Drawing's dimensions
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Traditional methods used for 3-dimensional visualisation are rediscovered in many fields. Architects and designers have sought appropriate and useful computer-based techniques that they can describe spatial relation with. This paper considers the significant opportunity that is now available in education to help understanding of 3-dimensional space with stereo-equipment powered by computers.

Keywords: 3-d visualisation, CAAD, 3-d modeling, stereoscopy

Introduction

Visualisation plays an important role in human communication. Very often written words express visual experience; oral accounts often are confirmed with expressions related to visual terms of seeing: ‘I don’t see the point’, ‘From what I can see’, ‘Let’s see what you say’, ‘See life’, ‘I must see what I can do’. The reason of frequent use of expressions of seeing is that 80% of information obtained from outside world is brought by sight.

Our eye perceives space (by objects in space) besides light and colours. The role of space is more important for a professional such as architect. People come and go in a 3-dimensional world, in a real world, where we live. Man reacts visual and spatial events by instinct, such as surface of an object, distance of a light source or speed of a coming object. Man elaborates such information reached him, learns from it and shapes his own experience, mostly as subconscious perception.

Studying people’s attitude, behaviour and relation to space is a crucial task in architectural design.

Man feels a bay in ground. Man is not only perceiver of space, but a forming participant as well. Man and space relationship is close and intimate. Right representation of space can be understood if we place spectator itself in the actual place.

The 4th dimension (adding motion, this time to a 3-dimensional environment) can be experienced as one itself walks in space. Traditional motion pictures miss a full and voluntary participation of viewer. Those can be achieved by having aware of free moving and one can feel by experiencing of space. Pictures taken by stereo binocular are not quite adequate. There is missing a contemplate effect at perception: objects can be observed from one standpoint, one spectators angle by moving its own head. Viewer in a real space notices that closer parts of objects move comparing to the more remote details. This increases naturalness of perception of spatial elements.

Spatial dimensions influence value of architectural space in large measure, however hundreds of other things contribute to judgement of spatial solution of a building. Those might be lighting, shadows or even degree of humidity. It is worth to note importance of description of changing time besides spatial values.

Workphases of building technology can be shown on one of the most clear way. There is a long tradition of 3-dimensional visualisation at Technical University of Budapest, Faculty of Architecture. Department of
Descriptive Geometry had different methods for representing geometrical surfaces, shapes in 3-dimensional ‘drawn’ models.

Imre Pál, a professor at Department of Descriptive Geometry was one of the most well-known masters of anaglyph drawings. His books were translated onto most of the European languages, but he had Japanese translation of his book as well. He made contributions to a lot of textbooks on descriptive geometry. These books were useful very much for students who had their first steps in 3-dimensional, constructive geometry studies [4,5]. ‘Geometry is the base of a lot of other science. Stereoscopic seeing has a great role in order to make geometry public property,’ he said.

Man sees slightly different pictures with his 2 eyes. He can orientate in space by that. If we want drawn objects see as real 3-dimensional ones, than we should create 2 different views both for left and right eyes [2]. These pictures should be received by both eyes independently.

Human brain then unify them into a 3D-like view. This serves as a basis of stereoscopic representation on paper.

Stereoscopic views are easy to discover geometrical properties of objects with. Fig. 2. shows one central projection (as pictures are created for eyes) of column. One can state by experience that column is cylindrical, however it is conical. (Fig. 3.)

Use of stereoscopic projection is rapidly growing in medical science, in chemical engineering, bioengineering and media art.

Since human eyes have different spatial positions in skull, two pictures created by lens of eyes differ from each other. The further points are from eyes, the less distance from each other on retina is. The human eye-resolution is about 30 arcsecond, it means that spatial seeing beyond 500 m doesn’t exist [1,2].

**CAAD and 3-D visualisation**

There is an elective course in graduate school program of School of Architecture, TU Budapest.
Students choose some documentation of never built buildings from architectural library. Most of the projects are shown on perspective drawings. They should ‘decode’ building ‘encoded’ in perspective. There was a series of exhibition in Japan in 1996 (Archeology of Future City). A group of students of Professor Uzawa, Tsukuba University worked on making computer models of unbuilt buildings. I saw how useful and challenging was the process of understanding and discovering historical buildings by making digitized models of them.

**Stereoscopes**

In the 1960s there were installed special viewer appliances for demonstrating complex geometrical surfaces. These stereoscopes are still available in public area of our university. Demonstrational material covers introductory study of both orthogonal and central projections.

**Anaglyph pictures**

The idea of anaglyph pictures is based on complementary colour system. Two different views are constructed for left and right eyes. Colour filtered glasses exclude one of the drawings: can see the drawing with green lines, and vice versa. We use this traditional tool fed by computer generated complementary drawings [2].

**Polarised images**

There is another known way to display images pairs: projecting them either on screen with two polarisation:
vertical and horizontal. Wearing standard polarised glasses one can obtain the right 3D-like images [1,2].

**Shutter glasses**

One of the most popular new technologies we experiment with is based on shutter glasses with high-speed electronic shutters. Liquid crystals are used to be turned into transparent or opaque. Projected views are refreshed at 120 Hz, while shutter glasses operate at 60 Hz.

**Personal monitor**

A promising technology is developed at Albacomp, a Hungarian company. Two lightweight monitors are mounted onto glasses. This unique product produces a high-resolution colour video image that appears in the user’s eyesight. An appearing view covers only 18° from viewer’s visual angle. This tool might be used for carrying and evaluating information at a building site, while detailed drawings are kept on a laptop PC.

**Role of time in building description**

Demonstrating the way of construction of a building is useful not only for teaches purposes, but for technological development as well. We set up experimental conditions for showing how the digital model is built in a CAAD program database and how the real construction can be carried out. Both students and contractors find the weak point of a project analysing its management.

**Conclusion**

Well-known technologies as stereography fertilised with computer technology open new windows onto
architectural representation of newly designed buildings. Students as most flexible and open users of computer technology have a chance to discover new approaches to one of the oldest profession (architecture) can be involved in research activity. Drawings have new dimensions, can be peeled off in an on-going altering workshop.

Notes

1. Johannes Steurer: Stereobildcodierung für den Menchen als Beobachter Technische Universität München, 1992
4. Pál Imre: Térláttatós ábrázoló mértan [in Hungarian, Descriptive geometry with anaglyph drawings] Budapest, 1959
5. Pál Imre: Térgeometria a m_szaki gyakorlatban [in Hungarian, Practical 3-D Geometry] Tankönykiadó, Budapest 1973
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10. Archeology of the Future City, Exhibition catalog, Tokyo, 1996

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