THE VALUE OF DESIGN RESEARCH

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ENVISIONING THE FUTURE ARCHITECTURE OF KNOWLEDGE CREATION

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ABSTRACT

The process of knowledge production deeply depends on often tacit and inexplicable experiences deeply rooted in the material world in such a way that it becomes a computational medium (Hutchins, 2001).

Through a historical survey of four architectural typologies — libraries, universities, offices, and museums — the paper recognizes the emergence of a new architectural type that transgresses former typological boundaries for the processes of knowledge production: the knowledge space.

The paper aims to frame, by means of a series of architectural projects — elaborated during a one semester studio — the field within which the knowledge spaces will perform in the near future. Though each project has its own rationality and can be read as a finished work, it is possible to trace common themes and issues.

The first — Individualization, the body of knowledge — dwells on the deeply individual character of the process of knowledge production, and elaborates on the fact that the knowledge worker and his very body are the primary material for the production of knowledge.

The second theme — Socialization, movement and chance — elaborates on the observation that knowledge work — or better yet, the cognitive processes that constitute its vital substratum — happens wherever people happen to be.

The third theme — Utopia vs Dystopia — deals with the observation that the knowledge worker operates in a composite environment where work and life constantly confront each other, increasingly transgressing borders.

The fourth theme — Embedded technology — raises questions about the relationships between space and the technological infrastructures ever more invisible, and yet present in our environment.

Keywords: distributed cognition, architecture, knowledge work, knowledge creation.

1 INTRODUCTION

The following paper presents a two years research project developed at the Berlage Institute in Rotterdam (then The Berlage Center for Advanced Studies in Architecture and Urban Design at TU Delft) in collaboration with Steelcase Inc. The first part of the project aimed to frame within the discipline of architecture the theme of human augmentation (one of the main concerns for Steelcase researchers) and to see which are the material architectural qualities that can

support people in the performance related to knowledge work (de Benoist, Leyk, Marullo, Mimica, Ponzo and West, 2012). A second part of the research made use of different architectural projects, developed in a design studio[1] by a group of students at the Berlage, to look for and outline a series of features and themes that might characterize the development of working environment in the near future (de Benoist, Leyk, Ponzo and West, 2013).

2 THE RELEVANCE OF KNOWLEDGE WORK

In the last fifty years, in the productive regimes of western economies, manufacturing has increasingly been replaced by immaterial production as the main drive for growth and development. The very concept of work needed to be associated to a set of activities no longer aimed at the material production of goods.

In the course of time, while becoming central for the maintenance and progress of the overall socio-economic pattern, knowledge work has proven to reluctantly fit the logics of scientific management that were initially transposed into it from manufacturing activities, and it progressively acquired a specific character, where the highest value of work resides in the innovative content — i.e. in the capacity to create new values and meanings — attached to products and services.

Knowledge work, this kind of immaterial production, has increasingly been recognized as being characterized by rich and nuanced sets of practices — the creative process — that (knowledge) workers experience in a very diverse set of conditions.

The present research assumes that space plays a significant role in the cognitive processes of knowledge production and aims to investigate the conditions in which the physical environment can almost be seen as an augmentation device for people's creative performance.

3 HUMAN AUGMENTATION

Human augmentation usually refers to any attempt to overcome the limitations of the human body through natural or artificial means. If, on the one hand, human augmentation refers usually to the possibility to improve human physical performance, the central interest of the present work is to investigate how the material environment can improve the human cognitive performance, enabling and supporting people's creative attitude and the processes of knowledge creation.

Hutchins (2001: 2071) explains how "cognitive activity is sometimes situated in the material world in such a way that the environment is a computational medium." Elaborating on this concept, Hollan, Hutchins and Kirsh (2000: 178) assert that "for the design of work environments, […] work materials are more than mere stimuli for a disembodied cognitive system. Work materials become elements of the cognitive system itself. […] Well-designed work materials

[1] The title of the studio, held in the winter semester 2012-13, was *Knowledge Spaces: Envisioning the Future Architecture of Knowledge Creation*, tutors Dietmar Leyk and Giorgio Ponzo.

become integrated into the way people think, see, and control activities, part of the distributed system of cognitive control."

