, but also replicable, so they become practices and behaviours available to all.

From the perception of the profound needs of society, but also from the knowledge of the opportunities of technological development and the necessary objective of sustainability, some trends emerge, within which it is necessary to imagine and design solutions, places and services that are strictly connected to a rethinking of urban mobility:
- slow mobility promotes a different relationship between the area of travel and the area of parking, inviting new behaviours in the use of public space; the spread of micro-mobility implies

providing the streets with adequate spaces, including for the shelter of vehicles;
– the city of proximity implies imagining accessible places, but also the proximity of quality, active and attractive public spaces;
– smart mobility and the smart city are accompanied by new ways of using and interacting between places and services, mediated by technology.

Within these trends, the public space project adopts a series of strategies that support innovation and change in the sphere of mobility within cities and territories.

The design strategies intervene on multiple levels, involving different actors and processes and aspiring to different levels of impact.

At the first level, the design of the space acts in its material components that shape it, or that determine its aesthetics and methods of use. Even the design of the public space, like the design of artefacts recognized as "cultural products" (Volonté, 2009), contributes to building culture by facilitating the perception of places as "signifiers" for those who use them, through devices that enable encounters, and the sharing of common spaces and activities. We can recognize some paradigms that characterize the approach to contemporary design. First of all, the scale of intervention is increasingly the scale that belongs to interior design, i.e., the small scale. This scale relates to the dimension of gesture and the human body, which emphasizes the soft, intangible qualities of an environment, such as light, warmth and comfort: the spaces are "furnished" with a series of elements that guarantee a comfortable use of the space, which allow for affection, rest, care and belonging. Here, then, are spaces that host small sitting rooms, seats and tables, a green space that is not monumental but aimed at contributing to climate mitigation, favoring biodiversity and promoting activities of taking charge, collective care.

Often the small scale of intervention is of a temporary and flexible nature: using not only fixed and permanent furnishings, but also elements, and small, mobile, temporary objects that are open to unexpected uses. Furniture that often aspires to transform neglected spaces, forgotten interstices in planning, but which are meaningful to the inhabitants and users of the city. Spaces that, thanks to a different mobility design, can be returned as a different use, such as when light devices

essentially modify the perception of space and lead to reversible, circular systems that collect spontaneous uses of space and make them become the norm.

Putting people at the centre of design also means guaranteeing safety and the absence of not only architectural but also cultural barriers. The project adopts the point of view of fragility, in children, women and the elderly, starting from the ergonomics of the body up to the perception of the place so that it is understandable. Hence, we can recognize ourselves, as in the famous Superkilen project in Copenhagen where the redevelopment intervention is a large open-air installation, full of symbols belonging to the multiple communities that inhabit the neighbourhood.

Another paradigm of contemporary design is that of designing spaces and elements that encourage interaction, participation, wonder, and free initiative: a playful and narrative approach leads to the activation of reactions and relationships. We can think of simple devices such as the Warsaw musical benches, but also of more complex interventions such as those implemented by the Canadian group "Daily tous les jours", a studio whose interaction design has a focus on collective experiences: transforming everyday life with enchanting sceneries in public spaces. Their projects are opportunities to make change possible, stimulate involvement that ignites conversations between strangers and creates strong bonds between citizens and their environment.[3] Their swings, for example, bring a large, busy street in Montreal back to a scale of use for people, encouraging passers-by to stop, and collaborate with each other. "21 Balançoires" is a musical installation from which certain melodies emerge only through cooperation between the players: it is a collaborative game that gives the community an opportunity for sharing where this was denied by the design of the fast-moving, high-density urban road.

A second level of intervention can be identified in the projects that strategically involve the inhabitants in the transformation of the space, and which therefore take on an innovative dimension in the design process. Co-design or participatory design has taken on multiple forms, tools and methods, but they are all aimed at involving

3. See: www.dailytouslesjours.com/en.

the end user – be it an individual or a community – in the processes of transformation of places, in the decision-making, construction and Implementation phases, and in the management phase over the long term. Design thus operates on the collectively imaginable future. Time is a value but here it is above all a pretext for change: a public square that lasts a day, a month or a year, allows us to imagine and foreshadow a new world and projects it towards a permanent dimension because it is shared, tested, and seen in a new way, initially, by those who experience it every day.

In this sense, the temporary nature of the interventions, the DIY construction, takes on a design value, understood as a practice of transforming reality towards a better system.

Starting with the example of New York,[4] cities around the world have experimented with tenders, competitions and regulations that have made many of these policy practices become realized. And this is the third level of intervention that we can identify. It is the level that assumes the visions of designers and social actors and promotes them to address the governance of city development, as in the case of initiatives to promote cities that are more closely integrated, sustainable and with a gentler and slower mobility. Or, as in the very recent example of the Swedish national innovation body Vinnova and the design think tank ArkDes that promoted Street Moves, a plan that focuses attention on what they call the "one-minute city", which operates at the single street level and pays attention to the space outside the front doors. Through workshops and consultations, the initiative enables local communities to become co-architects of their own street layouts. The programme has already been rolled out experimentally at four sites in Stockholm and other cities and has a timetable of about 10 years.[5]

4. In 2007, NYC Mayor Michael Bloomberg had the idea that all New Yorkers would live within a 10-minute walk of an open space. He assigned the goal to the Department of Transportation, imagining that underutilized parts of the City's street network could potentially be converted to public space and started the famous NYC Plaza Program that counts more than 70 locations citywide where streets have been repurposed into actively-programmed, partner-managed, neighborhood destinations.

5. See: www.bloomberg.com/news/features/2021-01-05/a-tiny-twist-on-street-design-the-one-minute-city?srnd=citylab-design.

2.3 Designing new behaviours and new urban spaces

Many initiatives aimed at supporting sustainable development of cities are obviously not new, but we can argue that the unique situation caused by the Covid-19 emergency represents an opportunity for many cities to improve urban conditions in the long term.

Besides, citizens have become intensely focused on health and have altered many long-standing habits and preferences. The role of mobility planning is crucial in reimagining the future of cities.

Several public administrations have developed programmes in response to emerging needs during the pandemic and have promoted experiments for new services and new urban arrangements that are directed towards sustainability but also to public health objectives. Among these, many are aimed at immediate and quick interventions for the modification of mobility and public spaces, such as those now universally known as "action-planning", "guerilla urbanism", "pop-up" projects, "city repair", "DIY Urbanism", "Tactical Urbanism", "Lighter Quicker Cheaper"[6] projects and so on. These minimal and temporary interventions are carried out in a very short time and with limited resources, usually involving a variety of actors ranging from individual citizens to associations and local administrations.

But it is necessary to go even further to consider the impact of the pandemic on behaviour, policies and economies and to plan more incisive and long-term solutions. The debate, in fact, is turning towards real "city models" that are different and effective over the long term, where new daily needs and behaviours are collected and promoted by new models of permanent spaces and services. Planners, designers, architects, landscape managers and local administrators are already engaged in looking at the transformation of our relationship with the public space and the way we move through the city.

6. See: "The lighter, quicker, cheaper transformation of public spaces" www.pps.org/reference/lighter-quicker-cheaper/. There are several publications describing these issues, e.g: Overmeyer, 2007; Chase *et al.*, 1999; Hou, 2010; Bishop, 2012; Lydom, 2015.

2.3.1 Slow mobility and public space reappropriation

Among the main interventions at the time of Covid-19 are those aimed at dedicating more and more space to cyclists and pedestrians, thus avoiding the overloading of public transport and the use of private cars during the health crisis. In this way, initiatives to support micro-mobility and slow use of the city have multiplied. Micro-mobility refers to a range of small, lightweight devices operating at speed typically below 25 km/h that are ideal for trips up to 10 km, and human-powered or electric; these include bicycles, scooters, skateboards, cargo bikes, and rickshaws.

First, encouraging slow mobility meant quickly transforming the layout of the streets so they could safely accommodate more bicycles and pedestrians. Furthermore, reflections on the role of public space design have been accentuated, considering the Slow City from the perspective of the materiality of its public spaces and their capacity to activate potentials of soft or active mobility (Mezoued, 2021).

Pop-up cycle paths, for example, provide an immediate answer to the urgency of rapid deployment of cycling and pedestrian spaces, especially in densely populated urban areas. The organization's Covid Mobility Works platform documents over 100 cities worldwide that dedicated street space for cyclists and pedestrians during the pandemic.[7] As well, the spaces dedicated to car parks have been transformed into lanes dedicated to bicycles or to expand the pedestrian area. Entire restricted traffic zones have been established and streets pedestrianized. Cities all over the world have closed roads to give more space to pedestrians and cyclists and the temporary road closures provide a testing phase towards more ambitious projects in cycle-paths, pedestrianization, and public space enhancement (Bliss, 2020).

The slow city thus becomes not only the city where slow mobility is privileged, but also where the space of the streets is reclaimed, taken

7. See: www.covidmobilityworks.org/. Among the initiatives collected by the platform there is the Milan's "Strade Aperte", that seeks to rethink mobility and public spaces to ensure a more sustainable and liveable city. The initiative aims to transform 35km of streets with a rapid, experimental city-wide expansion of cycling and walking space to protect residents as Covid-19 restrictions are lifted. The goal is to create protected and accessible roads for all, offering new public spaces and encouraging travel on foot, and by bicycle and scooter, as an alternative to public transport and private cars.

away from motor vehicles, and activated for a different use by the citizens. Slowing down the city therefore also means encouraging new functions for public space: public space is not only a space for transit and movement, but also a place that hosts activities.

From the point of view of urban design, this change of perspective involves a series of interventions that can act on different levels.

The first level is, as we have said, that of the road layout design. The lanes for vehicles become narrower and cycle paths and pedestrian paths are established. The intervention methods range from the lightest, with signs painted on the road surface, to more structural interventions for the reorganization of the road network.

The second level is that of the transformation, including temporary, of spaces through the set-up of furnishings, physical elements, and safety structures that allow a different use of the place. One of the typical examples is that of humble parklets. Since their conceptualization in 2011 in San Francisco, the concept of the humble parklet has spread across the globe, reclaiming small pockets of public space on roads and streets. Initially an 'intervention', parklets are now formalized by several municipal programmes, helping increase the permanent quality of streets and generally improving the public realm where cars once stood. They are often intended as an external extension of private and commercial entities such as restaurants and cafes, but they should also provide a safe environment for the free use of residents and other users. They have seats, support surfaces, greenery, shelter from the sun and protection from the main road, and they are often placed on a base that raises the street level to that of the pavement, thus extending it without any barriers to access for all. In a general sense it can be said that the space was "freed" and "slowed down" thanks to the spread of slow mobility, recalling and promoting the design of elements of comfort, but that are also playful and attractive, which allow for a new kind of use.

2.3.2 Smart mobilities and smart cities

As described in the above paragraphs, transportation systems and the mobility of people and goods in a territory are closely interconnected, just as the concept of smart mobility is often associated with the

concept of smart cities. Smart mobility is a relatively young concept that has developed significantly in the last decade involving political and private actors.

It is difficult to provide a single definition of smart mobility because the theme is related to other aspects outside the transport sector but is also closely linked to the concept of sustainable mobility.

In fact, smart mobility concerns a set of actions that can be implemented all together or as a priority with the aim of improving urban mobility.

A first issue concerns vehicle technology both in terms of power supply and automation. Electrification of vehicles using batteries, plug-in hybrids and/or other new technologies plays an important role; if smart energy distribution is also considered, electric vehicles could both be emission-free at the place of use and contribute to electricity storage, supporting the reduction of carbon in the atmosphere. Regarding vehicle automation, one of the benefits relates to the possibility for vehicle occupants to use time on board for other purposes while not being involved in driving (Bakker *et al.*, 2014; Fagnant, Kockelman, 2015; Coronado Mondragon *et al.*, 2015).

A second, closely related, issue, concerns Intelligent Transport Systems (ITS) and smart infrastructures. The ability to manage and acquire information allows vehicles to become increasingly connected in real time: this can influence traveller behaviour and optimize the performance of the transportation system (Alam *et al.*, 2016).

Data management represents the third aspect of smart mobility; user-generated and user-directed information (e.g., crowdsourcing) can integrate mobility options as they are context-specific (Toole *et al.*, 2015).

The last issue concerns mobility services; the scenario that is outlined sees mobility as a personalized service available on demand – Mobility as a Service (MaaS). In this way, users will have immediate access to a clean, green, efficient and flexible transport system to meet their needs.

Within Mobility as a Service individual vehicle ownership is replaced by usership, i.e. the ability to purchase access rights to an interoperable package of mobility services (e.g. car-sharing, cab, bus, rail, streetcar, metro, bike-sharing, etc.) owned by other providers. The operation of MaaS may be facilitated by the use of integrated platforms

that can process big data, and intercept and meet transportation demand (mobility need) in real time (Wockatz, Schartau, 2015; Thakuriah *et al.*, 2016; Jeekel, 2017; Docherty *et al.*, 2018).

Finally, a further issue can be considered taking into account the approach called A-S-I, which is based on the components Avoid/Reduce, Shift/Maintain, Improve (Boungardt *et al.*, 2019).

The main goal is to achieve significant reductions in greenhouse gas emissions, reduced energy consumption, less congestion, and to create more liveable cities.

The first component, *Avoid/Reduce*, concerns the improvement of the efficiency of the transport system as a whole. The central idea is that the need for motorized travel and the duration of the journey can be reduced through the compact development of cities. In this way, the demand for mobility can be reshaped: residential, work and leisure districts must become more closely connected, services must be closer and accessible even with light and slow forms of mobility. Urban development must consider slow use, on foot or by bicycle, and not just fast transit.

With the second *Shift/Maintain* component the goal is to improve the efficiency of the individual journey. In particular, the aim is to change the modal split by shifting users' choices from a more polluting and energy-consuming urban transport mode (for example, the car) to more environmentally friendly modes. Two possible modes concern travel: i) on foot or by bicycle, and ii) those who use public transport. Walking and/or cycling is one of the most effective and environmentally friendly options for increasing sustainable mobility. This change also involves a rethinking of the quality of public space: cities must aspire to comfortable spaces, which invite people to stop in them, to imagine collective activities and uses, and to take care of the context in which they live. Policymakers and designers must imagine new urban landscapes and new processes to obtain them, involving inhabitants, users and businesses, thus creating a common consensus on the innovative cities of the future.

Although public transport, such as trams, buses and trains, can also generate emissions, the lower specific energy consumption per passenger-km and high occupancy rate (persons/m^2) mean that the associated CO_2 emissions per passenger-km are lower than for car use.

The last component to be *Improved* concerns the efficiency of vehicles, fuel and the operational management of public transport; this

includes strategies to make public transport increasingly attractive and competitive. More than ever, attention must be paid to the energy sources necessary for the functioning of transport systems: the introduction and use of renewable energy sources must become a basic principle (Wimbadi *et al*., 2021). However, it is equally necessary to look at the new models of mobility and smart cities, with services for citizens and functional data management.

2.3.3 Accessibility and proximity

Accessibility is one of the recognized characteristics of a quality public space. With "place accessibility" we traditionally mean the convenience with which it is possible to reach the place itself, its connection with other significant points of the city, considering the infrastructures and/or physical-architectural, digital and cultural barriers that distinguish it. Historically, the urban planning concepts have guaranteed accessibility by supporting the use of cars, creating fragmented cities that are heavily automobile-dependent. In this way, most urban fabrics, though connected, are not easily accessible without a heavy reliance on automobiles.

