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CREATIVITY IN ARCHITECTURE: THE COGNITIVE PROCESS

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ABSTRACT

According to the cognitive approach, the paper develops the analysis of the design process in architecture and reflects on the cognitive processes applied to space and design, in order to identify the role that creativity place in the process. The paper analyses also the variations and the restrains, which feeds creativity during the development of the architectural project. The paper wants to demonstrate the fundamental importance of memories in developing planning process and creativity expressed in it. The explored contribution of cognitive science supports this thesis. Even the writings of architects as well as critical writings on architecture lead us in the same direction. By means of an experiment we demonstrates how the same planning request activates in the expert agent particular links and not others. These links start a specific, special and adventurous trip in memories and in study references. They may be technical, personal references, more or less revealed, more or

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less aware, not randomly generated by a planning question, which is potentially fortuitous and substantially unknown.

Key words: creativity, architecture, memories, design

Introduction

The original question was formed around the creativity and the creativity in architecture. We were looking for that 'quid' that distinguishes an architectural design quality, original, unexpected, first 'impossible' and that once designed and constructed becomes a reference.

We explored the creativity, its characteristics, its role within the design process in architecture. We analyzed creativity according to the cognitivist approach using the tools of knowledge engineering and scientific literature related to Artificial Intelligence.

The organization of space is an essential component of the space capacities of human agents. It is a fact that human agents are able to conceptualize space first, and then to design and organize them.

We intend to add the space domain to other domains discussed in creativity typical cognitive science. In particular in our analysis have been studied the concepts of comprehension of space and spatial organization with reference to creative and non-routine cognitive functions according the perspective of modeling.

Creativity

Creativity is often considered as an innate ability, by which actions of original creation give rise to brand new items and elements. On the other side, creativity can be also regarded as a process able to transform and recombine existing entities, toward different, novel configurations.

Only few people particularly inspired are recognized being excellent in creativity, but the creativity has several degrees and many facets and not be limited to geniuses, rather we must consider that there is a continuum ranging from everyday creativity to exceptional creativity [1].

In the cognitive environments of artificial intelligence research [2, 3, 4, 5], creativity is seen as a normal function of the human intellect, to be analyzed according to a strict

theoretical and experimental scientific investigation. The modeling and design of artificial space environments, cities and urban architectures in particular, must take into account highly heterogeneous information sources.

Creativity is the ability to come up with ideas or artifacts that are new, surprising and valuable. In exploratory creativity, the 'countryside' is a style of thinking. The deepest cases of creativity involve someone's thinking something, which, with respect to conceptual spaces in their minds, they couldn't have thought before [2].

Innovation depends on the discovery of new matches: knowledge domains form a vast 'space' and creating a deep analogy means to link, within this space, the two different regions. The generative capabilities tend to be ineffable; a scientific problem can be illuminated by discovering a deep analogy as well as a daily problem.

Creativity is expressed in a context of a strong intention; it is the pressing intention that finalizes the choices, without intention the intimate mechanism of intuitive elaboration can't activate in recombining elements and possibilities present in the situation.

For a working definition of creativity is useful to define the domain of study by placing that a creative process has to have three characteristic properties: (i) like all mental processes starts from some data elements; (ii) the process does not have a definite purpose, but only a few existing restrictions or criteria to be met; (iii) gives a result that is new to the agent creator and is not merely remembered or perceived and not built by heart through of a simple deterministic procedure; (iv) the results may not be truly original: a mental process can be creative even if other people had the same idea [4].

Creativity and Architecture

Herbert Simon was the first to assert that the existence of a planning science is possible, and to strengthen this thesis he mention the instruments of limited rationality [6]. His proposal as regards a theory of representation follows a strong proximity to the problem solving theory: planning is included in the theoretical environment of problem solving, [7].

Vitruvius distinguishes the universal part of the reasoning from the more specific one that concerns the object. The architects' science must be enriched by the knowledge of many different things. Interesting is the introduction of the distinction between the reasoning and a necessary body of knowledge this distinction gives a status of mutual independence [6].

When practitioners decide to dedicate themselves to new or unique problem, which do not fit into known categories, their investigation is a process of artistic designing. The structure of this procedure is the one of the reflexive dialogue always present in the design activities. The designer creates a long plot of moves, putting each moves group to multiple assessments taken from its repertoire of domains for design [8].

The design of architectural environments must refer to sources of information that are highly heterogeneous. There are not only quantitative and qualitative spatial constraints to consider in data relationships and choices that shape the project, but also relationships and conceptualizations regarding the function and abstract at the same time.