The deep integration between perception, cognition and action brought researchers to see the brain "not as (primarily) the engine of reason or quiet deliberation, but as the organ of environmentally-situated control" (Clark, 1998: 274)". It remains to be seen how exactly mental environment and physical environment figure with one another in the cognitive process and performance.

Architecture is, of course, not alien to this discourse.

4 HUMAN AUGMENTATION BY ARCHITECTURE

The present research looked at distributed cognition as a form of augmentation, in order to bring this concept closer to the boundaries of the architectural discipline. In fact, by juxtaposing a vision of cognition as something built from the inside out with the idea that the mind is a central logic engine, distributed cognition "looks for a broader class of cognitive events and does not expect all such events to be encompassed by the skin or the skull of an individual" (Hutchins, 2000: 2069). Hutchins identifies "at least three interesting kinds of distribution of cognitive processes […]: cognitive processes may be distributed across the members of a social group, cognitive processes may be distributed in the sense that the operation of the cognitive system involves coordination between internal and external (material or environmental) structure, and processes may be distributed through time in such a way that the products of earlier events can transform the nature of later events. The effects of these kinds of distribution of process are extremely important to an understanding of human cognition" (Hutchins, 2000: 2069).

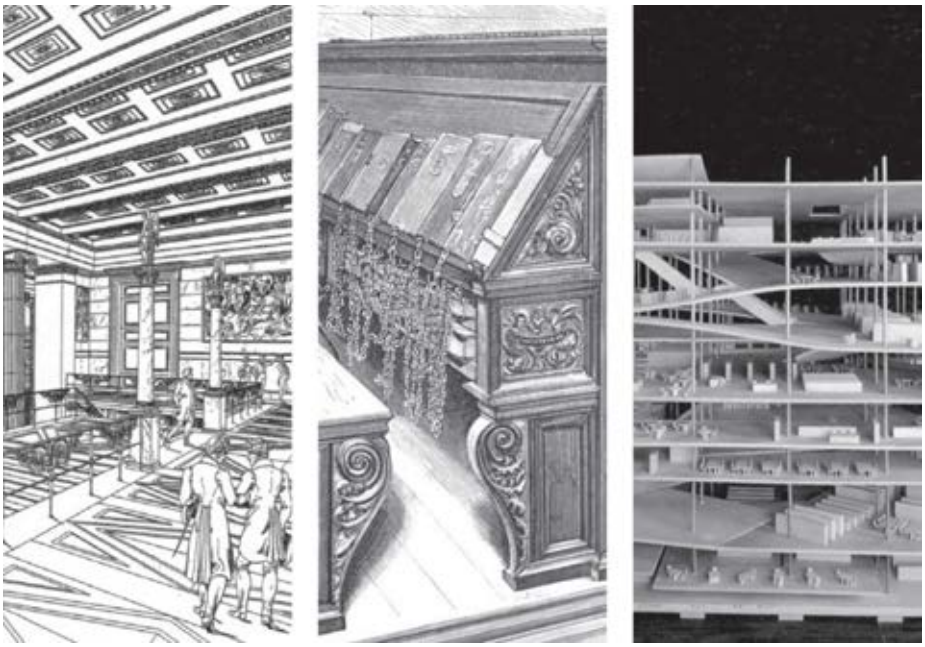

Figure 1 – Three examples of cognition distributed across social relationships, the material environment and time process in architecture: Karl Friedrich Schinkel, Altes Museum, Berlin, 1823-30; Michelangelo Buonarroti, Biblioteca Laurenziana, Firenze, 1519; OMA, Jussieu Library, Paris, 1998

Discussing cognitive augmentation within the discipline of architecture requires studying the relationships between human cognitive processes and the environment where these processes take place. Are there specific places where cognition and cognitive production are stimulated? How do these places work?