These models have shown their weakness during the urban lockdowns imposed by the pandemic in recent months and have prompted policymakers and planners to urgently imagine new models of urban functioning.

On the one hand, the need has forcefully emerged to consider accessibility not only to places but also *to the activities* that happen in the places themselves, and which are not only aimed at obtaining goods and services, but also at exchange and personal interaction. You can therefore talk about an "activity-based" approach to accessibility and measure the number of activities accessible at a certain distance or travel time from a given location. These measures make it possible to effectively evaluate the inequalities within the city because they make it possible to measure the choice between different activities available to the inhabitants of a certain territory.

Focusing on activities also means introducing in accessibility measures an assessment of the attractiveness exercised by the quantity and quality of locally available activities. In this sense, the gravitational measures of accessi-

bility […] focus on urban attractors or magnets, assigning different weights to the activities present in the area based on their attractiveness and net of material and intangible costs (time, money…) that must be supported to reach them (Borlini, Memo, 2009).

On the other hand, other models have developed that were only in embryo before the pandemic, and which propose to overcome the fragmented city based on accessibility by car.

The now famous model theorized by Carlos Moreno of Sorbonne University (Moreno, 2020) is initially based on the observation of the transformation of the ways of using the city, induced above all by new technologies that have imposed new ways and times of work, of life, of wakefulness and sleep, thus generating a city that experiences a continuous stream of activities that are accessible around-the-clock.

The sequential chronology of the city, a legacy of industrial Fordism and of the contrast between the city of the day (which works) and that of the night (which is fun but also dangerous), is in perdition, giving way to the multi-rhythmic city (Moreno, 2016).

The proposal of the Moreno model, 'the city of 15 minutes', has been enthusiastically welcomed by numerous local administrations and politicians, starting with the city of Paris. It aims to reconcile sustainable urban development with the new rhythms of urban life and advocates a radical transformation of the urban structure: to overcome the still mainly mono-functional structure of the inner city and its various specializations with a polycentric city, following the 4 fundamental principles of: proximity, diversity, density and ubiquity. Moreno's model and its variations[8] recommended redesigning neighbourhoods so that individuals can reach the set of venues they visit most often during their daily life within a 15-minute travel distance, either by bike or on foot, to overcome the social gaps between different areas of the city (Borghetti *et al.*, 2021).[9]

8. There are many variations of the model, both for the underlining of a specific sub-objective, and for a different desired temporality (Moreno *et al.*, 2021).

9. Not everyone agrees that the 15-minute model is adequate for all non-European cities (O'Sullivan, 2021) nor is it able to improve the social and economic gaps between different areas of the city. The graphic study (http://whatif.cslparis.com/15mincity/) developed for Sony by the Sapienza of Rome (Monechi *et al.*, 2021) reveal how the "city of 15 minutes" already exists in the most central districts, where the inhabitants often find

The double objective, therefore, of promoting accessibility as the availability of activities and opportunities for meeting people, together with the 15-minute city, has led, in the short period of the past few months, to many initiatives for the transformation of the public space. Numerous innovative temporary urban infrastructures were promoted which provided an immediate response to new urban needs, developing transversal actions of mobility planning and design of public space. The dimension of temporariness, which increasingly characterizes the design approach for the transformation of public space, is confirmed to be strategic for a community-centred development, which listens to the needs of people and tries to give immediate answers, even in experimental test form. One of the challenges of the near future will be to consolidate these temporary infrastructures for a permanent change of the city.

Bicycle lanes, maze-like parks, hyperlocal micro-markets, outdoor restaurants, pedestrian zones, parklets, squares and public places within neighbourhoods, are just some of the examples of the numerous interventions adopted that have changed mobility and transformed public space, making it more liveable and accessible. Each time these interventions involved a design in terms of traffic planning and in terms of urban space, adopting gentle measures such as ground paints, bollards, greenery, lighting, free-standing furniture, and elements with a double function of service for people and non-motorized vehicles (bicycles and scooters for example).

Conclusion

At the end of this dissertation, we can infer that the design of sustainable mobility in our cities must be addressed using a complex approach, where the public space design and transport planning should collaborate and share tools, processes and approaches.

Transport planning is strictly linked to the development of a territory, providing answers to the needs of citizens and fostering changes

themselves less than a quarter of an hour from many services, with the only exception of work, which is the function that often forces them to leave the neighbourhood to become commuters. The further one is from the centre, the more distances are lengthened, and services are scarce, so a real change in the social divide would require interventions on a larger scale in the distribution of services.

at different scales of intervention from the operational level to the strategic one.

Public space design offers a different attitude towards innovation in the context of everyday life, proximity, and the ways in which we move, behave and reside together in cities.

The near future's challenges are considerable and give a central role to the design of cities and the lifestyles of the communities that live there. The concerns raised by the pandemic have only accelerated some contemporary issues and highlighted emergencies that cannot be ignored. Among them, is the challenge of environmental sustainability which requires massive investments in a different urban development.

The city project must grasp the signals that derive both from new behaviors and sustainable challenges and promote them to practices that are gradually consolidated also in the form of services and public places. Slow and smart mobility, the city of proximity, accessible places are scenarios that no longer represent the near future but the near present.

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Part II

New spaces for health and well-being

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3. Rethink the design of care looking at Outer Space. How art and design role can improve the living conditions of hypersensitive people and the whole society

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Abstract

This issue brings disruptive proposals driven by art and design to boosting mental health in time of change, as declared by Horizon Europe's main objectives: the development and interventions which promote well-being and prevent mental illness to help cope with and mitigate the stress of a changing society. The topic widens from the subjects hypersensitive to the scene of an entire society that faces a dimension of post-traumatic stress disorder related to Covid-19, and it extends to the need to prevent and not just cure. Hence the importance of a strategic alliance between culture, health, and social education. Pandemic and transformations lead to more mental health problems, included anxiety, depression etc. Also, exponential incorporation of technology in our daily lives has caused profound changes in the way we work, live, and communicate. This is likely to have significant impact, both positive and negative, on mental health. Several studies showed that those who are frail, tired, or ill are more subject to the action of stress, and environmental international research has now shown how the well-being of those who live the structures dedicated to hypersensitive people (care homes & hospitals) can affect factors related to both architectural dimension to the artistic.

There are many examples today that demonstrate the importance of the therapeutic contribution of architecture, art, and design, to redevelop places of hospitality and care, and create environments in which there is a deep harmony of space, light, and beauty.

The research proposal in this paper starts from the idea that the places of care and well-being can be seen as a large social design

laboratory, a multidisciplinary approach path to the value of arts and culture for wellness and health in which many questions emerge: how do you create health? How design culture can be translated in a resource for the health of persons of the organizations, of communities? How artistic and cultural practices can be involved in the management of major challenges contemporary, from active aging to the promotion of health for hypersensitive people? The aim of the author is to affirm the fundamental role played by design in supporting the therapeutic process increasing the quality of the environment for a new cultural welfare, in which emerges the central contribution of culture and art to our mental health and our capacity for social cohesion. The new proposal, that might seem a risky theory, looks at the good practices and behaviours of astronauts on the International Space Station (ISS) that inhabiting an unknown environment with characteristics other than those we are accustomed to experience on Earth can be considered hypersensitive subjects in all respects. The author, with twenty years of experience in *Space Design*, in which confined environment and microgravity are the two principal differences that affect living and working in Space, invites to take inspiration by Space to improve the well-being on Earth.

3.1 The strategic relationship between beauty, culture and health in the design of care and wellness environments

Recent years have seen a revitalization of scientific research that investigates the interrelations between culture and health. Neuroscience, medicine, psychology worked together with cultural organizations on a path where theory accompanies practice. Research confirms that culture is a determining factor in psychological well-being. The privileged relationship between cultural participation and the state of health arises following the publication of epidemiological studies which have demonstrated unequivocally that the intelligent use of leisure time is associated with an extension of life expectancy and a reduction in certain degenerative diseases, like Alzheimer's disease or cancer. Culture is generally considered "entertainment", therefore brought back to the superfluous, however, cultural activity takes on a precise value, proving to be an important tool able to prevent cognitive

decline, mitigate stress conditions and contribute to general welfare (Grossi, Ravagnan, 2013).

As already included in the European Agenda for Culture 2018, the report of the World Health Organization, WHO 2019, attests that art and culture are important health resources for care, health promotion and building equity and social quality (Fancourt and Finn, 2019). Today more than ever, these interrelationships become strategic to address the human and urban convalescence that individuals and communities face. Artistic approaches can be considered as complex or multimodal interventions, combining several different components which may concern the aesthetic involvement, the stimulus of imagination, sensory activation, the evocation of emotions and cognitive stimulation. It may also include social interaction, behaviours, physical activity, the involvement in health issues and interaction with care settings and spaces.

The perceptual-sensory characteristics of the environment assume a strategic value in the design of architectural spaces, giving emphasis to psycho-emotional aspects and semantic value to spaces. Some key points in the design of health and wellness places are *wayfinding*, the orientation to access, the facilitation to reach the goal, which in the absence of clear and simple indications generates confusion and stress; *waiting areas*, which must be in a light-flooded environment to facilitate social interaction; *landmarks* that give the space a precise identity; *therapeutic garden* and distributed green, very important to maintain contact with nature; as well as the *natural light*, determinant to maintain the balance of circadian rhythms in harmony with the cycles of day and night that mark the days; the *air quality*, calibrated through systems able to ensure proper ventilation of the interior spaces; the *acoustic quality*, thanks to the recent technologies able to manage the sound and the absorption of noise; and of course the *privacy*, essential in spaces where you live the community and the sharing of environments. All these "attentions" to the environment should be integrated in spaces in which the harmony of proportions and perspective fugues can restore a general sense of beauty and well-being.

The therapeutic contribution of architecture, art, and design is fundamental to redevelop the spaces of hospitality and care and create environments in which there is a deep harmony of space, light, and beauty. The theme extends from hypersensitive subjects – here

considered vulnerable people, with mental and emotional changes that increase sensitivity to environmental stimuli and cause anxiety, depression, difficulty relating to others, stress, including elderly, senile dementia and diseases such as autism, anorexia and all forms of depression – to all the stresses that come from the environment outside the scenario of an entire society that faces a dimension of post-traumatic stress disorder related to Covid-19.

The pandemic brought the challenge to more advanced levels. On the one hand, in fact, the places of culture and art have been closed and banned from attending. The health system has been subjected to unprecedented stress. On the other hand, the need to find answers to the demand for well-being has become even deeper, widespread, urgent, also because of the widening of social gaps. The recently published research report *Art Consumption and Well-being During Covid-19 Pandemic*[1] presents the results of an extended survey conducted in summer 2020 that attests that cultural consumption is at the top of the list of activities to which people have dedicated themselves to manage moods during constraint (over 85%). The contribution of arts and culture to one's own well-being has been described by 64.2% of respondents with the expression "makes me feel better", 42% as a possibility to experience beauty, wonder and transcendence and 38% to reflect on one's own life.

This study reports an interesting reflection on psychophysical well-being is particularly relevant regarding the way in which art and culture affect moods, feelings, and emotions: visual arts, architecture, as well as music and literature have the power to decisively affect mood improvement through immersive experiences of beauty, wonder and transcendence. It makes also evident the need to *prevent* and not just *cure*. Hence the importance of a strategic alliance between beauty, culture, health, and social education to retrain care environments and increase the well-being spread.

1. This research was carried out in 2020 by the Cluj Cultural Centre (RO) and Fondazione Bruno Kessler (IT), in collaboration with BOZAR Centre for Fine Arts (BE) and UGM Maribor Art Gallery (SI), within the Art & Well-being Project, co-funded by the Creative Europe Programme of the European Union and brings a new perspective on how arts influence well-being during a crisis period, such as the Covid-19 pandemic.

https://art-well-being.eu/research-report-art-consumption-and-well-being-during-covid-19-pandemic/.

3.2 Beauty and health in the Italian culture

The use of beauty and art to regenerate body and mind is not a recent phenomenon. The connection between environment and health is already highlighted by Hippocrates in 460 BC in his treatise on Air, Water and Places in which he stresses its importance for the health of the citizen. The Greeks regarded the physical and psychosocial environment as a factor in the so-called "art of healing". The Asclepia were the first hospitals, therapeutic campuses that survived for twelve centuries in the Hellenic territories, with structures for the art and for the regeneration of the body, such as the Odeon, the theatre, stadium, gymnasium, paintings and sculptures to recall the therapeutic power of the divine Asclepios. The "space of dreamers", which was part of these complexes, was conceived as a place of abstraction and concentration.

During the Renaissance, the beauty and value of art characterized Italian hospitals as places of "taking care" transforming the idea of general hospitalization into real *hospitality and care machines*, a shelter that is based on the design of the experience and generates healing. In the buildings everything contributes to health: functionality, abundance of air, light and water and also beauty. The Pellegrinaio blue sky of the cycle of frescoes inside Santa Maria della Scala in Siena is an extraordinary artistic example of this harmony between space, light and colour, but above all it is what the sick patients saw lying down, modifying their living illness being absorbed by beauty.

As long as the medicine has been poorly effective (that is until times very recent), the assistance to the person, understood in the most holistic form, even before the physical one, was the main task. The beauty of the places had to balance the uncertainty of the care, the assistance to the person had a more holistic value, and before the physical recovery, the aesthetic component and the harmony of light and colour were decisive for the emotional and spiritual satisfaction. The Ospedale Maggiore Ca' Granda in Milan is an extraordinary example of Renaissance architecture and great compositional balance wanted by Giangaleazzo Visconti and Francesco Sforza, in which the Florentine Antonio Averlino, called the Filarete, has been dedicated to the search for the highest quality and innovative solutions that went

Fig. 1 – Pellegrinaio frescoes of the Renaissance hospital at Santa Maria della Scala in Siena.

beyond the aesthetic aspects, starting to consider also the hygienic ones, and remained an inspiration for centuries for many others European hospitals, such as the technological solution of the sewerage system that connected all the toilets. For several centuries, the tradition of high-quality decoration and commissioning of works of art continues, combining the *aesthetics of shape* with *ease of use*, the *comfort and cleanliness* with *hygiene and healthiness.*

In the nineteenth century the Polyclinic was born, which responds to changing hygienic and functional needs, but in its efficiency does not neglect the artistic aspects. The church of Santa Maria Annunciata in the hospital San Carlo Borromeo commissioned to Gio Ponti should have represented a place of prayer, a "temple", using the words of the same architect, "an ark-vessel where you can meet man and God". At the same time, the aim of the Polyclinic pavilions is explicit to make the hospital feel like a comfortable environment by intervening on the factors that can influence the perception and make the places friendly and evocative, also introducing the concept of "view" and enhancing the therapeutic role of green and nature.

