Displaying Spatially Complex Constellations

An Endoscopic Exploration Implementing the CUBIC-VR Technique

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Abstract

This paper presents a research project on approaching the possibilities of an "alternative" utilization of the Cubic-VR technique as a form of digital endoscopy. Exemplified by a meaningful exploration of the Viennese American Bar (Architect Adolf Loos) the potential for conveying spatial complex constellations is illustrated.

1. Introduction: Digital Endoscopy

"Endoscopy" stands for "inner view" having been used for decades exclusively as medical instrument for the inspection of "human voids" prior to its specific implementation in other fields of science. Even though special endoscopes are now available for model viewing of architecture and urban construction the picture quality produced often does not prove satisfactory. Endoscopic model rendering calls for profound photographic knowledge as both inconvenient light conditions and longer exposure times are to be made up for. Focusing (focus control) might also prove problematic. In other words: needle-sharp renderings comparable to snapshots of an architecture model will not result. Regarding animated endo-pictures it took way into the eighties till satisfactory results were produced by means of CCD-camera-technology. The meanwhile widely available computer-assisted simulation applications (CAAD) surpassed the endoscopic rendering technique based on viewing of physical models by means of optical instruments. "Exoscopic" (bird's eye perspective, etc.) viewing angles, however, were popular in those days. Nowadays fewer scale-architecture models are being built. Viewing by optical endoscope anyhow relies on an existing (physical) model supporting an "interior" view without any ifs and buts, particularly as no wearisome training is required.

What we basically are interested in is not the development or the immediate handling of the instrument "endoscope" as such, but rather the idea of endoscopy, i.e. obtaining "true to reality" insights into model situations. The slim design of optical endoscopes provides us with a destruction-free viewing possibility of physical models, whereas computer modelings can be taken apart wherever required.

The differentiation between "optical" and "digital" endoscopy has already been outlined in detail by Stellingwerff and Breen [1] predominantly dealing with the set of instruments implemented for endoscopic model viewing. Due to the fact that a sequence of pictures produced by an optical endoscope also lends itself to further processing activities might lead to linguistic confusion. The term digital endoscopy as used for our purposes comprises the computer-assisted processing and revision, also applying to the production of a sequence of pictures from the CAD-model and the production of a panoramic representation. The present project deals with rendering of panoramic sequences on the basis of digital shots followed-up by subsequent refinement ("manipulation"), mainly aimed at increasing knowledge by means of endoscopic diagnosis.

2. From QuickTime-VR to Cubic-VR

With a research grant of the Vienna University Anniversary Trust of 1998 “Lost Neighborhoods – A virtual encounter of the no-more existing building of the Synagogue in the Neudeggergasse 12” profound experience with the QuickTime-VR technique was gained. QuickTime-VR (in brief QTVR) is a spatial simulation technique first introduced by Apple and meanwhile acting as animation standard for other platforms. The basic idea of this technique is to provide virtual worlds by means of software-expansion based on conventional and widely available PC-technology.
Generating “virtual” space by means of QuickTimeVR (brief: QTVR) puts the principle of ramified picture sequences to use, i.e. different picture segments corresponding to the spatial navigation paths – are joined together at predefined nodes. The user can determine the course of the previously defined scenery at these nodes by reproducing the individual scenes on the virtual cylinder. The smoothly linked picture segments also lend themselves to a 360° rotation in the horizontal level. Even if wide-angle lenses with a focal distance of 15 mm are used for the panoramic rendering some (vertical) limitations regarding field of vision are to be taken into account.

Meanwhile Cubic-VR technique has been introduced by Apple [2]. Not a cylinder, but a cube is the starting point for this technique, the surfaces of which are to be applied with floor-, ceiling and wall mappings. While viewing a Cubic-VR presentation the observer will immediately realize that his view can “wander” without interruption from “top” to “bottom” as well as in the horizontal line. The resulting freedom of action resembles the possibilities of the human body, resp. the head and even exceeds them. The Euclidean basis, the cube, normally is not realized as such any more, but only acts as “surface” for the picture material to be implemented. This procedure can be used both for interior and exterior space.