The attention could be then focused precisely on those environments that permit some key processes of the creative activity to be performed. In the course of history, we have assumed as four main processes of knowledge production: sharing knowledge, eliciting knowledge, systemizing knowledge and assembling knowledge, each as addressed by a particular architectural type: the library (sharing), the university (eliciting), the office (systemizing) and the museum (assembling). An evolutionary atlas of these types reveals how the very concept of knowledge work and its spatial conditions have developed throughout history in relation to specific historical events in knowledge production and technological development (figure 2).

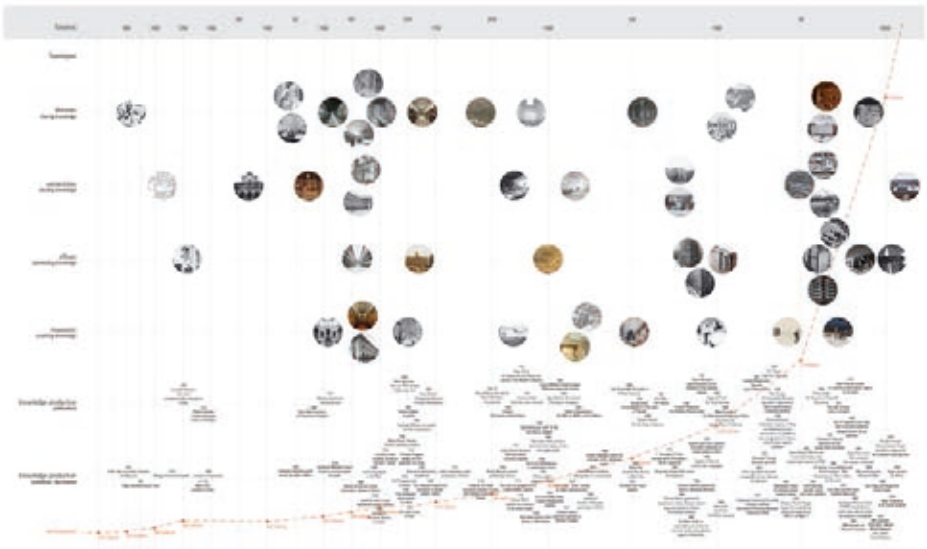

Figure 2 – Four building types, libraries, universities, offices and museums are mapped on a timeline in relation to historical events and scientific and technical discoveries constituting an atlas of references for the spaces of knowledge production.

The typological atlas demonstrates how the selected building types have tended towards a progressive “emptying” and “clearing” of their architectural specificity in relation to the increased demand for relational and communicative space.

Recent patterns of knowledge creation have profoundly transformed our ways of producing immaterial value and cognitive work processes have become more flexible, nomadic, collaborative and interdisciplinary; accordingly to this phenomenon, it seems that architecture has gradually evolved toward the construction of an open and flexible environment made accessible to various and multiple uses, habits, rituals and functions.

The increasing spatial openness and simplification become explicit, precisely in the typological evolution of the building plans of libraries, museums, universities and offices. Through time, these architectures evolved from ordered, subservient arrangements of purpose-oriented spaces, facilities and technical cores toward an overall laxity and flexibility of the plan, devoid of inner constraints. This

flexible layout has supported and augmented the processes of socialization and internalization of knowledge by complementing the main building functions with (apparently) extraneous programs and activities (figure 3).

Figure 3 – The evolution of the knowledge spaces shows how the building plans has increasingly been emptied from functional and special specificity in favour of a growing amount of space (the pink hatch in the picture) for movement, socialization and flexible uses.

The architecture of the places of immaterial work creates comprehensive environments able to integrate the processes of knowledge production with a parallel and intentional programmatic variety, mirroring the dynamic indeterminacy and the irreducible complexity of the city with indoor gardens, leisure and resting spaces as well as commercial and “public” areas.

The concept of “knowledge space” emerges when cognitive production overcomes the tangible boundaries of a building. People are now able to create and distribute knowledge potentially anywhere while profiting from the diverse experiences and encounters happening in different spatial contexts. Immaterial products cannot be easily limited within any physical enclosure since the whole environment has become a field of cognitive production.