In recent times we are witnessing a *hybridization of places* to spread a harmony and a well-being that is functional to feel good, healthy, using art, design, and beauty to regenerate the body and mind. While on the one hand, the focus is on the redevelopment of treatment places, on the other cultural centres and museums are experiencing the inclusion of people with cognitive disabilities through new formulas of *accessible museums*. These experiences have in fact opened paths of cultural mediation not yet beaten, new and effective ways of contact between those who enter a museum and the physical and cultural contents of the collections, of interaction with those contents, of understanding, of remembering – what you can, how much you can, if you can and above all creating meanings and communication. Contact, interaction, understanding, remembrance, creation, and communication are the actions underlying any strategy to break down barriers of any kind and to involve the public, the whole public, even the non-practicing public, that is, the non-public, in the cultural proposal of a museum. If the places of art and culture are not by nature inclusive spaces, as shown by the bleak data of the low affection expressed by Italians, the experiences with people affected by dementia teach that you can change. Museums can become welcoming spaces for many, they can learn the languages of many types of audience that today remain outside their gates and teach them their own (Cicerchia, 2019).

3.3 Space Design as inspiration for hospitality and care environments

In this fluidization of spaces – in which the types are contaminated to increase the well-being of people, and the power of beauty through art, design and architecture changes behaviours and mitigates the effects of hypersensitive subjects' pathologies – the proposal to be inspired by Space for the design of hospitality and care spaces does not seem so risky.

The author, with twenty years of experience in Space Design – in which *confined environment* and *microgravity* are the two principal differences that affect living and working in Space – proposes to look at the good practices and behaviours of astronauts on the International Space Station (ISS) that inhabiting an unknown environment with characteristics other than those we are accustomed to experience on Earth can be considered hypersensitive subjects in all respects. The well-being

of astronauts depends on a number of natural environmental stimulations – such as the light of Sun, colours, air, wind, temperature variations, scents, flavours and sounds – that normally we live and feel on Earth and that are able to stimulate the vital functions, and that unfortunately in Space the artificial environment of the habitation modules is not still able to reproduce, and over time provokes monotony, a loss of widespread interest and also depression. The human being, under normal conditions, reacts to these stresses tuning its balance with nature and the surrounding environment. For these reasons, the lack of a single natural stimulus can therefore compromise biological and mental health (Dominoni, 2021). The study of lighting, as it happens already for the design of both small rooms and big spaces that not always can rely on the outside light, must consider balancing the circadian rhythms. Natural light is fundamental to regulate sleep and waking, and its lack in confined environment causes strong alterations of the physiology of the human being generating insomnia and general impatience. A good design must develop illuminating bodies with variants, in terms of temperature of light and luminous intensity, like natural ones. Light can also create space partitions defining private rooms or can change the perception of the environments, overall if in isolation conditions. Using lighting effects, we can recreate the Sun that filters through the windows reflecting multiple and vibrant shadows. Also in the science fiction imagination, there are solutions that seek to recreate environmental stimuli natural, as you can see in the movie Solaris by the Russian director Andrei Tarkovsky, in which the sound of the wind was reproduced through strips of paper placed under the aeration fans of the space station. Coming back to the reality, in Space the crew members often in the absence of adequate solutions try to create a better environment through the most unthinkable devices that they have available as the cosmonaut Anatoly Berezovoj who in 1982 spent part of his 7 months on board of Salyut 7 listening to a cassette player in which they had been recorded the sounds of woods, birds, wind and of the storming of the leaves, in short, the terrestrial sounds (Clark, 1988). Living the confinement in small environments in which all the activities are concentrated in little spaces, and in which one must live for a very long time (without the possibility of going out to take a breath of air, as it happens on board the ISS) causes an increase in the need for privacy, and cascading, emotional stress, aggression, nostalgia, and depression. There are numerous tensions experimented on board between

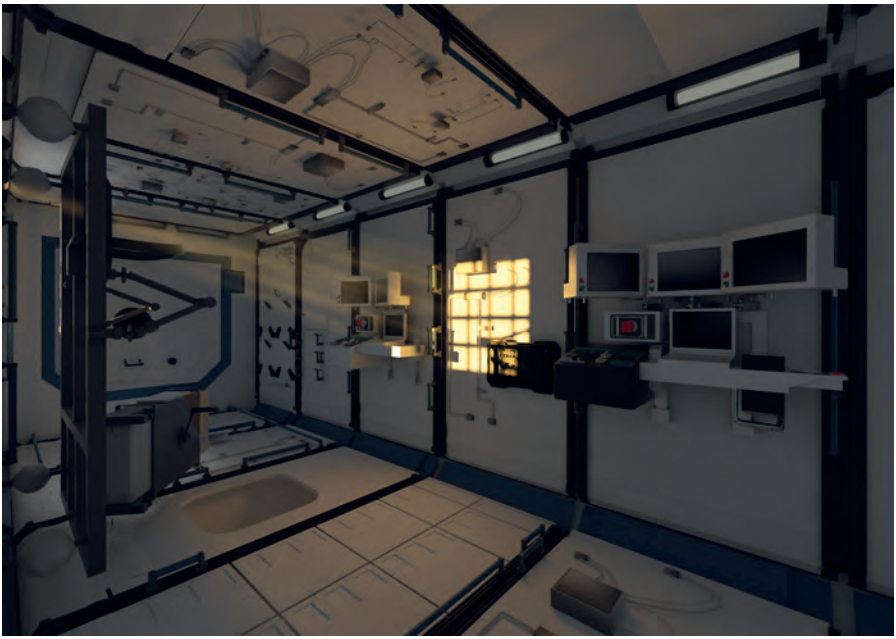

Fig. 2 – Technology and poetry interact with lighting to obtain komorebi effects and re-create natural circadian rhythms. Master of Science Course in Space Design "Space4InspirAction", Politecnico di Milano.

the crew, and between astronauts and ground controls, such as the mutiny of Carr, Gibson and Pogue against the mission leaders in Huston, ended with radio silence from the three men of the Skylab (Di Bernardo, 1997).

Perhaps the closest experience to us that can be comparable to the life on board the ISS is the forced isolation, living in our homes, imposed by the Covid-19 pandemic emergency. I had the occasion to live this experience with the students starting in the second semester this year, at the end of March 2020, the Space Design Course Space4InspirAction (S4I) at the School of Design, Politecnico di Milano[2].

2. The Space4InspirAction (S4I) Course, this year at its 4th edition – created and led by Annalisa Dominoni and Benedetto Quaquaro from 2017 inside the Master of Science in Integrated Product Design, School of Design, Politecnico di Milano – is the 1st and unique academic Course of Space Design in the world recognized and supported by the European Space Agency (ESA) through experts and scientists who suggest and then deepen the project themes, in line with the objectives of the all space agencies' strategic programs, with the aim to generate disruptive ideas and visions to increase the well-being of living in Space through Design approaches, methodologies and thinking.

There are some specificities of Space Design that makes this discipline an interesting testing ground for the development of distance learning methods during a pandemic: astronauts live in a confined environment that brings lack of privacy, deprivation of natural stimuli and sometimes depression or nervousness for the impossibility of getting out that were close to the situation of us and our students living in isolation, maybe without a personal space in which to work or relax, and with the desire to move and practice sport in the open air. In this situation, students could be closer to their users and their needs to design new products which could better satisfy the functional, physiological, and psychological requirements when living on board the ISS.

The designer can act to reduce the negative effects of confinement, designing an artificial environment rich of sensorial stimuli that are able to reproduce in the best possible way those already present in a natural environment. Why not try to transfer the User Centered Design (UCD) approach and the well-established good practices in Space Design to improve the living conditions and well-being of hypersensitive subjects?

There is a specific methodology for Space Design created by the author called Use and Gesture Design (UGD) which put in a systemic view the human being and the movements, the interactions and the gestures related to the equipment to use during scientific and maintenance activities, or experiments, and the environments. Creating this new methodology, I wanted to join to the design process the analysis of use and gestures while imagining a new product that will be used in microgravity and in confined spaces, an experience that for all of us is unknown and it is not part of our daily life. Designing for confined spaces and for microgravity conditions require the ability to predict use and gestures that is to say foreseeing how an object will be used and in which ways, to be able to imagine, for example, the actions and the movements of the crew in relationship to the new Neutral Body Posture (NBP) that is assumed in microgravity, and foresee the physiological, perceptive, ergonomic, psychological and motorial requirements that will arise to the astronauts in conditions that are completely new and unknown to the human being (Dominoni, 2002).

Looking at Space Design it's not perhaps the same approach that we should use when we approach hypersensitive subjects that have behaviors and reactions that are hard for us to code by imagining what their

ideal environment might be and how they might benefit from sensory stimuli properly designed considering their hypersensitivity?

These reflections invite to consider the design for sensitive people with cognitive difficulties from another point of view and from another environment, Space, which although so different presents similar characteristics. This new field of experimentation opens promising design experiences of contaminations in which the hybridization of different disciplines borders even exceeds those of our planet.

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4. Spaces as thresholds. New design approaches for mental well-being

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Abstract

Spaces and their views are changing. The perception of physical and mental well-being is also shifting. We are experiencing a transitional time when new needs and requirements emerge, affecting human behavior and the space definition at macro and micro scale. New dynamics and perceptions are recognized, leading architects and designers to focus on studying and applying innovative methods. The aim is to enhance overall life quality at urban and personal living levels.

These considerations lead to a general innovative concept of physical and mental well-being where spaces are thresholds between indoor and outdoor, city and building, interior and environment. Following this concept, various studies highlight the importance of biophilic design in internal spaces, factually bringing the outdoors inside the space, benefiting the psychological and general well-being of users through greenery and natural light. It is a transversal approach at various scales that involves different creative fields; Architecture, Interior Design and Fashion implement models to ensure and enable well-being.

The research presents approaches in relation to well-being on various scales and analyze them through several international examples comprising new trends in the UAE where the two authors live and work.

4.1 From mental health to mental well-being

The recent approach to the definition and design of spaces for the protection and care of mental health adopts methodologies aimed at reintegrating the individual into the social context. Spaces for the care and treatment of these disorders are no longer enclosed within inaccessible boundaries and, on the contrary, are thresholds facilitating the transition between inside and outside, patient and environment, illness and recovery. They not only reflect typological aspects based on new therapies, but follow topological rules. They deal with both quantitative and qualitative relationships between areas of different nature, and between internal and external environments. That includes the external space, the surrounding, the adjacent landscape and the entire city housing the structure. Hence, architecture becomes a system, it connects and coexists with the outside. This is a metaphorical and tangible relationship representing the most important and real goals for care and well-being.

In many circumstances, buildings addressing these goals bring nature inside, as in the case of the Psychiatric Hospital of Helsingor, Denmark. The complex, result of a collaboration between the design offices BIG and JDS, is designed to incorporate gardens in its plan to give patients a relaxing view toward the nature.

Following a reverse approach, some facilities for mental disease open the sight towards the landscape or the city reconnecting guests and contexts. In the case of the Alzheimer Daycare Center designed by studio VRA in Spain, the countryside is reminded in the small courtyards populated by typical local plantation and by the views opened toward the surroundings. The aim is to visually, socially and emotionally reconnect the patients to the agricultural social context part of their lost memories.

Fig. 1 – Alzheimer Daycare Center designed by studio VRA, Spain. Credits by Studio VRA.

Fig. 2 – Alzheimer Daycare Center designed by studio VRA, Spain, sights toward the landscape. Credits by Studio VRA.

Sometimes the inside-outside relationship is completely inverted as in the case of the building Sint-Josef part of the large campus caritas in Malle, Belgium.

Here the confined space inside the existing building becomes a public place where streetlamps, benches greenhouses and nature are housed as an outdoor space (Cornaro, Divitiis, 2021).

In many countries' legislation, the right to health implicitly or explicitly includes the right to mental health, as in the case of Italy.

In recent decades, the perception that mental health issues are affecting not only certain social or personal categories but can potentially affect anyone at any age has become clearer. This "democratization" of the disorder has helped to attenuate and sometimes to break down numerous taboos. In the same way, the "democratization" of treatments and care spaces has contributed to make the disorder more visible and accepted, liberating it from its segregation. In recent years, psychological distress has consequently lost its discriminatory characteristics.

Therefore, the sentence written on a wall of the Lab Museum of the Mind, hosted in one of the pavilions of the former psychiatric hospital of Santa Maria della Pietà in Rome "At a closer view, no one is normal", seems to be the motto of a transformation that has now taken place.

The data published by The Lancet in the article *Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the Covid-19 pandemic*, highlight the profound psychological impact left by the pandemic. The study interprets the data with the conclusion that "mitigation strategies could incorporate ways to promote mental well-being and target determinants of poor mental health" (Santomauro *et al.*, 2021).

The phenomenon observed by the research consolidates the belief that mental illness can affect anyone at any age under the occurrence of unexpected events or conditions.

The definition of mental health by the World Health Organization (WHO) helps to understand better the blurring limit between illness and discomfort. According to WHO, mental health is "a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" (World Health Organization, 2004). Therefore, designing with users' mental well-being in mind, automatically implies the consideration of some strategies and approaches used for mental facilities projects.

Among the strategies, the topological aspect is one of the fundamental factors for the design of any building. It validates the consideration of spaces as thresholds connecting the building with the urban and the natural environments.

4.2 Biophilic design and well-being

Following this notion of threshold – or, better, fading barriers – between nature and urban spaces, it is relevant to introduce the concept of biophilic and its application to cities, urban spaces on a macro scale, and biophilic design at the intermediate level.

Worldwide, pandemic restrictions on social distances and mobility have emphasized the need for interaction with external spaces and nature. Overall, the benefits of mental well-being associated with the natural environment and its integration into urban life have been universally recognized and appreciated. Contact with nature and natural light is beneficial for the well-being of the person in terms of the mood, the health, the spirituality; it enhances the body, the spirit and, in commercial terms, the productivity and the creativity as well.

O.C. Wilson refers to biophilia as the link of the human with the natural surroundings, the instinctive predisposition to affiliate and connect with nature (Wilson, 1984). This tendency is strongly felt in cities and urban environments where city life is intense. It is therefore undeniable that it is important to maintain a balanced urban lifestyle/natural environment in big cities. This intrinsic connection with nature and its dynamics is part of human life and its development. Human evolution benefits from the experiences of nature and strategies of adaptation, supporting the development of our species as distinct individuals and society. The link requires to be nurtured to continuously generate beneficial effects, therefore the need for a balanced inclusion of nature in built environments. Studies demonstrate the beneficial effects of biophilic design at urban and interior design levels on mental, physical health, overall performance, and well-being (Kellert, Calabrese, 2015).

It is an area of great interest for our society and the development of the built environment, currently inspiring many research and studies on the subject. The main goal of biophilic design in the build environment is to improve life-quality at all levels, including mental well-being.

S.R. Kellert, author of *Nature by design: The practice of biophilic design*, elaborates the universal principles of biophilic design, conditions addressed to enforce the biophilic design effectiveness in the human environment:

1. Biophilic design focuses on human adaptations to nature that advance physical and mental health, performance, and well-being.
2. Biophilic design creates interrelated and integrated settings where the ecological whole is experienced more than its individual parts.
3. Biophilic design encourages engagement and immersion in natural features and processes.
4. Biophilic design is strengthened by satisfying a wide range of values that people inherently hold about the natural world.
5. Successful biophilic design results in emotional attachments to structures, landscapes, and places.
6. Biophilic design fosters feelings of membership in a community that includes both people and then on human environment.
7. Biophilic design occurs in a multiplicity of settings, including interior, exterior, and transitional spaces and landscapes.
8. Effective biophilic design involves an "authentic" experience of nature, rather than one that is artificial or contrived.
9. Biophilic design seeks to enhance the human relationship to natural systems and avoid adverse environmental impacts.

