# Virtual Space - new tasks for architects

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The meaning of architecture is extended due to the new media. As never before, computers help architects to handle huge amounts of information or give them a freedom to handle complex shaped models. However, it is not the shapes, but the space and its qualities they are created in, that imposes a new kind of architecture. This article focuses in an abridged version on some attributes of virtual space, its expanding features for real space and what the chances for architecture might be. But - what is space? Is it something objective? How is it perceived by man? This questions have to be answered first to understand the following hypothesis.

## Space and its meaning in history

During the past centuries the meaning of space has changed. Philosophy, psychology, physics and mathematics over time lead to different cognition. Above the finite space and transitoriness on earth Aristoteles saw the immortality of sky. Only in the renaissance Copernicus and Bruno described the infiniteness of astronomic space, followed by Newton's description of the absolute and homogeneous, even empty space. This was, for a long time basis for the scientific understanding of space. Mathematically it was describable by Euclid's geometry, the three dimensions length, width and height. Later Riemann's geometry provided the chance, to handle the infinite space, to map any point in space to another, to map infinite space to finite. This geometry allowed the thinking of infinite but limited space, similar to the infinite two-dimensional "space" (area) of a sphere in three-dimensional space. It is also the best fitting mathematical model for Einstein's theory of relativity. In his theory, time as a so called "fourth dimension" and space had to be linked together, since space differs for observers moving in different speed or direction. Space-time is the only objective reference. Einstein states that "*Under the influence of the ideas of Faraday and Maxwell the idea was developed, that the whole physical reality might be describable by a field, which components depend on four space-time parameters. ... What makes up the character of the real, is just the four-dimensionality of the field.*" [1]

## Orientation of man in space

Orientation of creatures in space is based on three questions [2]:

- what - physical composition?
- when - time-based appearance?
- where - spatial relation (topology)?

All three questions are complementing one another. Due the absence of physical objects in virtual space and today's immersive equipment, only "when" and especially "where" is of relevance in this context.

"Where" (space) is mainly perceived by our eyes, our visual sense. The act of seeing can be divided into first: physical perception of light on the retina with transmission over nerves to human brain and second: processing of this received information in brain. Whereas the anatomic basics with linking of nerves are "hard coded" and nearly finished within the first weeks of life, the second: processing or spatial knowledge of children develops over a longer phase and can be split in three phases [3]:

- egocentric - spatial knowledge is only referred to the self
- allocentric - relative space, independent of the self, reference to objects
- geocentric - absolute space, independent of the self and objects, relations between place and objects

Though reaching a certain level of abstraction, mental maps are still based on an egocentric basis [4].

Schöne [5] describes glasses with prisms as a well known method for the research of human visual-motoric capabilities. In experiments it has been proven, that if the participants are given a chance to actively experience this visual "defect" (e.g. by walking around versus being driven in a wheelchair), after some time they are able to compensate it. Especially after a several day lasting sensory deprivation, the ability to orient is reduced significantly. This means that perception of space has to be readjusted day by day.

This might indicate, that man is able to comprehend more complex space structures due to the readjusting abilities. Experiences of several people in the CAVE environment as mentioned below make this assumption seam reasonable.

## Qualities of virtual space and scenarios

The qualities of virtual space might differ from so called real space, which in this context means space as we know it on earth. As many of the real space's phenomena like continuity or perspective are possible in virtual space, there is an overlapping of both. Whereas real space is limited to reality, virtual [lat.: existent due to power or possibility] space is created by human mind and thus only limited by thoughts (and for an immersive real-time presentation currently the speed of computers). This freedom gives virtual space unlimited qualities like free space-directions, fusion of object and space, free shapes, time and movement as changing factor, zero gravitation, free definable forces, etc.. Possible scenarios for virtual space beyond a normal reproduction of real space might be

- variation.space - transformation of space according to certain rules like speeding it up to nearly speed of light, which makes it get a longitudinal distortion
- simultaneity.space - multiple occupation of space, "snipping into fingers" might transport a visitor from space A to space B
- interaction.space - space reacts on visitor's actions.

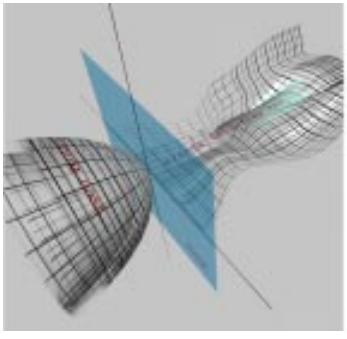
## Architecture in virtual spaces

As hardly any other profession, education of architects and their everyday business is working with space. Floors, walls or ceilings as multifunctional wrappings provide space for the variant activities of the users in buildings or cities. In different projects at the "Institute for fundamentals in planning" (igp) at the University of Stuttgart, the CAVE environment of the high-performance computing-centre [6], provided necessary computational and visual resources. The "*... different visual paradigm: inside out [CAVE] instead of outside in [e.g. display]*" [7] helps users to quickly learn orienting in different virtual spaces. Experiencing "inside out" can be compared to the above mentioned experiment of walking around (active) versus "outside in", that can be compared with being driven around in a wheelchair (passive). Besides standing **in** the modelled space, the **real-time feedback** of the virtual reality (VR) environment is important.

It showed, that there are new fields, that architects can give a substantial input. Their ability to work together with and think themselves into the work of other specialists as well as to coordinate different requirements turns out to make the process of the new design a lot easier. Some samples of what architects can create in virtual space are:

- space.work - collaboration - working together at different places
- space.info - datamining - compact representation and sorting of knowledge
- space.show - exhibition - augmented reality, real and virtual
- space.com - enterprise - virtual headquarter of physically non existing enterprise

What could be observed during the past years is that in these projects in virtual space there is more freedom to concentrate on the themes and that inclusion of time in architecture leads to new results. It can further be observed, that - after the first fascination for free shapes - the more people work on a theme, there is a reduction in expression, shapes become more appropriate, getting close to the ones in "real" architecture as a kind of "form follows function". And finally: the main impact of designing virtual space is on the thinking of people and the way they start interpreting real space - will this understanding of real space still be valid by tomorrow? Will there be new theories of space? Or is promise (the future) and reality (present) just the same due to curved space-time [8]? The situation is as Neil Spiller mentions [9]: *"We are not what we used to be and neither is our space."*



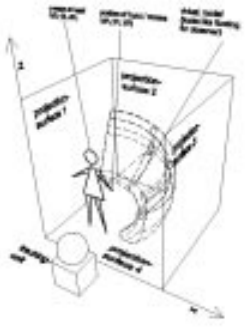


Figure 1: space.info [author] / scheme of CAVE-environment [author] / space.work in CAVE-environment [main4mind - müller, k.]

## References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6 http://www.hlrs.de

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