We could, in this sense, conceptually assume the metropolis itself, with its infinite and non-programmed redundancy, has become the ultimate potential source of knowledge creation.

5 THE CITY AS A KNOWLEDGE SPACE / THE KNOWLEDGE SPACE AS A CITY

The opening of the spaces for knowledge production toward the city does not represent a mere architectural whim or fashion. Rather, it shows how architecture has been able to embody certain needs of the process of knowledge production. Knowledge creation relies on the interplay between explicit and tacit

knowledge (Nonaka, 1991), and on cognitive processes that do not necessarily happen in a strictly defined working environment.

Moreover, in recent years the ubiquitous information technology transformed ever larger territories into places of knowledge production: people work in the most diverse environments, ranging from transportation infrastructures to cafes.

The whole city becomes an ideal place for knowledge production since diverse experiences and encounters occur there, providing a fertile ground for communication, exchange, and insight, which are fundamental stages of the creative process.

It is therefore possible to look at the city as a space of knowledge production, and conversely, also to look at the knowledge space as a city, an environment capable of including an ever larger array of programs, activities and people.

6 THE FUTURE ARCHITECTURE OF KNOWLEDGE CREATION

The present research studied eight city models from the history of architecture[2] as potential generators of eight discrete forms of knowledge space.

The main qualities of these city models are identified as possible enablers of knowledge production and are transposed into the knowledge space, first by means of diagrams then, by constructing paper models that become an abstract framework to test the theoretical assumptions elaborated throughout the research. Rather than being literal architectural models, they have to be seen as devices that stimulate further investigations on how to transform hypotheses into a material — architectural — condition.

The projects aim to present diverse perspectives on the future of the spaces of knowledge production. Though each project has its own rationality and can be read as a more or less complete point of view on the topic, it is nevertheless possible to trace common themes and issues that frame the field within which the knowledge spaces will perform in the near future.

The following section presents some design resolutions and attempts to devise an initial possible reference literature to investigate further the different topics.

6.1 INDIVIDUALIZATION, THE BODY OF KNOWLEDGE.

The cognitive activities at the basis of the creative process belong to a deeply individual dimension.

In the creative process, people acquire, elaborate and express a considerable amount of knowledge through individual experience and practice, rather than through a systematized and formal language. The notion of “personal knowledge” advanced by Michael Polanyi (1958) and summarized in the catchphrase “we know more than we can say” acquires a new relevance. The

[2] The city models that were used for these investigation are: the ancient Chinese city (618 A.D.), The Garden City by Ebenezer Howard (1898), the Greek agora, No-Stop City by Archizoom Associati (1969), Brodoacre City by Frank Lloyd Wright (1932-58), plan for Magnitogorsk by Ivan Leonidov (1930), the City within the City by Oswald Mathias Ungers (1977), the Obus Plan for Algiers by Le Corbusier (1931-32).

knowledge worker and his very body — the locus where the different life experiences are synthesized — are the primary material for the production of knowledge.

The physical sensations that the human body receives from the surrounding environment are recognized to be valuable for their capacity to bring coherence and authenticity to life experiences, which are increasingly split and scattered in a multitude of cognitive stimuli (figure 4).