It stimulates a comprehensive engagement with nature, generating a responsive and beneficial connection. It may be applied to a multitude of spaces and landscapes, embracing space users and positively impacting their mental health and well-being (Kellert, 2018).

Following this frame, the biophic design application uses strategies adaptable to different situations and conditions. Kellert and Calabrese, in *The practice of biophilic design*, identify several approaches of actions:

The **direct experience of nature:** direct experience with nature in the built environment. It focuses on the relevance of natural light; the air and natural ventilation for a better human comfort and productivity; the beneficial effects of water and fire mainly on senses and comfort; the positive presence of plants and structured vegetation, natural landscapes and ecosystems; the beneficial contact with animals; the weather and its exposure as human experience and part of life, generating positive stimulation and satisfaction.

The **indirect experience of nature:** the exposure to natural elements and processes. It includes the contact with images of nature; natural materials and colors; the simulation of natural light and air; the reference to nature for shapes and forms, **natural geometries**; the allusion to nature in different ways; the **information richness and diversity in relation to nature; the relevance of visible aging, changes, and the patina of time on elements reflecting the natural passage of time; the biomimicry, applying the processes and forms from nature to human solutions.**

The **experience of space and place:** the reference to dynamics and natural environment applied to human environment. It includes **prospect and refuge; organized complexity; integration of parts to wholes; transitional spaces; mobility and wayfinding; cultural and ecological attachment to place** (Kellert, Calabrese, 2015).

In conclusion, the biophilic design is beneficial for all the spheres of the human life (health and well-being) in the built environment at any level.

4.3 Threshold body and space

The mentioned experience of space and place includes the relationship body and environment. In this regard, fashion is an interesting field to be explored, considering that in recent years it has been often paired to well-being in a narrower or broader sense. A niche, often defined as slow fashion movement, responds to the issue under different aspects (environmental, mental, physical) and in different ways. The environmental well-being is usually pursued by the collaboration between designers, textile producers garment manufacturer and artisan makers with the aim of adjusting production methods and reducing waste. The mental well-being of the consumers is enhanced by the emotional connection to the product, for how it has been produced or designed. The physical well-being is satisfied by the absence of chemical in the textile and by the adaptable form/texture of the garment to the body (Thompson, 2019).

Apart from this movement, expression of a new trend in fashion, what is extremely interesting to observe is a less direct approach toward well-being by some avant-garde fashion designers. They

demonstrate a crossed approach between fashion and architecture with common application of personalization and topology concepts, validating the fact that well-being is a value shared by many creative disciplines at different scales.

Already in the 80's, the fashion industry started focusing on personalized solutions demonstrating that the mental comfort and well-being are not only obtained by the relationship of the individual with the space he inhabits, but also by the close connection between mind, body and clothes.

Issey Miyake in 1988 launched the fashion line Pleats Please, recently exhibited in the Kanazawa 21th Century Museum of Contemporary Art. The collection consists of an engineered fabric with no sewing that generates clothes of different shape, type and uses based on clients' requests.

With a similar aim, Moncler, thanks to the collaboration of the fashion designer Craig Green, has recently launched two collections of jackets, blousons, fishtail parkas, shirts, and trousers creating personalized dwelling described by the designer itself as "wearable habitats" (Yalcinkaya, 2019). The collections respond to physical needs and imply metaphorical aspects connected to nomadic and contemporary lifestyle. These poetic factors generate empathy between users, the space around the body and surroundings, providing, at the same time, well-being through protection and functionality.

4.4 Wellbeing and its application: case studies in the UAE

Many of the approaches previously introduced, find interesting applications in practices observed in the United Arabs Emirates. The Government of the UAE has a clear vision regarding mental well-being as society's common achievement. It has been set among the priorities of the Country with the establishment of the Ministry of Happiness and Wellbeing in February 2016 and the launch of a National Program for Happiness and Wellbeing (AE, 2017). The UAE has already successfully implemented some of the wellness and well-being best practices in the design of landscapes, public exterior and interior spaces.

Even though the city of Dubai in the United Arabs Emirates is geographically situated in a desert environment, it presents various green dedicated areas. The city is in constant expansion following the increase in population, generating a deep need for additional contact with nature and further green spaces. Increasing attention to green developments at urban and planning levels is rising and tangible. Several strategies have been studied and implemented with a greater focus on the development and maintenance of green areas in the city. Furthermore, attentive sustainable initiatives are focused on human and social well-being.

The Dubai 2040 Urban Master Plan dedicates great focus on these topics. Some of the strategies involve:

- improve the efficiency of resource utilization;
- develop vibrant, healthy and inclusive communities and double green and leisure areas to provide a healthy environment to residents and visitors;
- provide sustainable and flexible means of mobility;
- enhance environmental sustainability;
- develop a comprehensive legislation and plan a governance model to support sustainable development and growth.

The vision of the Plan will bring, among other goals, the green and recreational spaces to double in size; nature reserves and rural natural areas to constitute 60 per cent of the Emirate's total area; the establishment of several green corridors to link service areas, residential areas and workplaces; the facilitation of movement of pedestrians, bicycles and sustainable mobility means across the city; the increase in length of public beaches by 400 per cent (AE, 2021).

The Dubai 2040 Urban Master Plan is greatly promoted and supported by both public and private entities. Aligned with the Dubai 2040 Urban Master Plan and UAE's Vision for the next 50 years, Brand Dubai (the creative office of Government of Dubai Media Office) in partnership with Dubai Municipality, launched the Dubai Creative Parks Initiative, a call to redesign public parks across Dubai. Considering the Vision to double size the city green areas and other points, multidisciplinary teams of young talented Emirati including architects, interior designers and event planners engaged themselves in developing creative proposals for urban parks in the

city. The focus is on promoting a healthier lifestyle with sustainable proposals for a more balanced nature and urban landscape. The aim is to endorse well-being and happiness in the city and communities, involving the creative part of the society. Dubai's distinction as lifestyle destination will be further confirmed by these initiatives to improve citizens, residents and visitors' wellness and life quality, following Dubai 2040 Urban Master Plan's objectives (Brand Dubai and Dubai Municipality announce partnership to redesign public parks across Dubai, 2020).

Some recent built projects in Dubai are demonstrating the integration of nature into the urban landscape as seen in Dubai Hills Central Park, a notable example of green principles applied in the city and the community. The park is part of Dubai Hills Estate, it is designed by InSite International, Planners, Landscape, Architects, Allied Practice of KEO International Consultant, and developed by Emaar Group. The multi-purpose estate development (about 1,100 hectares) is planned in accordance with sustainable principles. The park is the "beating heart" of the whole planning, an outstanding green and recreational large area serving the community and the city. The entire expansion articulates from it, including residential and commercial areas as part of the whole development.

The park, located inland for a length of almost one kilometer, is well connected with the city's major landmarks. It promotes a healthy lifestyle for families and residents/nonresidents. Wellness and well-being are among the main priorities; this aspect is confirmed by several activities and events offered to the community. It includes vast green areas, running tracks, tennis tables, sport fields (football, tennis, basketball, volleyball), outdoor sports areas and gyms, picnic areas, kids play areas, dogs park, along with structured activities such as skate park, splash park and event zones. It is a large green oasis, articulated in surprising diverse landscapes alternating dry areas consisting of rocks, sand and typical desert vegetation linked to the territory, and green areas composed of different plant species. As part of the scenario, wisely planned water features create additional landscape articulation. The sinuosity of the undulated levels and hills creates interesting visual perspectives and embraces the visitors with unexpectedly diverse environments. The cultural connection to the

context is perceptible, highlighted by the selection of materials and the botanical path. The names and origins of vegetation are detailed to discover different types of plants, to develop knowledge of typical flora of the region.

The contrast to the surrounding desert creates an even stronger connection with the city and its development, generating a sturdy relation with the community and a growing sense of engagement. Knowing that community and city are the main beneficiaries of the urban developments, a sense of proudness and ownership emerge. The park is easily accessible from all the areas of the Hills Estate and from the external sectors.

The concept of fading thresholds between the interior and exterior space and between the building and the nature is also visible in the interior-exterior relationship of a building designed for the city of Sharjah, one of the seven Emirates part of the UAE. The House of Wisdom, the Cultural Center designed by Foster + Partners Architects, is an innovative oasis of knowledge celebrating Sharjah as UNESCO World Book Capital 2019. The project is a futuristic hub integrating library and cultural center, fully embracing the adjacent enclave. The purpose is to define an innovative meaning of library/cultural center in a contemporary and technological community and at the same time to create a highly comfortable space where culture and well-being merge together.

The building welcomes the visitors with a vast green landscaped garden and water features. The straights lines of its architecture are merging with the sand and dunes of the visible territory. The large cantilevered linear roof is perceived as floating on the glass facades. The external movable screens in bamboo allow natural light control, a priority of the space as direct connection to the outside.

The external and internal design is well integrated with the context and is inspired by the local traditions with innovative elements. Experiencing the building, the overall feeling is calm and nurture of the mind: a general well-being. In addition to the library and study rooms, it offers exhibition spaces, children's' dedicated space for education and knowledge, a F&B outlet, prayer room and women's area. All supported by technology.

The heart of the two-floors building is a central and double-height courtyard: the "knowledge garden", a place where green and natural

light meet and penetrate inside as an integral part of the experience. Water features enhance peace, the water sound comforts and supports meditation. The garden allows users to enjoy knowledge and nature as well as intense contemplation.

Several glass rooms, such as glass cubes, are distributed on the ground and on the first floor and are designated for studying and meeting. Some of them extend into the central garden, creating an interesting visual connection and movement of forms.

The entire building allows flexibility. Some acoustically insulated pods are distributed around the ground floor. They are equipped with remote functions for individual research while being inspired by the astonishing outdoor sight. The pods embrace users like a "nest" and promote a sense of protection in a personalized space. In addition, different seating configurations in the vast reading area offer solutions for collaborative and individual work. The variety of seating options facilitates the users' deep concentration through a customized experience.

As explained before, the mental well-being is not ensured only by the fading threshold between the nature and the building, but also by a smooth transition between the building and the city. This concept allows people to reconnect with the context that doesn't only mean being physically part of it, but also being socially and emotionally involved.

Among recent Dubai projects developed on the threshold concept, an interesting case study is Concrete, designed by OMA Architects in the artistic district of Alserkal, it opened to the public in 2017. It is a flexible space where exhibitions, performances and conferences take place. Additionally, it offers the possibility of directly bringing the art gallery's life into the urban public space in front of it and vice versa. The outdoor area and the indoor space of the building are linked by the presence of huge sliding-pivoting doors of the same height of the exhibition space. They also reconnect the scale of the city with the human scale. The distorted mirror effect of their surfaces, made by translucent polycarbonate, establishes a relationship between visitors and the gallery, between them and the *piazza*, and it creates opportunities for interpretation. This enhances the empathy with the site and the building.

Even in the fashion field, the UAE offers pioneering innovations and demonstrates to actively using the potential of fading the threshold between the body and the space with the aim of the mental well-being. As an example of project at the service of the mental well-being for fragile users, Sensewear by Witsense includes a series of clothes designed for people affected by autism. Witsense is a Design Collective composed by Emanuela Corti and Ivan Parati, both based in the UAE, and Alessia Moltani. Many items of the collection are connected with hidden sensors able to detect the heartbeat, body movements and the breath rhythm of the user. A digital input is then sent to the clothes through a Wi-Fi system in order to activate a wellness-related response from the clothes themselves.

Fig. 3 – PUMPME jacket by Witsense. Credits by Witsense.

The PUMPME jacket answers to users' stress by activating inflatable elements hidden inside the cloth. In this way, the jacket is able to apply pressotherapy to the body to calm and comfort the subject affected by autism.

The innovative and experimental approach done by Witsense suggests that in a very near future our clothes could systematically include digital devices and will be able to translate our physical and

psychological needs into a correspondent reaction providing overall physical and mental comfort (WITSENSE, 2017).

Dubai, defined in 2016 as the first Smart City in the Region (D'Mello, 2016), with connectivity and digitalization among its main goals (Dubai Plan, 2021), seems to be the perfect candidate for such future experimentation (AE, 2014).

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5. Post-pandemic scenarios of office workplace: new purposes of the physical spaces to enhance social and individual well-being

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Abstract

The hybrid working model, that allows employees to co-locate and work remotely (at home or elsewhere), seems to be prevailing, according to recent studies and the future projections developed in the post-pandemic new normality. The assessment of the two models has revived the debate over the new meanings of the office workplace and the experimentation on its spatial design.

This paper aims to identify the values and features that make the office space attractive and ensure its survival. It begins by analysing the creative experience of remote work gained by workers during the lockdown, identifying both issues and benefits given by the acceleration in the use of advanced digital technology and the innovations in the management of remote work. Then, the study retraces the debate on the design of office spaces and services in recent decades and the processes that have accompanied it, involving more and more employees.

Besides a certain continuity detected between the issues addressed before and after the pandemic, the study emphasises an emerging perspective that assigns a new centrality to the human being, understood in its complexity which goes beyond the user-centred approach, involving physical and mental well-being[1]. The paper will also

1. Among the multiple attempts to define the meaning of well-being (Dodge *et al.*, 2012), the UK Office for National Statistics has produced a model where the domain most relevant to the workplace is "personal well-being". Personal well-being can be thought of as *"life satisfaction based on an individual's perception of their health, happiness and sense of purpose"* (Cooper *et al.*, 2014). It is this perspective of personal

present the sustainability perspective, specifically the awareness on the impact of human behaviours and design choices on an urban and global scale.

5.1 Premise

The Covid-19 lockdown and the gradual reduction of the pressure of the pandemic emergency have offered an unprecedented opportunity to conduct a grand experiment that could accelerate the progress of projects and processes for future working models. They can help to implement design studies on the workplace, specifically on the co-located ones, in terms of quality of service and space, and testing their impact on people's lives.

The pandemic lockdown has led to a massive increase in home telework activities[2] thanks to the opportunities offered by the spread of ICT and the expansion of the applications of this technology in the working models. Afterward, the new normal condition, although not in a safe and permanent form, has allowed employees to return to work in their original workplace, full or part-time. Alternatively, they have chosen to work in a 'third place', other than their office or their home, taking advantage of the models of co-working spaces, previously reserved mainly for self-employed workers (Reuschke, Ekinsmyth, 2021). One of the main requirements linked to the success of this third format is its proximity to the workers' homes or other places that are part of their daily routine (school, supermarket, gym, etc.), resulting in savings on commuting time and cost, and representing a safety factor in times of pandemic, because it has allowed a reduction in the use of public transport.

This study analyses benefits and drawbacks linked to the different working models related to the above-mentioned places, trying to recognise specifically the new characters, in both spaces and services terms, of the 'co-located work' mode that motivates the re-existence, the

well-being, and its interaction with work and community, which will be considered throughout this paper.

2. In contemporary specialised literature, the expression 'working-from-home' includes both service and goods production. Therefore, this study adopts the expression 'home teleworking' meaning with 'telework' the ICT-based mobile work – TICTM – performed by employees who work remotely, away from their premises or fixed location, using digital technologies and the internet (Samek Lodovici *et al*., 2021).

success, and the smooth functioning of the business company office space. This 'in presence' mode can even be integrated with teleworking, considering that hybrid forms will probably be the successful ones in the future. Therefore, the final objective of this study is to determine the purposes that could be assigned to the office workplace in the future, adopting the point of view of the involved stakeholders (workers, companies, designers, etc.) and embracing an analytical perspective that puts the human being at the heart of these design strategies.

