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Designing beyond Earth. An evolution in body-space-architecture paradigm for space design

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Architecture design, Extreme environment, Future design, Habitability, Space architecture

The concept of space in architecture could be defined as the cognitive substance of the experience of the architectural phenomenon, whether real or virtual. Architectural history theorist Sigfried Giedion describes architecture as a phenomenon-mutation and interprets architectural space as corporeal in Greek architecture, plastically conceived; compact and closed interior space in Roman architecture; organically synthetic in modern and contemporary architecture, the result of the intersection of the first and second concepts of space, open to the outside world [Giedion 1998]. In the future-present, space in architecture could take on a new meaning if (and when) it is related to the concept of space that goes beyond the philosophical, physical, and mathematical language and thus takes on a relative value, i.e. referring to celestial bodies. The study of human space in architecture has always been central to the discipline, and the design of spaces which combine architectural quality with that of habitability is even more relevant in contexts where the host environment presents extreme conditions. The research aims to extend the study of the relationship between body, space, and architecture, to the dimensions of habitability beyond Earth [Häuplik-Meusburger & Bannova, 2016], with a focus on space habitats. Moreover, this work aims to stimulate discussions about the discipline and the practice of space architecture.
The research has been developed through a methodology that investigates the design proposals for space habitats that have been put forward since the birth of the discipline in relation to issues of space and scale, in completely new and partially unknown conditions. The objective of this analytical-comparative study is to identify those invariable paradigms of this design approach, while highlighting those variable characteristics and peculiarities that require unique adaptation depending on factors, such as the environment or the occupants. The work considers both orbital and planetary projects, characterised by the physical conditions of

microgravity [Masali et al. 2011], as well as the different scales of design, from the individual environment to the urban structure of settlements.
To create a case studies reference sample list were consulted conference proceedings, scientific journals, architecture magazines, architecture websites, and architectural firms' portfolios, as well as press releases from international space agencies and digital archives, including dissertation results and call for ideas or design. A preliminary survey was conducted via the bibliographic archive made available by the SpaceArchitect.org organization, which included documents written or recommended by the American Institute of Aeronautics and Astronautics (AIAA) and the Space Architecture Technical Committee (SATC) which promotes research and dialogue about human life in space. Pivotal case studies have been, for orbital architectures, the International Space Station (ISS) and the Lunar Gateway, and for planetary ones, projects such as the Moon Village, Marsha, Lunar Master Plan, and Nüwa Mars City. Considering these projects as representatives of the categories they are fitting into, it has been possible to understand the relationship between body and space in such extreme environments, as well as how the design features evolve and adapt in the different contexts.
Focusing on new spaces and terrains of experimentation, this research aims to highlight issues related to new paradigms of architectural measurement. The emphasis is on the importance of measurement and how the body in space plays a key-role in redefining standards of modularity at multiple scales [Bannova 2021]. For example, from an ergonomic and anthropological point of view [Tiziani 2013], it is important to consider factors of perception and comfort that are often underestimate in terrestrial architecture.
In extreme environments,[1] even the smallest design detail could have a significant impact on physical and mental well-being [Schlacht et al. 2009]. Therefore, it is crucial to consider every aspect of design in such situations, even at the urban level, where the size of objects can have a major impact. Therefore, it is important to consider questions about urban planning and the organization of cities in space. Considerations has been made regarding the inhabiting models to be applied in space, the characteristics of dwellings and terrestrial urban fabrics to be preserved, and the strategies to be implemented, given the unique and extreme conditions of the environment in which they are designed.
In conclusion, this research explores the relationship between inhabiting space and the body-space-architecture paradigm, examining how humans have influenced and been influenced by their environments throughout history and into the future of space exploration. The focus is on the dynamic interplay between humans and their environments, which has evolved in concert with human understanding of the universe and its place within it. It further unveils a bilateral correspondence between Earth and Space. Architectural knowledge gained on Earth has served as a springboard for innovation in space, and conversely, discoveries made in space have fuelled advances on our home planet. This mutual progress highlights the interconnectedness of these seemingly different environments. Finally, one of the purposes is to stimulate a discussion on this paradigm regards in order to move and develop it towards new frontiers.

ENDNOTES

[1] In the sense of "as a habitat characterized by harsh environmental conditions, beyond the optimal range for the development of humans [...]. Basically, all inhospitable conditions for life".

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FIGURES

Fig 1. - D'Amico Giacomo, Mars Settlement - Astronaut's View, 2021, Digital Collage, 16x24 cm. Author's personal collection.