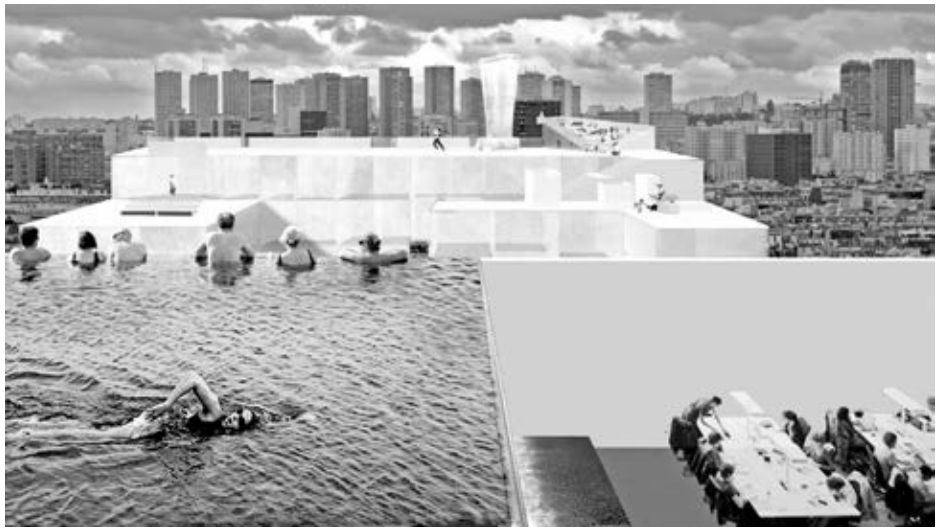

Figure 4 – Stimulating the senses while providing opportunities for physical exercise will be key features of the knowledge spaces, which will be expected to support the worker's body and mind (image from 'The Boulevard' project by Congxiao Lu; top level: swimming pool and open air working terrace).

Taking care of the body acquires a specific importance. It is crucial to recognize that the body-centric feature is not an apology or an appropriation of current trends on health and wellness; on the contrary, the body, its performance, and the sensations it derives from the environment are recognized as critical raw matter in the process of knowledge production.

6.2 SOCIALIZATION, MOVEMENT AND CHANCE.

Knowledge work has clearly abandoned the safe boundaries of companies' corporate headquarters (Duffy, 2008a); knowledge work — or better yet, the cognitive processes that constitute its vital substratum — happens wherever people happen to be.

In this sense, the reference to the city as a profound metaphor for the space of knowledge production takes on an even more imperative meaning. The city provides a wide range of possibilities that need to be discovered by the knowledge worker. For this purpose, his working activity needs to incorporate two specific attitudes.

The first is a certain inclination to move from place to place. The office and the practice (in their shared etymologic meaning of "doing things") are distributed among places that need to be connected by different personal trajectories. Referring to 16th and 17th businessmen's activities in London, Frank Duffy argues that this mobile character of knowledge work has a long tradition and is

somehow independent from the technology that actually allowed work to leave its conventional organizational boundaries: “the earlier one goes back into the history of the office, the more peripatetic people appear to have been, the more diverse their access to workplaces, and the more permeable the urban context within which they worked. Even without information technology, people knew how to move about, choose appropriate settings and share space” (Duffy, 2008b: 126)

The second attitude can be defined as the capacity to take advantage of occasional encounters, both with people and things. It seems that serendipity — the faculty of making discoveries by accidents and “taking advantage of unplanned but not totally unpredicted and certainly not undesired” (Duffy, 2008a) events — takes a major role in some stages of the knowledge production process.

As a result, the knowledge worker becomes a nomad not only in practice, splitting her duties across different physical and mental places; her very work has an innate predisposition toward mobility (figure 5).