The issues of health protection and safety in workplaces add to the already growing attention (with respect to the spread of the virus) on the impact of ICT on the well-being of workers, understood more and more holistically, both as physical and psychological factors, with specific attention to workers' sociability. Indeed, part of the ongoing studies related to the 8th Sustainable Development Goal adopted by the United Nations dedicated to 'promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all' (UN, 2015) show great attention to ICT-based work and to workers' well-being. Coherently, EU institution's activities support strategies to enhance existing legal and policy instruments to consider the specificities of teleworkers, including their rights.

This essay analyses the mentioned topics in three paragraphs. The first one traces the recent changes in the working models, previously cited, generated and empowered by the lockdown and the intermittent post-pandemic recovery, considering the consequences in the organisation of time and space between public and private, and the repercussions on individual sociability. The second one aims to highlight the state of the art before the pandemic on the design models of the office workplace and the progress on the process strategies related to this activity. The third paragraph focuses on the office workplace. Starting from the previous highlights, it presents new horizons and learned lessons – consolidated by the experience of the pandemic – that might generate new scenarios.

The study is based on qualitative and quantitative information resulting from an academic literature review, and on the analysis of case studies integrated with interviews with stakeholders (office design companies and representatives of large businesses) invited to academic seminars, who contributed to illustrate the state of the art in workplace design culture.

5.2 Pandemic and post-pandemic lessons learned experimenting new working modalities

The forced isolation aimed to reduce the circulation of the virus in the most intense phase of the pandemic and, later, the timid resumption of economic activities, with the return to in-office work, have highlighted different approaches in the search for solutions on the work activity and its spaces. The 'stay-at-home' period has resulted in the experimentation of tactics, with a degree of improvisation, to solve urgent critical issues, testing self-made projects carried out with the use of easily available resources, in response to a disruptive situation of exceptional gravity, however temporary it was considered. On the other hand, with the perception of the beginning of a turn towards a new normal, the need to manage change emerges with greater awareness, evaluating benefits and drawbacks, also to guarantee certain stability and resilience while facing possible changes in the international health situation.

5.2.1 Lockdown and teleworking from home

The domestic confinement measures have stimulated the spread of teleworking from home, made possible by using digital tools, which have been key enablers in this process. The study on telework requested by the European Parliament's Committee in 2021 (Samek Lodovici *et al.*, 2021), allows us to frame the contents described in the previous paragraph, supporting them through scientific contributions and data collected by internationally recognised Observatories.

A Eurofound survey (Eurofound, 2020) conducted among the 27 member countries of the EU reports that in the early Covid-19 pandemic phase, 36,5% of people started working from home (compared to 15,8% pre-Covid-19) and 46% of them were teleworkers with no previous experience of remote working. Furthermore, Sostero and Milasi identify, through the concept of 'teleworkability', the working sectors in which teleworkers are concentrated: financial services, ICT sector, real estate, professional, scientific, and technical activities, public administration, and the education sector (Sostero *et al.*, 2020). The digitisation process, which was already underway pre-Covid-19, has therefore accelerated

important consequences on the behaviour of workers and their time and space at home.

The time factor and its management have undergone a densification process. If one of the benefits of telework is the elimination of time for commuting, on the other hand the working time becomes longer and more irregular. The computer platforms system for remote work manages breaks, inputs, and outputs typical of co-located work using machine rhythm, no longer marked by the rituals shared with colleagues in presence. In addition, the private 'domestic' time is much more than before, but less defined and often contaminated by work. The term 'Autonomy Paradox' clarifies how the value of working time flexibility, presented as one of the first benefits in interviews with teleworkers, is at the same time a reason for causing higher stress levels and a disrupted work-life balance (Mazmanian *et al.*, 2013). In fact, one of the increasingly urgent policies regarding the protection of teleworkers is the 'right to disconnect'.

In the same way as the time factor, teleworking space overlaps with the domestic one, in teleworking from home. Its organisation is densified and enriched with equipment – activity-based settings – permanent or temporary, bringing to the foreground critical issues on a domestic scale, generated by promiscuity with family members and privacy management.

Finally, the office workspace was also the elected place for relationships, collaboration, and sharing. Therefore, the shift to teleworking has caused profound changes in these factors, too. On the one hand the intensive use of ICT has generated relevant advantages in collaborating across physical and organisational boundaries, overcoming new confines, on the other hand it has significantly affected the nature of social relations, reducing the opportunities for emotional and direct social interactions with colleagues. It has increased the feeling of being isolated, causing stress and impacting work satisfaction and the perception of remote work productivity (Toscano, Zappalà, 2020). Here too, therefore, we can retrace a paradox similar to the one described above.

5.2.2 Starting experiences of new normality

The gradual lifting of the state of emergency caused by the pandemic, and the increase in the number of vaccinated individuals, have favoured the partial reopening of offices in compliance with social distancing policies. However, both employees and companies have recognised the benefits of remote working. In fact, even if teleworking from home suffered a reduction in the intermittent post-pandemic period, a percentage of workers keep working from home or have chosen to alternate remote and presence-based working. A significant number of workers prefer to look for the already mentioned 'third place' which is increasingly characterised by urban proximity to the place of residence, and that is offering advantages such as the provision of shared facilities and services, removal from domestic distractions, and the implementation of social relationships. Therefore, the office workplace is facing a spatial fragmentation and re-location, also in this case accentuating a process that was already underway. In fact, the thematic literature reports expressions like 'extended workplace' and 'multi-location work' (Hislop, Axtell, 2009; Martins, 2015) bringing forward implications about the workers' experiences on how the workplace is conceptualised. Some private companies take advantage of these solutions to de-localise their office spaces by creating dedicated local hubs. The representatives of the European Trade Union Confederation (ETUC, 2021) reported two opposite views by companies on teleworking: one group fears a loss of individual productivity and wishes to return to a pre-Covid-19 situation. Instead, the other has seen an increase in productivity and seeks to implement an even wider use of teleworking, by integrating the equipment for home workstations and offering welfare support through courses. Moreover, internal teams of experts can be charged with managing actions, increasingly integrated into the company routine, to ensure the workers'.

The approach of the Municipality of Milan is very interesting in this respect because it has taken the pandemic as an opportunity to start renewing the way of inhabiting the city and using its services, basing its interventions precisely on processes and places related to the work activity. The experience of teleworking, strengthened during the pandemic through Extraordinary Agile Work – *Lavoro Agile*

Straordinario – by the employees of the Municipality of Milan[3] resulted in a high degree of satisfaction (shown by approximately 5,800 questionnaires) and the desire not to regress (Tajani, 2021a), representing a strong transformative potential at different levels with repercussions both within the workplace and on the urban scale. In fact, the second observation raising from the previous one, brings to the fore the debate on the 'city of 15 minutes', the opportunity to invest in projects that satisfy proximity-based needs rather than in large infrastructure (Moreno, 2019), through the contributions of businesses, administrations, and associations, based on the concepts of polycentrism, proximity, and hybridisation. This position is supported by a number of studies developed by Politecnico di Milano and Università Cattolica del Sacro Cuore, in cooperation with the Municipality[4]; they show that the distribution of co-working spaces is already increasing in the city's outskirts, getting closer to workers' houses, and that the transformation of co-working, although reduced in the number of workstations for independent workers, is increasing in the number of employees, especially in large co-working places. The Municipality of Milan, with the enhancement of the 'smart working' experience, combined the previous two perspectives of analysis defining (through informal terminology) the concept of *near-working* (Tajani, 2021b), allowing its employees to work remotely at decentralised offices, placed in dismissed spaces or existing co-working ones, and setting precise policies for 'smart working', range of coexistence and connection with the work team, flexibility in working hours, and the right to disconnect. Finally, in May 2021, as part of the Milan Smart City alliance, workspaces adhering to the 'Smart Work Community' and available to employees of the Municipality in 'agile work' were identified.

3. In Italy the terms 'smart working' and 'agile work' are used interchangeably. They refer to the same organisational and working model of telework, as defined at the beginning of this essay: working as an employee of a company from a place other than its headquarters, with equipment provided by the company and in close relationship with it.

4. The research projects and the results of the surveys are available at the 'Osservatorio Smart Working' of the Department of Engineering Management of Politecnico di Milano, the Transformative Actions Interdisciplinary Laboratory – TRAILAB – of Università Cattolica del Sacro Cuore, the Department of Architecture and Urban Studies – DASTU – of Politecnico di Milano, and specifically in Mariotti I., Akhavan M. (2020), "Gli spazi di coworking a Milano: localizzazione ed effetti sul contesto urbano", in Aa.Vv., Costellazione Milano. Contributi di ricerca per un'esplorazione del campo urbano, Milano: Fondazione Giangiacomo Feltrinelli, 146-165 (in Italian).

The result that emerges from these surveys is that the changing of spatial-temporal working patterns, the new spatiality of workplaces, and the multilocation work have an urban impact connected with research on health, job quality and well-being.

5.3 Pre-pandemic debate on design projects and processes of the workplace

The pandemic has boosted unprecedented changes in the rethinking of processes and projects of workplaces, and their purpose. However, these changes were already happening pre-Covid-19 time, though with a less determined approach.

In recent years, investments have increased towards the reshaping of the physical work environment (McCoy, 2005; Goldhill, 2013), and the demand for better workplaces with a greater awareness and knowledge about the impacts of indoor spaces on psycho-physical well-being (Anthes, 2020). Organisations have experimented with temporary solutions, pilot projects, and at the same time by exploring new ways of working (Brownson, 2004) for short and long-term scenarios, since workplaces can become drivers to enable values such as employee engagement, company's feeling of belonging, talent attraction.

Interesting results have emerged from studies that focussed on the relationship between office characteristics and employees' behaviour (Oldham *et al*., 1983). Surveys and studies have monitored and evaluated the pros and cons of the impacts of office layouts typologies and the effects of processes on people (Vischer, 2008). Indeed, characteristics such as productivity, satisfaction, and mental well-being of users are significantly influenced by design factors such as desk location, furniture, lighting, finishes (Kwon, Remøy, 2020).

5.3.1 How user needs can shape the spatial layout

De Been and Beijer (2014) already revealed that the type of office is a significant predictor for employees' productivity, concentration, communication. In fact, during the past decades, many layout models have been implemented, often named with acronyms, that companies

have adopted for their spaces with low testing of the solutions with user's needs.

From the Cellular Office, where one person occupies a room, to the 1960s when the Open Plan Office – OPO – configurations spread around the world, a layout preferred mostly for reducing overhead costs and footprint, with characteristics such as openness, flexibility, and few interior boundaries (Bodin Danielsson, Bodin, 2009). Several studies have identified some negative factors associated with open-plan offices, such as noise, lack of privacy, loss of control over work, that are considered responsible for a decrease in work efficiency (Ayoko *et al.*, 2020).

To counteract the weaknesses of these configurations, companies started shifting from OPO to spatial layouts focussed on the employees' activities, such as the Activity-based Working offices – ABWs – where employees choose their workstation according to the work activity carried out at any one time, and the so-called work settings provide support to a variety of working activities (Appel-Meulenbroek *et al.*, 2011; Seddigh *et al.*, 2014).

A clear difference between OPOs and ABWs is the office use. The OPO applies assigned workstations while the ABW applies a non-territorial workplace concept with flexi-desking (van der Voordt, 2004; Rolfö *et al.*, 2018). Studies have shown that satisfaction increases in ABW compared to OPO, though there are still some unsolved issues, such as workstation shortage, nesting, lack of auditory privacy, and difficulties in finding colleagues. These results have led to a variation of ABW concept into Agile workplaces – AW – constantly transforming, adjusting, and responding to organisational learning (Joroff *et al.*, 2003; Keeling *et al.*, 2015).

Companies have also mixed some models, for example KPMG Australia moved their Sydney-based employees to an OPO site (Evans, 2015) that combines ABW and AW principles (i.e., to break down physical barriers and promote cooperation and collaboration across divisions). With the spread of coworking spaces, companies have approached hybrid models, such as the "Hub model" which promotes multi-location work; Pinterest ended a lease obligation in San Francisco to boost new ways of working and a "more distributed workforce" (The Economist, 2020).

In order to enhance the employees' well-being, specialised spaces have been integrated into the workplace, such as the "Energy hub" by

Generali, in Milan, where an entire floor of the Zaha Hadid tower is dedicated to “cocoons” for solitude and restoration and spaces for free courses, training, and to practice meditation. This model can promote new testing activities to respond to the specific needs of individual users and the community.

Fig. 1 – Energy Hub of Generali Group in Milan, designed by Design Group Italia, 2019.

5.3.2 Space planning as an engaging process

More and more frequently designers’ approach to workplace projects integrates participatory processes, able to translate insights from the end users into tangible solutions. This is achieved by listening to them, capturing their impressions via surveys, focus groups, data collected by qualitative and quantitative methods, real-time observations.

Following this approach, the end users have to be engaged also in the decision-making process. Several studies demonstrate how user participation in the design process has a positive effect on people’s responses on their workplace (Lee, Brand, 2005; Veitch, Newsham, 2000). People who participate in decisions about the space, are more likely to have feelings of belonging and ownership (Vischer, 2008). A 2016 Gallup Poll notes that teams with high employee engagement rates are 21% more productive. User involvement decreases misuse of the workplace (Appel-Meulenbroek, Groenen, Janssen, 2011) and supports shared understanding of why it is necessary to implement a change (Nielsen, Randall, 2013). Case studies, such as Studio TILT Spitfire Audio project, show a design process based on codesign methodology

as described in the 2013 book, 'Codesigning Space' (Egan and Marlow, 2013); the process led to a design that is inclusive and responds specifically to the needs of different groups of employees.

Based on data collected through a series of collaborative workshops performed across all stages of the project, Studio TILT provided design solutions to facilitate the company culture and its ways of working. The project consisted not only of a spatial design, but also resulted in the creation of a series of bespoke workstations to match the requirements of each of the very varied Spitfire teams. Quiet and loud zoning, different types of enclosed and semi-enclosed spaces, differentiation of the types of furniture following the collaborative/focused scale, indoor plants, were all thought through to best respond to the users' well-being.

Fig. 2 – Collaborative Workshop performed in all stages of the project of Spitfire Audio Office, designed by Studio TILT, 2013 (Photos by J. Tate and J. Donovan).

Despite the benefits of user engaging processes, companies' space planning approach often seems more based on top-down corporate policies than on a thorough analysis of the advantages and disadvantages of alternative models. As mentioned before, issues related to the adoption of non-ad hoc layout models and processes raise questions that still have to be explored, that affect the users' well-being at different levels (Wineman *et al.*, 2018) and become opportunities to be challenged by addressing design solutions in terms of space planning and processes, whether it is about headquarters or third places (any other spaces where work is done) to rebalance productivity and well-being.

5.4 Relaunching the office as a space where people want to go

The office is still considered the strategic location with spaces where "meanings are constructed" (Courpasson *et al*., 2016), able to enhance feelings of belonging and to facilitate different working experiences (Brown, 2009). Indeed, results from interviews with decision makers demonstrate that the physical spaces of the office will still be "very important" in the future and companies such as Netflix and Yahoo still conceive the traditional way of working (in presence) as the only possible efficient model if compared to remote working experiences (The Economist, 2020).