We studied the instatements and some writings of the architects that have characterized and marked the architectonic scene and territory where they have realized their intervention and the way they read and interpret architecture. Thought constants evicted from the architects' writings specify the role they play in their intentions of spatial transformation and in their approach to space or territory, when it is set as a planning problem to the architect. Every master refers to the memories [9].

Creativity and Memory in Architecture

Mental images and memory objects make up that database in which the expert agent has his reference. The various places of his memory, which constitute his database in continuous evolution, are a necessary part of the cognitive structure [10].

'The observation of things has been my most important formal education, and then the observation has turned into a memory of the seen things. Now I seem to see them all laid out like tools neatly lined up, like in a dictionary. But this list between imagination and memory is not neutral. Is important the relationship between observation and memory, and the analysis and creativity' [11].

This citation tells exactly how the request design find creative and unexpected answers from known objects, on which the mind stops thinking and reworks turning them into something new and different. An example are the lighthouses of Maine who reworked become a coffee maker, and lighthouses together with the Elbe cabins designed and redesigned become the Theatre of the World coming from the sea.



Figure 1 : From the Maine's Lighthouse to the Pot.



Figure 2 : From the Pot to the Theatre of the World.

We can recognize this way of creativity starting from memories objects not only in contemporary architects but also in famous architects of the past. Andrea Palladio in the famous Villa Rotonda alla Malcontenta used re-joining elements coming from Pantheon making something completely new, the ancient temple grammar become a private villa.



Figure 3 : From the Pantheon to the Villa Rotonda

Objectives

Through the use of a modular ontology and an approach based on e-connections theory [12], the research project aims at drawing on different domains connected to spatial modeling and designing activity (formal rationalities, e.g. geometries, and informal rationalities, such as emotions) [5]. Ontologies will be useful modeling more

efficiently and effectively databases and relations needed to optimize the processes of simulation of operational spatial environments' analysis and transformation [13].

Beyond quantitative and qualitative spatial constraints, there are relations and conceptualizations depending on function and being meanwhile abstract, that need to be considered in data relations and in agents' decisions [12].

The aim of the research is the construction of theoretical and experimental frames, in particular of algorithmic and heuristic integrated models for portable software. The research envisages the construction of a tool able to expose agents-architects to their own spatial memories, to provide architects-agents with augmented mnemonic and reasoning environments functional to spatial analysis and transformation [9].

References

- Cottraux, J. A chacun sa créativité: Einstein, Mozart, Picasso... et nous, Odile Jacob, 2010.
- 2. Boden, M.A. The Creative Mind, Myths and Mechanism, NY, Routledge, 2004.
- 3. Hofstadter, D. Concetti fluidi ed analogie creative, Milano, Adelphi, 1995.
- Johnson-Laird, P.N. The Computer and the Mind. An Introduction to Cognitive Science, London, William Collins Sons & Co. Ltd., 1987 (Italian translation by Patrizia Tabossi,1997, La mente e il computer, introduzione alla scienza cognitiva, Società Editrice il Mulino, Bologna).
- 5. Minsky, M. The Emotion Machine, Simon and Schuster, 2007, ISBN 0-7432-7663-9.
- Hatchuel, A and Weil, B. La théorie C-K: Fondements et usages d'une théorie unifiée de la conception, Colloque Sciences de la conception, Lyon 15-16 mars, 2002.
- 7. Simon, H.A. Machine as Mind, in Android Epistemology, MIT Pre7ss, Cambridge, 1995.
- Schon, D.A. The Reflexive Practitioner, New York, Basic Books, 1983 (Italian translation by Angela Barbanente, Il professionista Riflessivo, Dedalo, Bari, 1993).
- 9. Stufano Melone, M.R. Creatività nel Processo Progettuale in Architettura: un Approccio Cognitivista, Doctoral Thesis, Pisa, 2011.
- 10. Stufano, R.; Borri, D.; Rabino, G. Creativity and Planning Process in Architecture: a Cognitive Approach, INPUT 2012, Cagliari, May 10-12, 2012.
- 11. Rossi, A. Autobiografia Scientifica, il Saggiatore, Milan, 2009.

- Hois, J.; Bhatt, M.; Kutz, O. Modular Ontologies for Architectural Design. Formal Ontologies Meet Industry, Proceedings of the 4th Workshop FOMI 2009, September 2, 2009, Vicenza, Italy, in association with the 10th European Conference on Knowledge Management. Frontiers in Artificial Intelligence and Applications, Vol. 198, pp.66-77, ISBN: 978-1-60750-047-6, IOS Press.
- Borri, D. and Camarda, D. Planning for the Environmental Quality of Urban Microclimate: A Multiagent-Based Approach, Lecture Notes in Artificial Intelligence, Vol. 6874, p.129-136, ISSN: 0302-9743, 2011.