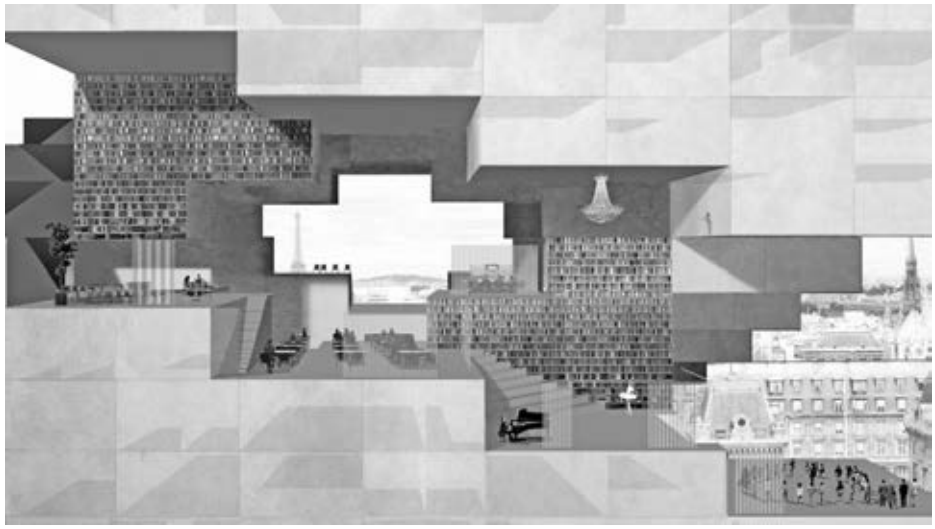

Figure 5 - The circulation within a building acquires a relevance that goes far beyond its functional aspects. It becomes actually the place where interaction, communication, and exchange — three fundamental activities of the process of knowledge production — happen (image from ‘The Boulevard’ project by Congxiao Lu: the whole building is characterized by a continuous circulation system that is also able to host a variety of programs across the entire volume).

6.3 UTOPIA VS DYSTOPIA.

The condition in which the knowledge worker seems to operate is a composite environment where work and life constantly confront each other, increasingly transgressing borders, and seeking an impossible equilibrium.

In a way, it has become impossible (and even undesirable) to disconnect from processes of knowledge production, because it would simply mean to stop thinking. Even leisure and restoration fully belong to the productive pattern: they are necessary instruments to refresh minds and bodies in order to face creative challenges with a higher level of inspiration.

Technology undoubtedly helps this process, making work practices available in a wide array of contexts. Putting a broad set of spaces of different kind in relation to one another in an extremely porous condition produces an environment that offers, at the same time, chances and risks. On the one hand, the knowledge worker is empowered by a wide array of choices in where and when to perform his activities; on the other hand, the all-encompassing nature of knowledge work presents a condition where there is no escape from pervasive working situations and each aspect of life is captured in a productive process.

As a result of this double-sided condition of knowledge work, the characteristics of the spaces of knowledge production might remain suspended between utopias — Edens of well-being and ideal workplaces — and dystopias, where there is no escape from work.

The convergence of (knowledge) work and life has to be perceived as an opportunity to dismantle the modernist paradigm of a life split into clearly separated fields, and generate new possibilities. The spaces of knowledge production have to become less and less prescriptive on the ways in which different areas are used, and literally make space for interpretation and appropriation by the users (figure 6).

Figure 6 - The all-encompassing character of the process of knowledge production is mirrored in spaces that can potentially circumscribe multiple aspects of living (image from 'The Babylon' project by Alejandra Arce; view of the central vertical void, connecting different working environments across multiple levels).

6.4 EMBEDDED TECHNOLOGY.

The ways in which the working environment has changed — dramatically reducing the importance of the desk-centred workplace in favour of new forms of working styles — are results of the deep impact that information technology has had on work, workers and workplace in the last decades.

So far, architecture has been unable to interpret which specific spatial potentials are unleashed by this technological development and the related social transformations.

All the projects elaborated in the course of this research depict a world where informational content will always be accessible and evenly distributed across space. In this situation, usually defined as a condition of ambient technology and intelligence, it becomes important to understand if and how space can play a role in supporting, modulating and enabling people's relationship with information. The projects generally took one of two extreme approaches.

The first looks at technology as an agent that is able to structure and shape both the physical environment and, as a consequence, people's behaviour within it. In this case, a high-tech environment hosts a number of different activities and helps people get together across distance and time. Here the different spatial settings can be completely transformed by the presence and use of technology that, in the working environment, tends to come to the foreground, offering an array of interactive arrangements that are adaptable to different needs (figure 7).