Nowadays, the design of the office space is a key element to frame the employee value proposition since satisfaction and happiness are strictly related to the quality of spatial experiences (as cited in the previous paragraphs). Its functions deserve to be challenged to create purposes that bring people in, a place people want to travel to.

5.4.1 The office as a "listening" space

As mentioned before, participatory processes improve user satisfaction, and the importance of focusing on people as individuals has improved, as a consequence of the pandemic. Addressing the right solutions to meet all the different users' needs is hard due to many uncertainties, such as varied human behaviour, change of workforce, and lifespan of projects and processes. Data-driven recommendations about the design (or renovation) of office spaces and sharing the process including the end-users can minimise the negative effects and support employees' wel-being. A fruitful planning process to engage people can involve design thinking as a human-centred approach, in particular those strategic activities to gather feedbacks, test and prototype design solutions. Data collection can be performed through quantitative methods such as online surveys, and qualitative methods such as observation studies, shadowing, interviews, ethnographic studies (Reeves *et al*., 2008). These last and hands-on activities should take place in dedicated office spaces, to get deeper insights, to prototype and test design solutions together. Having a physical space to engage

users, to listen to them, speeds up the process of the definition of needs, desires, and expectations. In-presence activities, with a high level of engagement required, are more effective than those attended remotely, that make people less likely to ask quick questions and share ideas. In-person meetings are also a way to combat the "zoom fatigue" (Wiederhold, 2020).

5.4.2 An equipped space to manage a new hybrid model between physical and virtual

The hybrid in-presence and remote working format will prevail in the future (Grzegorczyk, 2021) since employees will not agree to go back to five days of commuting (Gensler, 2020b). They prefer the experienced flexible working conditions, visiting their office only for specific reasons and to provide working support. Leaving aside the reasons related to the value of office relationships, the co-located working space can in fact offer services, infrastructure, equipment, high technology and fast internet that sometimes cannot be found in the remote workspace.

Setting the stage for the hybrid working format requires particular attention in the design and management of space to ensure and provide for a sufficient quantity of individual in-presence workstations every day (also following the pandemic safety requirements) and keeping track of on-site employees. The adoption of a hybrid working format leads companies to manage a number of people in the office space that can vary from day to day. Multipurpose rooms, equipped with movable and modular furniture, analogue and digital tools, can act as diaphragmatic spaces. Architectural elements such as bifold doors and sound-absorbing curtains can adjust the size of these space according to the number of people and the activities they host.

The search for models of spatial design to enhance and exploit this respiratory expansion and reduction movement of the environment, through new advanced spaces and services, will constitute one of the main future issues in the real estate sector.

In fact, one of the main challenges in designing new office spaces in presence is to use technology as a bridge between physical and digital. The level of maturity of technological developments, the hyper connec-

tivity, the intensive research on augmented reality, Internet of Things and artificial intelligence can offer an accurate 'phygital' experience (Zurlo *et al.*, 2018) – a neologism that results from the synthesis of the terms "physical" and "digital" often applied in the field of retail design – suitable for different business models and stages of remote working implementation and supporting a wide variety of mixed remote and physical working strategies. They can shape interconnected environments, human computational interface experiences, improving experiences both at the office and in workspaces at home (Averno, 2020), reducing the risk to put remote workers at a disadvantage.

5.4.3 Rebalancing territoriality and individuality

As previously introduced, privacy, territoriality, and communication affect the occupants' satisfaction and performance (De Croon *et al.*, 2005). In particular, a lack of privacy and personal territory can cause overall dissatisfaction in workplaces (De Been, Beijer, 2014). Indeed, according to the 2020 research conducted by the 'Osservatorio Smart Working' of the Politecnico di Milano, socialising (68%), encounters with external visitors (58%), strategy meetings (43%) and training (32%) are some of the activities that will be most likely to be found in the office of the future.

A growing demand for tailored design solutions is raising, where strategic balance between territorial (team) and individual spaces, and proximity among those, should be sought.

Recently, many companies have been adopting hot desking models, a non-territorial strategy that became popular with the spread of coworking spaces. This choice, where no desk is assigned, influences the way people interact within their team, and teams with others. Spaces should match workflow and user needs with zones able to respond to various levels of concentration and teamwork (Kaarlela-Tuomaala *et al.*, 2009). If teamwork is a prominent activity of the company, team zones should be located (Wohlers, Hertel 2016). Hot desking models could be applied to the teams' assigned areas, that can change, or be relocated, from time to time on a project basis. This way territoriality is kept for a certain amount of time, and collaboration is facilitated among team(s).

In addition, overlapping functional transition spaces and intentional high traffic areas can drive communication and encourage cross-teams' interactions. To avoid separations and spatial boundaries, proximity of team areas can be considered, and in-between spaces can be located strategically between team areas to create informal "collisions" and non-scheduled encounters. These can be highly beneficial as a source of idea generation, of spontaneous interactions, creating and sharing opportunities also for those who are introverted. They support those non-work activities (drinking coffee, breaks that can be imported from the working from home experiences without altering the effectiveness of the workplace, and actually improving communication.

Aside from being a place where teamwork is fostered, the office has also to embrace the needs on a personal sphere, related to privacy. Surveys and research results, as already presented, reveal that individual spaces for concentration and focus activities will be highly demanded in the future. Closed soundproof rooms, designed to provide single-oriented activities, can also avoid the noise level of other office spaces.

Nowadays, with flexible policies, people can choose to work from home and remotely. However, providing environmental experiences like home ones at the office, decreases the feeling of being isolated, lowers stress levels; at the same time being at the office allows people to increase the opportunities for emotional and direct social interaction with colleagues (Toscano, Zappalà, 2020).

5.4.4 High quality environments to strengthen the employees' sense of belonging and unique experiences

Social isolation, a sense of loneliness, and uncomfortable work-stations, linked to working from home, increase the demand for high quality physical spaces, able to provide unique working experiences and to strengthen feelings of belonging, well-being at work, and ownership.

User control over lighting, thermal comfort, noise (Kwon *et al.*, 2019) creates a level of agency which makes people feel in a familiar environment with degrees of experience customisation according to their needs. This can be achieved by providing movable fixtures such as acoustic panels, dimmable lighting system, smart HVAC controls. Since people have sensory experiences, and design affects all of five

senses, the office could offer a variety people can choose from; ergonomic furniture to provide different postures during the day to achieve physical comfort, various work settings to meet work tasks' requirements. This will allow creating a quality space that works for the majority of people.

As noted in the previous paragraph, one of the main activities in the future of the office will be meeting with external visitors. In fact, the office space can be a brand ambassador, designed also to enable clients and visitors to understand the brand, and employees to feel a part of it, to connect people to purpose on a deeper level. Objects as storytellers, embedded in the workspace such as personal items and physical elements (trophies, teams' memorabilia, branded items) help to inspire individuals and unite communities to communicate the company's values. Since 1970 Hiscox introduced art to its offices as a way of offering its employees something that stimulates, excites, interests them, the presence of such objects impacts on people's tasks, and creates a unique experience everyone has access to.

5.5 Conclusion

The reduction of the pressure of the pandemic emergency has revealed the importance of the experience gained with remote work and the desire to consolidate a hybrid way of working between remote and in-presence, considered as a more sustainable and harmonious solution for both the daily life of human beings and for the well-being of the planet. Therefore, this study aimed to identify the reasons that could allow the office space to confirm its usefulness and renew its role in a hypothetical future scenario of a return to normality.

The study has been carried out trying to retrace the factors emerging from the different perspectives of the stakeholders involved, thus including surveys reporting the opinions of workers and company leaders and the debate carried out by designers and companies engaged in the office interiors design and production.

The first part is dedicated to the transition from in-presence work, lockdown, and the gradual return to the so-called new normality, tracing benefits and issues. The second part describes the pre-pandemic state of the art concerning the debate on the design of

office spaces and its processes. The third part is dedicated to trying to connect the factors that emerged in the previous phases, thus combining the existing contents concerning office interiors projects and the new values that emerged during and after the pandemic. Some guidelines originated from these analysis activities that could each constitute a starting point for further analysis on the value of office space in future scenarios:

– engaging employees, according to a human-centred approach, since physical space and in-presence activities produce more effective results in defining the users' needs and expectations;
– fostering relationships, supporting informal encounters through collision spaces and advanced team-working in equipped locations to encourage in-presence and remote cooperation;
– supporting individuals, providing privacy for single-oriented work tasks through controlled workspaces and extra addressed services
– implementing technology, enabling interaction and management, through equipped 'phygital' services smart spaces, a hybrid between physical and digital-services and smart spaces
– exploiting spatial capability, including extra services to foster active sociability through multipurpose environments;
– designing experiences, fostering the employee perception of the company identity, opportunity for leaders to reinforce the employees' loyalty through the high quality of the environment.

ENGAGING EMPLOYEES	to better define users' needs and wishes	on-site activities
FOSTERING RELATIONSHIPS	to promote advanced hybrid teamwork	dedicated smart environment
SUPPORTING INDIVIDUAL WORK	to support individual-oriented work	high quality environments and addressed services
IMPLEMENTING TECHNOLOGY	to enable interactions and management	equipped phygital settings
EXPLOITING SPATIAL CAPACITY	to include extra services	multipurpose environments
DESIGNING EXPERIENCES	to foster a brand community	controlled spatial quality

Fig. 3 – Summary of crucial guidelines for the post-pandemic office workplace resulted from this paper analysis.

The pandemic and post-pandemic working experience seem to have fostered a transition to a new role and value of the office workplace, which places human well-being as a factor that generates innovative meaning in the office interior. In this sense, the office space is no longer interpreted in a competitive sense in respect to the remote workspace, but as complementary. The office space tends to have a lesser connotation of control, acquiring more and more a supportive and enriching function, considering human beings in their complexity, including physical and mental factors, and their insertion in a cultural and territorial context.

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6. Color and lighting in the new healthy domestic landscape

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Abstract

In the last 200 years, a radical transformation of society has taken place, the Industrial Revolution. People's activities have been transformed with mass migration from the countryside to urban centers and the development of industrialized societies. In a few generations, humans shifted from a life spent working in the countryside open air to one mainly in closed environments, with little natural light and subjected to artificial light. Observing this radical change in living environments that took place over a few generations, in this chapter, we address the complex question of the physiological effects of light and color in interiors on the health of human beings, which have been scientifically proven in the last twenty years. Besides, the risks and benefits to health arising from non-image-forming (NIF) effects of light are highlighted, and the limitations of light and color design in indoor environments compared to outdoor environments. Even though extensive neurophysiological research has demonstrated the importance of proper NIF management for human health, this is virtually absent in the design practice. Concerning these physiological effects, we also introduce the application implications that this scientific innovation is starting to have on the design methodology of residential interior design, in the delicate balance between natural light, artificial lighting, and colors.

6.1 Introduction: chronobiology, this unknown science

To understand the dimension of socio-economic change and the change in lifestyles, we consider that in Europe, in 1800, only 2% of the population lived in cities. It has been estimated that in today's industrialized world, people spend between 80 and 90% of their time indoors (Leech *et al.*, 2002; Evans, 2003; Mccurdy and Graham, 2003; Schweizer *et al.*, 2007; Boubekri, 2008). Based on this strong change in lifestyles, we can see that 200 years are nothing compared to the evolution of human beings and, from this point of view, the change of the environments where we live and our exposure to artificial lighting must be considered a factor of very recent introduction (Stevens, 1987). Under these conditions the light, the colors, the image of the surrounding environment perceived, differs considerably from the outdoors in which we have evolved for millions of years.

The word circadian, created from Latin words circa and diem, describes a periodic biological cycle that lasts roughly one day (Halberg *et al.*, 2003). The first scientist asking questions and observing the circadian rhythm was Jean-Jacques de Mairan (1729), with experiments on the Mimosa Pudica plant. He described that the opening of the flowers during the day and their closing at night persisted, also placing the plant in the dark, concluding that there is an internal biological clock that acts as in the plant. In the following century, the experiment on Mimosa Pudica was repeated, observing that the plant follows a cycle of about 22-23 hours (de Candolle, 1832). Despite these discoveries, many scientists rejected the idea of a clock in living organisms while supporting the existence of an exogenous factor due to Earth's rotation. They tried to find this factor empirically until the twentieth century when the foundations were laid for the science called chronobiology (Foster, Kreitzman, 2005).

Until 1980, the effect of light on the biological cycle of various mammals was observed, but it was believed that this could not also happen in human beings. It was erroneously hypothesized that this could have been an evolutionary advantage with respect to other mammals (Perlow *et al.*, 1980). On the contrary, famous research published in the Science Journal has demonstrated that light also affects humans' biological clock (Lewy *et al.*, 1980).

A timed system acts in our organism, managed by the suprachiasmatic nucleus of the brain, which lasts about 24 hours, through which all physiological processes such as sleep, nutrition, hormone production, blood pressure, body temperature, digestion, psychological alertness, coordination and muscle strength are managed (Klein, Moore, Reppert, 1991). It is important to emphasize that all of these factors have a daily cycle of action and also act on the effectiveness of our immune system. To know the actual timing state of our circadian cycle, the most effective method is based on the measurement of the amount of melatonin in the blood (Rosenthal, 1991; Lewy, Cutler, Sack, 1999). Melatonin is a hormone produced by the pineal gland under the control of the suprachiasmatic nucleus. In an individual with a correct timing of the circadian rhythm, melatonin increases in the evening hours immediately after sunset and begins to decrease before sunrise, remaining low during the day. However, the circadian clock needs to be synchronized for the needs of life on Earth, and the exogenous element that generates this synchronism is daylight. Indeed, in the absence of the rhythms of natural light, due to the Earth's rotation, the clock can go out of phase with multiple implications for our health and well-being (Evans, Davidson, 2013).

In the last 30 years, there has been increasing interest in research into the NIF effects of light and color on humans (Küller *et al.*, 2006; CIE, 2015; Westland, Pan, Lee, 2017). NIF has a direct effect on the human central nervous system which affects the brain waves as detected by an EEG (Badia *et al.*, 1991; Noguchi, Sakaguchi, 1999), the subjective alertness (Daurat *et al.*, 1993; Cajochen, 2007; Smolders, de Kort, Cluitmans, 2012) and people's moods (Lewy *et al.*, 1982; Küller *et al.*, 2006). Lighting have also effects on our behavior (Flynn *et al.*, 1973; Baron, Rea, Daniels, 1992) and the working memory (Miyake, Shah, 1999) which is an important element of cognitive psychology for problem-solving skills (Huiberts, Smolders, de Kort, 2016; Okamoto, Nakagawa, 2016) and learning (Mayron *et al.*, 1974; Keis *et al.*, 2014).

These arguments, mainly developed in the research area of chronobiology, have long been ignored in the design field and the lighting industries. The reasons for the lack of planning and production attention are many. On the one hand, there have been more than ten years during which the manufactures were committed to implementing the

new technologies of solid state light sources as a primary objective of research and development. On the other hand, there is a lack of demand, concerning this type of design innovation, due to total ignorance of these issues by users and designers.

The interest in research concerning the quality of life indoors has also increased a lot today after the awarding of the Nobel Prize for Physiology or Medicine 2017 to Jeffrey C. Hall, Michael Rosbash, and Michael W. Young for their research that demonstrated molecular and genetic mechanisms that control circadian rhythms (Davis, Sample, 2017).

6.2 The new domestic landscape and the IoT

In recent years, the design of the domestic landscape has seen in the advent of new Internet of Things (IoT) technologies, an element of unprecedented technological innovation, which has very important implications in interior design and well-being of people. This layer of the project, in the new domestic landscape, concerns the design methodologies and technologies available to lighting designers, but also the vast area of makers and all those who operate in the do it yourself (DiY) sphere. Nowadays, makers are independent designers who design and produce for the benefit of themselves, or to sell their custom designs to others (Anderson, 2012). Their design is based on a continuous experimental activity, different from the logic of economy of scale, achieving a new relationship with the project, which often lays its foundations on open source and open project systems that are spreading in the domestic context (openHAB, 2018; Home Assistant, 2021).

In the history of design self-production and DIY has been an established reality for many years, whose importance has gradually expanded over time to various product sectors, including, very recently, thanks to the advent of solid-state lighting, also the lighting sector. With the advent of voice assistants, this trend has accelerated even more in the home environment (Young, Young, 2018). Before LEDs, lighting sources mainly used low voltage (110-230VAC), with the consequence of having to comply with a series of certifications necessary to ensure the electrical and thermal safety of the product

that were not within the reach of makers. LEDs, on the other hand, have an extra-low voltage supply (<50VAC and <120VDC) and the electrical certification concerns the LED driver, which takes the mains voltage, transforms it into extra-low voltage and today can also be IoT connected. The LED driver powers the LED sources and becomes part of the project as an already certified device. As stated by Michele De Lucchi (2011) the availability on the light source market of new semi-finished products, such as LED modules and LED strips, now provides lighting designers with fascinating new degrees of freedom in interior lighting design.

In the context of wireless local area networks, the definition of Bluetooth 4.0 in 2009 laid the groundwork for the use of Bluetooth Low Energy (BLE) as a communication medium, through very reliable mesh-type networks, to control systems in the home. The difference with the pre-existing Wi-Fi lies in the lower power consumption of BLE and the limited amount of data that BLE can transmit, which is still adequate for a network that handles control signals. Other recent mesh-like networks similar to BLE are Zigbee and Z-Wave (Tross, 2019). It is in this context that, in recent years, lighting communication and control systems (LMS) born directly in the IoT context have been developed.

In the era of wireless and LEDs, today luminaires can also free themselves from the constraints of the power grid while maintaining the archetypes of home lighting, providing a welcoming mood also in the transition areas between interior and exterior. Such as the innovative MESH lampshade in turned, painted and corrosion-resistant aluminum, equipped with rechargeable batteries, designed by Marco Acerbis for Platek that was used in the indoor/outdoor transition spaces in the Alabriga Home Suites project in Girona.

Fig. 1 – Wireless power supply. MESH lampshade by Marco Acerbis at Alabriga Home Suites, Girona. Archt. Aryanour Djalali. Lighting Design: David Vilà, Espais d'Illuminacio. Photo S. Rotger. Courtesy Platek.

The impact of the IoT on the domestic landscape concerns the home automation themes related to the control of home systems, on which the "smart home" concept of the IoT has been superimposed today. These terms are often used interchangeably although they are not the same thing (Young, Young, 2018). Home automation works independently and should be able to adapt to people's preferences, so it is one of the possible functions of the smart home. In the modern smart home, there is also the possibility of system access interfaces ranging from smartphones to voice assistants, with the ability to easily integrate new devices and control functions from different manufacturers. Home automation always requires a design made by professionals, while the smart home is also part of the DIY to try to create a safe, comfortable, low power consumption and open environment, which is easy to upgrade and reconfigure (Leitner, 2015). In the smart home, the project covers the management of audio-video entertainment systems, temperature, shades, security and all IoT devices in the home, increasingly including artificial lighting.

LMSs have entered residential environments with two different approaches: those existing before the advent of the IoT have adapted,

developing devices to interface the IoT. Other newer ones, found in some LED drivers, have integrated directly into the IoT using BLE or Wi-Fi communication networks. In addition, next-generation LMSs, to be truly smart, need fundamental inputs to be able to relate to users and the indoor environment: sensors that detect the presence and location of users and sensors that can determine the amount and color characteristics of the light present in the interior.

Among the pre-existing communication systems, the main communication standard used since the 1990s for general lighting control is the Digital Addressable Lighting Interface (DALI) (IEC, 2018). This system can connect up to 64 devices, such as light sources, but also other devices such as switches, dimmers, sensors of various types and other compatible devices. Initially, the DALI network was only wired but today, through a gateway device, it can also be a wireless BLE and Zigbee. In 2019, the standard was upgraded to D4i, which facilitates the integration of sensors and communication devices, enables correlated color temperature (CCT) and color control, as well as defining new capabilities to store and report diagnostic data to the LMS. The introduction of tunable white LED lighting to the market, along with sensors, enables CCT control of light in interiors.

An example of tunable white lighting design is the renovation of a Victorian townhouse on Powerscroft Road in London's Clapton district. The aim was to adapt it to the needs and tastes of modern living. The lighting design integrates discreetly into the architecture in terms of visual continuity, without imposing itself and at the same time offering a lighting solution that makes it possible to create the ideal environment for various activities and the best atmospheres for different occasions. The result was an environment characterized by a harmonious fusion of Victorian and contemporary architecture, with clear visual and sensory references to the intended use of the different rooms. Tunable white dimmable lighting, with CCT varying between 1,800K and 6,500K, was designed to create the ideal environment for different activities, using Reggiani's Mood and Yori luminaires, connected in a BLE mesh, programmable and controllable via smartphone.

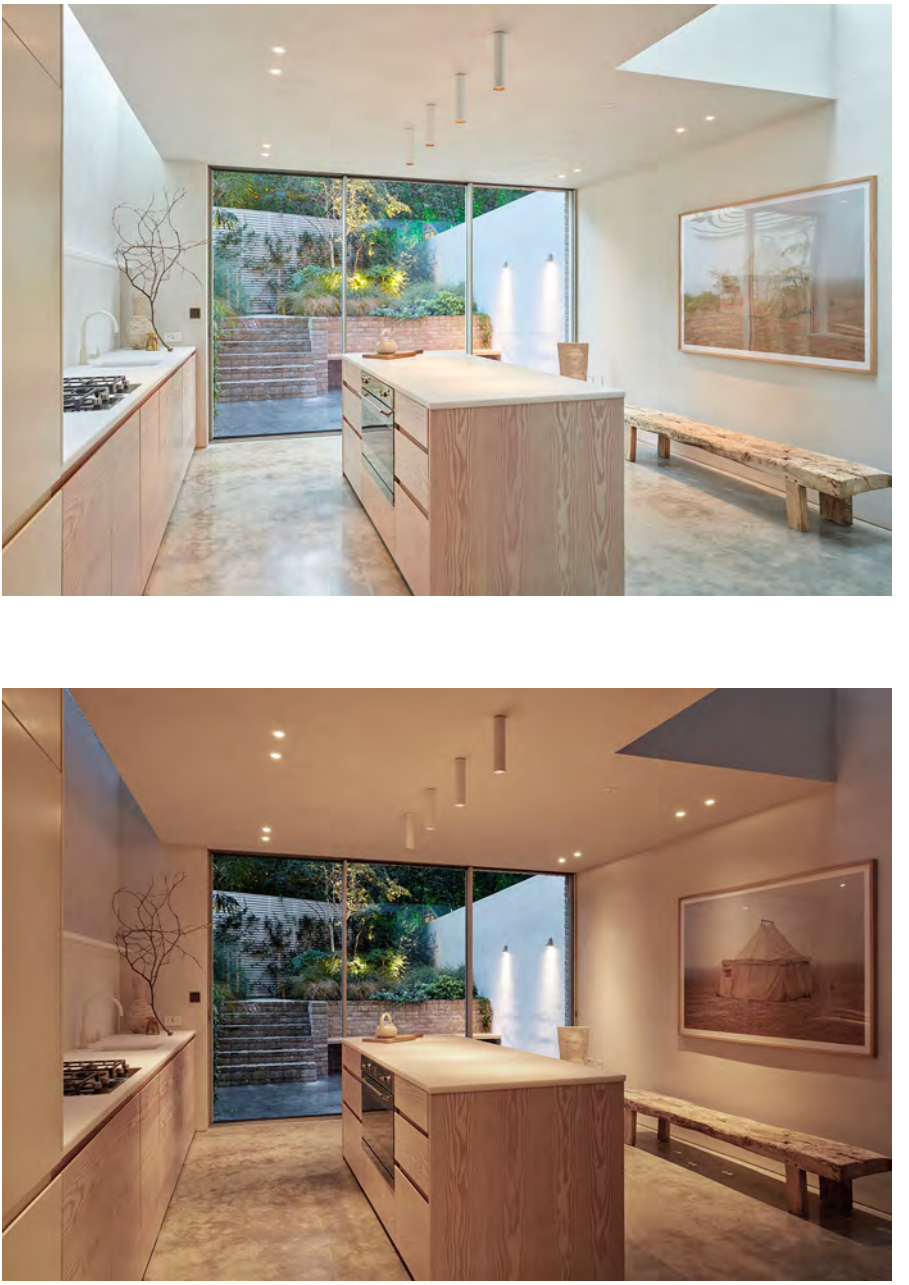

Fig. 2 – An example of tunable white lighting design. Victorian townhouse on Powerscroft Road in London's Clapton district. Lighting design: There's Light. Photo: JJ Greenwood. Courtesy: Reggiani.

For many years, the most widely used system in the broader context of building automation has been the KNX standard (ISO/IEC, 2006), based on a wired network, which makes it possible to manage up to 57,000 different devices in a building. Many manufacturers make KNX-compatible devices that can be easily integrated into the lighting design to control the sensors, the amount and the CCT of light emitted. KNX was created to enable energy savings and comfort in all types of buildings through the Heating, Ventilation, and Air Conditioning (HVAC) control. Recently, gateways have been developed to be able to use KNX also in a Z-Wave wireless network and there are several apps for smartphones, which can act as interfaces, also remotely, for programming, managing and controlling the system.

Fig. 3 – The Ratos Headquarter lighting in Stockholm controlled by Casambi App. Courtesy Annell Ljus + Form AB.

In 2011, the BLE mesh based Casambi LMS was introduced on the market. It can also interface with the DALI network. Casambi can configure and control lighting via an app, on a smartphone or tablet, with an intuitive graphical interface, or even via classic wall controls. Using a photo of the environment, the lighting designer can configure the system directly on the image to define the controls, luminaires and sensors, and establish behaviors and links between all devices.

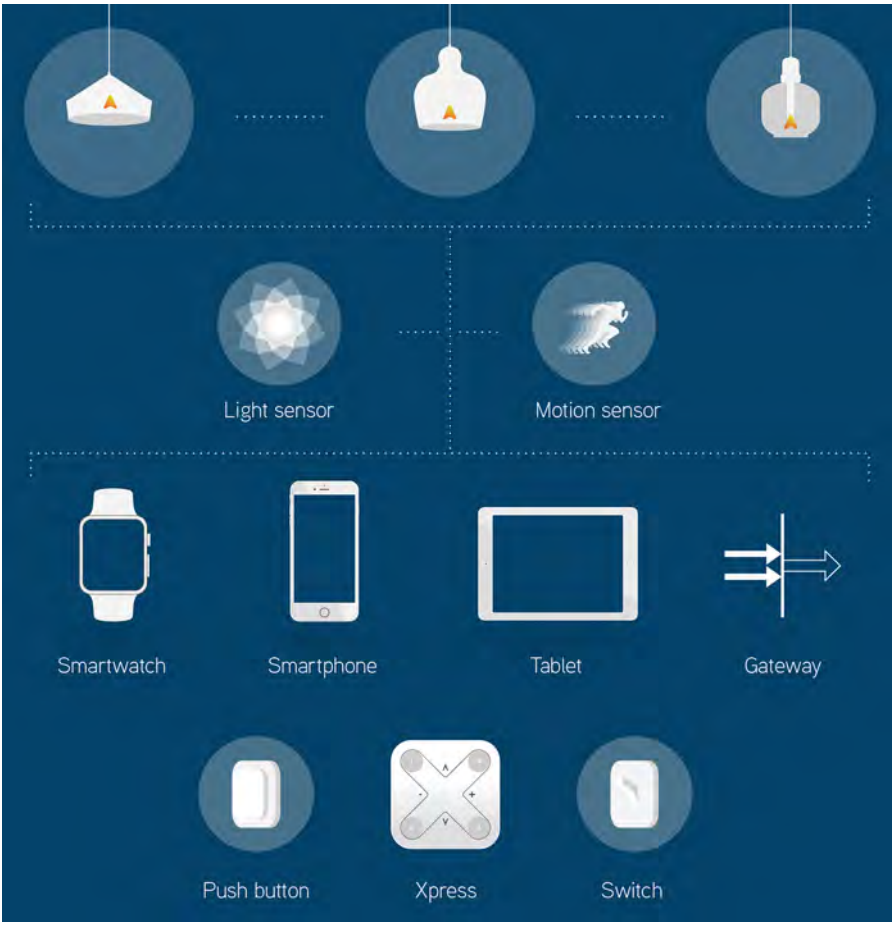

Fig. 4 – The Casambi system. Courtesy Casambi Technologies Oy.

Silvair has also developed a wireless BLE mesh based LMS for managing lighting systems in professional applications, such as retail and office spaces. Fagerhult developed the e-Sense set of systems using Casambi technology. These include a very advanced LMS, the e-Sense Tune, which provides individual users with independent and personal control to tailor lighting to their needs and preferences, even in different workspaces, when, for example, they move between personal offices, individual workspaces in shared areas, or conference rooms and recreational spaces. The idea is that everyone can take their lighting with them. Using light sensors and user recognition, the system is able to

adapt the lighting based on the user's profile and choices. User identification may be through recognition of the smartphone, or other smart device, carried by the user. Among the scenarios that can be set in the e-Sense Tune there are those for energy saving and that for the artificial simulation of the dynamic cycle of daylight, with its variation in CCT and quantity, which follows the user during the day, with the aim of encouraging the natural phasing of his/her circadian rhythm.

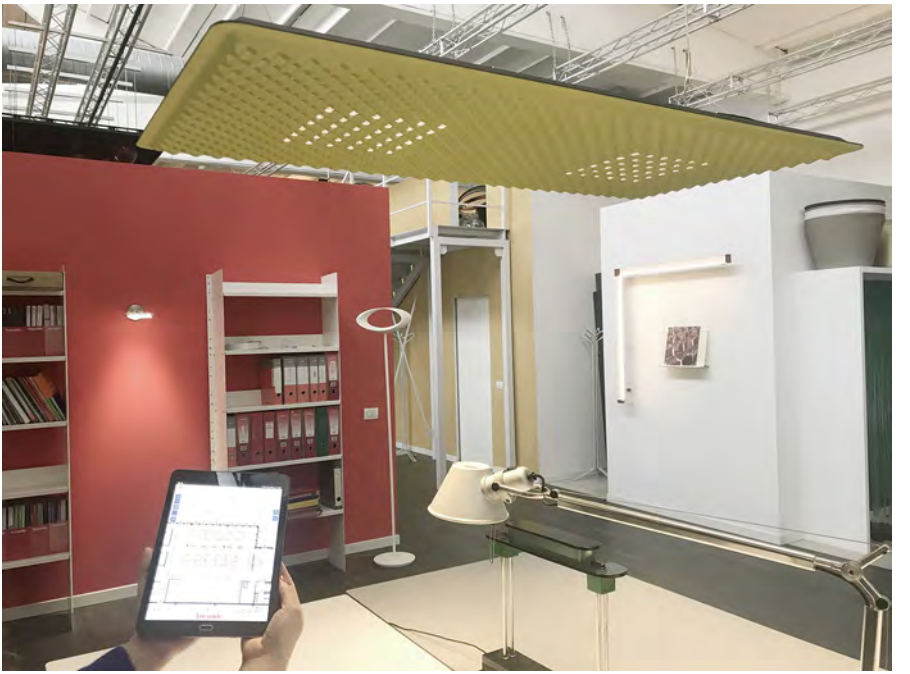

Fig. 5 – The Artemide App makes it possible to gather information through presence and daylight sensors built-in Artemide lamps. This creates Heat Maps in the App that allows the collection of essential data on the behavior of who interacts with space and allows the setting of lighting control parameters. Courtesy Artemide.