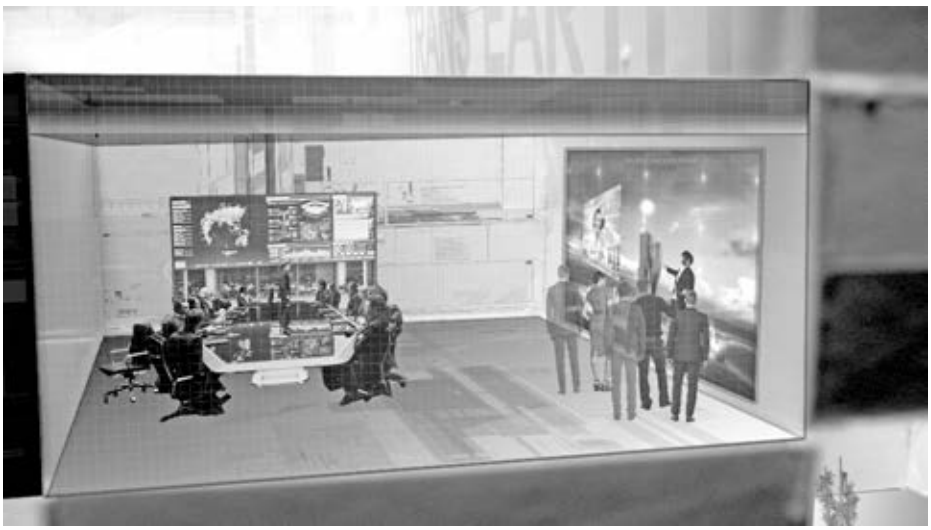

Figure 7 - Technology can configure spaces to accommodate multiple users' communication and information needs. (image from the project 'TransEarth' by Young Hun Kwon: one of the rooms that hosts the most advance technological devices. The architectural definition is at its lowest, allowing a continuous redefinition of the space according to temporary needs.)

A second perspective recognizes that technology does not represent the only enabler of creative processes but serves as one of the diverse agents that build a complex environment for the production of knowledge. In this case, information technology is assumed to be so pervasive that it basically disappears from sight, and leaves the scene open to other interpretations. Moreover, here technology is not only related to its informational content; instead, it is seen as a composite that aims to control the whole environment, also taking into

account the physical conditions like light, air and temperature that influence people's comfort. Technology needs to not only provide a reliable and efficient working infrastructure, which is its historical, almost fundamental mission, but also engage the bodily and affective spheres of the knowledge worker (figure 8).

Figure 8 - Highly sophisticated information systems make technology disappear from the surface, completely integrating it into the environment. The knowledge worker establishes a whole new relationship with their working environment, freed from digital devices and infrastructures (image from 'The Aleph' project by Francisco Ferreira: working places are distributed in a landscape that includes natural elements).

7 CONCLUSIONS

Through a historical survey of four architectural typologies — libraries, universities, offices, and museums — the research recognized the emergence of a specific kind of physical environments where information is created and disseminated: the knowledge space. It is a new architectural type that transgresses former typological boundaries and is able to present itself as an environmental condition, the milieu where the knowledge worker lives and performs, establishing multiple relationships with other people and objects.

As a second step, the research argued that the process of knowledge production does not rely only on systematic and analytic thinking; on the contrary, it depends on people's symbolic and affective cognitive processes that can be broadly understood as life experience, an often tacit and inexplicable form of knowledge.

For this reason, the research assumed that space plays a crucial role in unleashing — and at the same time capturing — people's creative potential. The working environment is no more a confined place, physically and conceptually enclosed within the boundaries of a corporation, but, by following the knowledge worker in the entire unfolding of her existence, becomes a larger domain that encompasses the most diverse conditions of "work."

This is recognized as one of the reasons why the knowledge spaces have progressively loosened the programmatic boundaries that characterized them in the past. This phenomenon happened in two directions: first inward, as the spatial arrangements became vague and adaptable in order to literally make room for the unexpected; then outward, where the spaces of knowledge production opened up more and more to the exterior environment in a seamless extension of the urban condition (Pimlott, 2008).

A set of specific spatial qualities emerged to characterize the environment of knowledge production, a sort of ecology that juxtaposes technological and social aspects as well. The possible relationships among the qualities belonging to these three fields — spatial, social, and technological — can help define patterns of future evolution of the workplace, the workers, and the work.

As the very nature of immaterial work changes from a process-based routine to performative knowledge creation, the spatial qualities of the working environments inevitably evolve embodying the specific features of the dynamic knowledge creation process.

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