At a higher level, Artemide has developed a dedicated app, the Artemide App. This system enables lighting and color management, as well as user presence detection to intelligently determine the most appropriate lighting for each context. In addition, the app is also a design tool for the lighting designer. Indeed, by importing the plans of the interiors

into the app used in the designer mode, it is possible to establish the relationships between the various elements of the smart lighting project and the related behavior. The lighting designer therefore expands his classic scope of intervention, which goes beyond the choice, positioning and orientation of the lighting points, to more complex elements of the project: such as the definition of the behavior of the LMS and the design of changing lighting scenarios, depending on the behavior, the time of day and the natural light conditions actually present in the interior.

6.3 Lighting and well-being in residential environments

With the 2017 Nobel Prize in Medicine awarded to Hall, Rosbash, and Young, the issue of circadian lighting for people's well-being in interiors has been brought to the attention of industry manufacturers and innovation-minded designers (Young, 2017). Indeed, the human body is made to function and synchronize according to the rhythm of the continuous variations of natural light (Czeisler *et al.*, 1981). Our physiology would require us to be exposed to natural light during the day and complete darkness at night, to promote sleep, a fundamental function for health, and to ensure the proper phasing of our circadian rhythm (Wright *et al.*, 2013).

Considering NIF effects, the amount and chromaticity of light in interiors is different than that in exteriors, because it depends on the urban context, the windows (Farley and Veitch, 2001) and the contribution of artificial light (Andersen, Gochenour, Lockley, 2013). Often, in urban areas, optimizing residential interior spaces dramatically reduces the amount of natural light present. Direct sunlight is perceived as too intense and is therefore reduced with the help of blinds, curtains or other anti-glare systems (Reinhart, Voss, 2003). Frequently in interiors, even during the day, regardless of the presence of natural light, artificial light is turned on. Two research studies conducted in residential interiors, in Boston and Milan, have shown that ambient light is not able to properly stimulate the human circadian system (Gochenour, Andersen, 2009; Rossi, 2019a).

Many individuals suffer from delayed sleep phase disorder (DSPD) caused by exposure to inadequate evening light (Cajochen *et al.*, 2011; Green *et al.*, 2017). The social context can also contribute to a form of DSPD known as social jet lag, in which the person is systematically out

of sync with social standards that generally involve a morning commitment to work and/or study. This has also been associated with problems such as excess consumption of substances such as caffeine, alcohol and nicotine (Wittmann *et al.*, 2006; Parsons *et al.*, 2015).

The alteration of the circadian rhythm can occur late, called owl disorder, or early, called lark disorder (Phillips, 2009). Over the course of an individual's life, it is quite common for him/her to be more owlish when young, extremely active in the evening but with late morning awakenings, while in old age they become larks, with fatigue just after sunset and early morning awakenings. However, beyond certain limits, these alterations become pathological. An alteration of the normal circadian cycle can cause migraine (van Oosterhout *et al.*, 2018), headache (Pringsheim, 2002), irritability (Evans, Davidson, 2013), seasonal depression (Rosenthal, 2006), immune system deficiencies (Christoffersson *et al.*, 2014), chronic fatigue (Bonsall, Harrington, 2013), obesity and diabetes mellitus (Cedernaes, Schiöth, Benedict, 2015). It has also been hypothesized that there is an increased likelihood of developing certain cancers as a result of the alteration of the circadian cycle that affects the production of various hormones and the efficiency of the immune system (Stevens, Rea, 2001; Schernhammer *et al.*, 2013; Yadav, Verma, Singh, 2017).

Today, circadian lighting is possible thanks to LED and IoT technologies (Rossi, 2019b). This design method should not be considered a complication, but neither can it be simplified. It is inaccurate to say that a lighting product is human centric or circadian, while it is more correct to say that it can have functionalities aimed at achieving a lighting design for the well-being of people in residential environments (Rossi, 2018). The lighting product lays the groundwork for having the technological functionality useful for biodynamic lighting, but this is not enough. It is the design of an interior as a whole, with the LMS being able to create biodynamic lighting able to connect to other key elements of the design, such as the ability to relate to the user, the colors of the interior and the changing availability of natural light.

Circadian artificial lighting needs to be assessed in typical human positions, it depends on the weather, daylight contribution and also the way all elements, such as walls and furniture, affect ambient light. A luminaire designed for these purposes should enable the control of the emitted luminous flux, the CCT, the color, the ratio of direct to indirect emission, should be energy efficient with a long operating life, and have

an LED driver that can be controlled remotely within the IoT (Brodrick, 2015). Or at least offer a subset of these functionalities. In addition, the LMS that controls the lighting system must provide the ability to dynamically vary lighting throughout the day, in terms of quantity and CCT, following the pattern of natural light.

It is in this context that the new light sensors (Caicedo, Li, Pandharipande, 2017), presence sensors (Newsham *et al.*, 2015) and the innovative indoor position detection systems (IPS) of users, based on smartphones, actigraphs and BLE beacons (Kalbandhe and Patil, 2016), have also assumed a fundamental importance. Continuously tracking the amount of natural light actually present in an interior is critical to managing its circadian deficiencies in indoor environments. Sensors are also beginning to be offered on the market that are able to determine the CCT of the real ambient light (Valencia, Giraldo, Bonilla, 2013), that is the result of the relationship between natural light, artificial light and light reflected by the colors of the wall surfaces and furnishings present in the interior.

The ability to detect the presence and position of users in the interior allows the LMS to adapt the artificial lighting accordingly, making up for the lack of natural light and following the daily dynamic pattern of the same. These design methodologies are the future of design oriented to the well-being of residential environments and energy saving in the context of the smart home.

6.4 The open question of color

Three key steps are missing for interior design to introduce NIF effects on the human circadian system.

Today there is no European or worldwide standard for quantifying these elements in interior design. The world body that deals with light, color, and the human visual system, the Commission Internationale de l´Eclairage (CIE), has proposed a document in which it takes stock of research in this area (CIE, 2015). Since it is a multidisciplinary issue, there are many entities that are dealing with it in various capacities. The European Commission has published a scientific report recognizing that LEDs for lighting do not present problems for human health and also providing the scientific existence of the relationship between lighting and the human circadian cycle (SCHEER, 2018). In recent years, methods for

quantifying circadian lighting have been proposed and two national standards have been defined in Germany (DIN, 2015) and the USA (IES, 2018b), but without giving design guidance. On the building certification side, the Well Building Standard (IWBI, 2014) has been proposed, which focuses on the health and mental and physical well-being of people in buildings. This certification concerns building features that have a direct impact on human health and well-being, and these include circadian lighting, although it is a non-mandatory parameter in evaluating a building's score.

There has also been scientific contention for years over the issue of color rendering of artificial light sources. The current international standard, the CIE's CRI, has been criticized by much research (Davis, Ohno, 2010; Freyssinier and Rea, 2010; Smet *et al.*, 2010; Bodrogi, Brückner, Khanh, 2011) because it doesn't really describe the ability of LED sources to make us see interior colors well. In 2018, a different standard for quantifying color rendering, ANSI/IES TM-30-18, was proposed in the U.S., with a stronger scientific basis (IES, 2018a). However, this has not been accepted by the CIE, so many manufacturers continue to use an inadequate method to describe their LED light sources.

The third element that is missing even more in the evaluation of NIF effects is precisely the color factor that intervenes on the surfaces of interiors and furnishings, i.e., what the eyes of human beings observe when they are awake in the 80-90% of their time they spend indoors. Research on NIF effects for the circadian system was conducted in the laboratory, on human subjects with dilated pupils, and fixed gaze inside a Ganzfeld-type sphere, in which quasi-monochromatic lights were projected (Brainard *et al.*, 2001; Thapan, Arendt, Skene, 2001). Therefore, these experiments lack any contribution from the reflection factors and geometries of everyday surfaces and how they send light back onto the retina. We know very well that, instinctively, people's gaze is almost never directed towards the light sources, but rather towards the surfaces of the environment and the evaluation of the interior space depends not only on the CCT of light, but also on the other natural and colored elements that may be present (Boyce and Cuttle, 1990; Bellia, Pedace, Fragliasso, 2017). It is known that visual perception of color can influence mood and emotion (Ou *et al.*, 2018). Many studies have been done using color samples or computer images with the difficulty of being able to transfer them to the design field (Anter, Billger, 2010), while other studies have been done in the field (Küller *et*

al., 2006; Hårleman, Werner, Billger, 2007), with differences that may also be cultural in nature (Hogg *et al.*, 1979).

Fig. 6 – Shine a Light House, Oberaudorf, Bavaria. Brueckner Architekten – Arch. Michael Brem. Interior design Anthea Herrle. Lighting design: iGuzzini. Photo F. Holzherr. Courtesy Brueckner Architekten.

Fig. 7 – Shine a Light House, the kitchen. Brueckner Architekten – Arch. Michael Brem. Interior design Anthea Herrle. Lighting design: iGuzzini. Photo F. Holzherr. Courtesy Brueckner Architekten.

This complex relationship between natural light, artificial light, and interior colors are present in the Shine a Light residence project (BIM award winner at the Heinze Award 2020) on the outskirts of Oberaudorf, near the Bavarian Alps, by Brueckner Architekten, where there is a dynamic integration of natural and artificial light thanks to the large windows, which also give residents breathtaking views.

The interior color scheme was derived from the impression of the setting sun in the mountains. The cautious cool colors, in various shades of gray, are combined with warm orange accents, creating a perfect interplay between noble and sublime, warm and cozy. A special space is the corner kitchen in the central living room, whose shape is inspired by the Kaiser mountain range. The building is energy self-sufficient thanks to geothermal boreholes and a photovoltaic system. The lighting was created with numerous custom-made elements, which blend unobtrusively into the architecture, and other iconic products in keeping with the building's classic modernity. Most of the lighting products are Laser Blade 5 LED Minimal, Underscore InOut RGB and decorative products from iGuzzini. The lighting is dynamic and has been designed in relation to the colors of the interior, it is also connected with a DALI network in the KNX smart home and enables the control of CCT and also of the color that is sent back from the parts of the interior coatings that have neutral white/grey colors. In this project the chromatic dimension of the interior has been entrusted mainly to the light, both the natural light that enters from the large windows facing south and the artificial light integrated into the architecture and the smart home project.

6.5 Conclusions

The scientific soundness of the human circadian cycle and its proper timing for our health is now an established fact that should make us think about how to design and renovate interiors in the future. Designers have two fundamental tools at their disposal, light and color, which can act on the NIF effects of humans. Today, lighting is designed almost exclusively to meet the needs of the human visual system and energy conservation. The chromatic project, on the other hand, follows canons linked to trends as well as to emotional,

cultural, geographical and artistic aspects. The problem is that lighting designers and color designers, who work in interiors, often don't talk to each other and aren't aware of the implications their design can have on people's health. Even worse, lighting is often only included in a final phase of the project.

An argument often made against introducing a new way of designing is that electric lighting in interiors has existed for more than a hundred years, performs its function well for visual perception, and does not generate health problems for users. However, this statement is incorrect. Instead, it should be said that almost no one had, until a few years ago, posed the fundamental question of scientifically analyzing whether the light present in interiors could create problems, mainly when there is a low contribution of natural light. To overcome these obstacles, a holistic approach to interior design would be necessary, which tends to overcome the sectoralization and super-specialization of the professionals involved in the project.

There are indeed nearly no reference standards in this area. However, from the research conducted in the third millennium, we can draw some basic design guidelines for the construction and upgrading of buildings to increase occupants' exposure during the daylight hours to the circadian light par excellence, which is natural light. However, this is often lacking in interiors, and adequate circadian artificial lighting is required, which also depends on the colors of the surfaces, although this involves higher energy consumption. We can define some characteristics that interior lighting must possess to be considered circadian:

- Artificial lighting in interiors should always be dynamic with quantity and CCT varying throughout the day in a similar manner to natural light variations.
- To promote the phasing of the circadian cycle, lighting in the first half of the morning and the first half of the afternoon, should be higher and have a cooler CCT.
- In the relaxation and evening phases we should use a warm CCT, with low levels of lighting, so as not to counteract the normal production of melatonin and not to delay our circadian cycle.
- Today, in the absence of specific standards, to determine whether and how much light reaching the eyes can be circadian, one can

use the reference model proposed by Rea and Figueiro (2016), and calculate it using available software tools (LRC, 2017, 2018; OSRAM SYLVANIA, 2018).
- High color rendering light sources should always be preferred. Actual color rendering should be evaluated using TM-30-18.

As explained in the previous paragraphs, all this is possible only today thanks to the availability of tunable white LED sources, connected in a network and managed by an LMS that is able, through sensors, to detect the presence of people and the quantity and quality of light present in the interior.

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Spaces and their views are changing. The perception of physical and mental well-being is also shifting, especially because of the pandemic. We are experiencing a transitional time where new needs and requirements emerge, affecting human behaviour and the space definition at macro and micro level. New dynamics and perceptions are recognized, leading architects and designers to focus on studying and applying innovative methods.

The book explores the radical transformation of living and working spaces, in which the hybridization of interior and exterior requires a new vision able to interpreter renewed people's behaviours and needs, a challenging issue for the design discipline that has a multidisciplinary nature as well as a multiscale approach for both research and practice.

Many examples today demonstrate the importance of the therapeutic contribution of architecture and design, to redevelop places of hospitality and care, and create environments in which there is a deep harmony of space, light, and beauty. The interest in research concerning the quality of life has also increased a lot of studies on the complex question of the environmental perception and the importance of natural stimuli for health in interiors, in which the physiological effects of light and colour are fundamental to balance the of human beings' equilibrium.

In the book we present testimonies of international researchers and designers who propose disruptive scenarios and methodologies to improve well-being and mental health conditions overall life quality at urban and personal living level through several examples: the city and the relations with the environment, commercial and hospitality areas, personal spaces, as well as outer space, in microgravity and confined environment, where the astronauts' experience living in confined environments can be compared to the domestic space and office interiors.

Our ambition is to re-launch an aesthetic, sustainable, design-based approach to improve dwelling conditions, trying to implement care into different well-being dimensions – mental, physical, social, and global – looking at the new people's behaviours, or even, generating new behaviours, through design.

FrancoAngeli
La passione per le conoscenze