3. From Illustration to Exploration

The towers of the above mentioned Synagogue in the Neudeggergasse (Vienna) surmounted the height of the surrounding overall height by double thus representing a dominant vertical in the rather contemplative building layout. As the bordering street only makes for a limited dissociation from the object, one’s eyes tend to go skywards automatically. Doubtlessly such a problematic situation can be tackled more effectively with the Cubic-VR technique than with implementation of the QTVR technique [3]. Cubic-VR not only offers the possibility of reproducing real and also computer-assisted calculated spatial constellations, but also furnishes us with a completely three-dimensional perceptible space amounting to something like a “picture stage”. This kind of setting a stage had already been feasible with the QTVR-format, the real potential, however, includes much more. Considering the lateral surfaces of the cube as reproduction surfaces suited to staging information applications, the cube provides us with six sides of a three-dimensionally perceptible spatial configuration acting as information platforms. Breaking with the concept of pure spatial representation of space, the type and manner of picture information to be displayed is not limited. Visual reception processes, however, are of a complex nature, reactions triggered by a complete spatial viewing thus can hardly be anticipated.

4. Perception Conditions as Requirements for Transfer of Knowledge

As a rule, far-reaching explanations of spatial complex configurations will not get across without issuing a variety of presentations of one and the same object. Thus architectural objects mostly are described by ground plan, section and view. These are orthogonal projections furnishing the viewer with artificial - as not corresponding to the viewing process of humans- and moreover, incomplete information on the object described. The skilled eye will, however, be capable of completing this information by means of imagination. In addition to the spatial nature the different projections provide the viewer with supplementary information. The ground plan and the section e.g. issue information regarding wall width or the horizontal and vertical dimensions of a building. Views demonstrate design principles such as surface partitioning, proportioning and the like. A holistic - i.e. correlating to human perception – impression of spatial three-dimensionality cannot, however, be delivered via projections or sections. Only using different techniques the viewer will accomplish to put the individual pieces of information together to a complete image. Understanding complex spatial configurations certainly demands more heavily on the human brain capacity than dealing with simple geometric constellations. Thus numerous examples for application of the instruments for explaining complex spatial constellations are to be found in the field of architecture. Starting with descriptions of baroque syncopations to organic building forms to contemporary building configurations in form of spatial loops and so-called blobs a vast area is to be covered The possibility of time overlays represents an additional benefit and any resulting depictions within a chronological context could also prove of great interest for art history.

5. Exemplary Spatial Constellation: American Bar

A suited example is located in Downtown Vienna offering an all-over viewing-interior situation, ingeniously emphasizing the interior design. The American Bar (also called “Kärntner Bar”) at the “Kärntner” Passage is characterized by extreme spatial confinement [4]. The main design approach surely attempted at overcoming this confinement with architectural means of design. The mirror band in separate fields throughout the overhead area provides the feeling of visual spaciousness, despite the existing confinement. By means of this “simple trick” the viewer is actually driven to direct his eyes to the many mirrors at the coffered ceiling, intending to distract from the tininess of the room. Detecting the phenomena of pretended spatial expansion and imparting the resulting space-related visual changes in a comprehensive manner was the main objective of the Cubic-VR panorama sequence rendered in this project.
The floor-, wall- and ceiling design of the “American Bar“ designed by the architect Adolf Loos surely merits such a recording method. Virtual conservation of architectural highlights and their simple as well as visually complete transfer were hereby tested and the suitability of the instruments applied checked in the context as described:

The opening of the total of four sequences starts with a 180°-panorama of the initial situation. You can return to this exposition situation after every one of the follow-up panoramas. Hyperlinks to the two-dimensional ground plan and section are also provided.

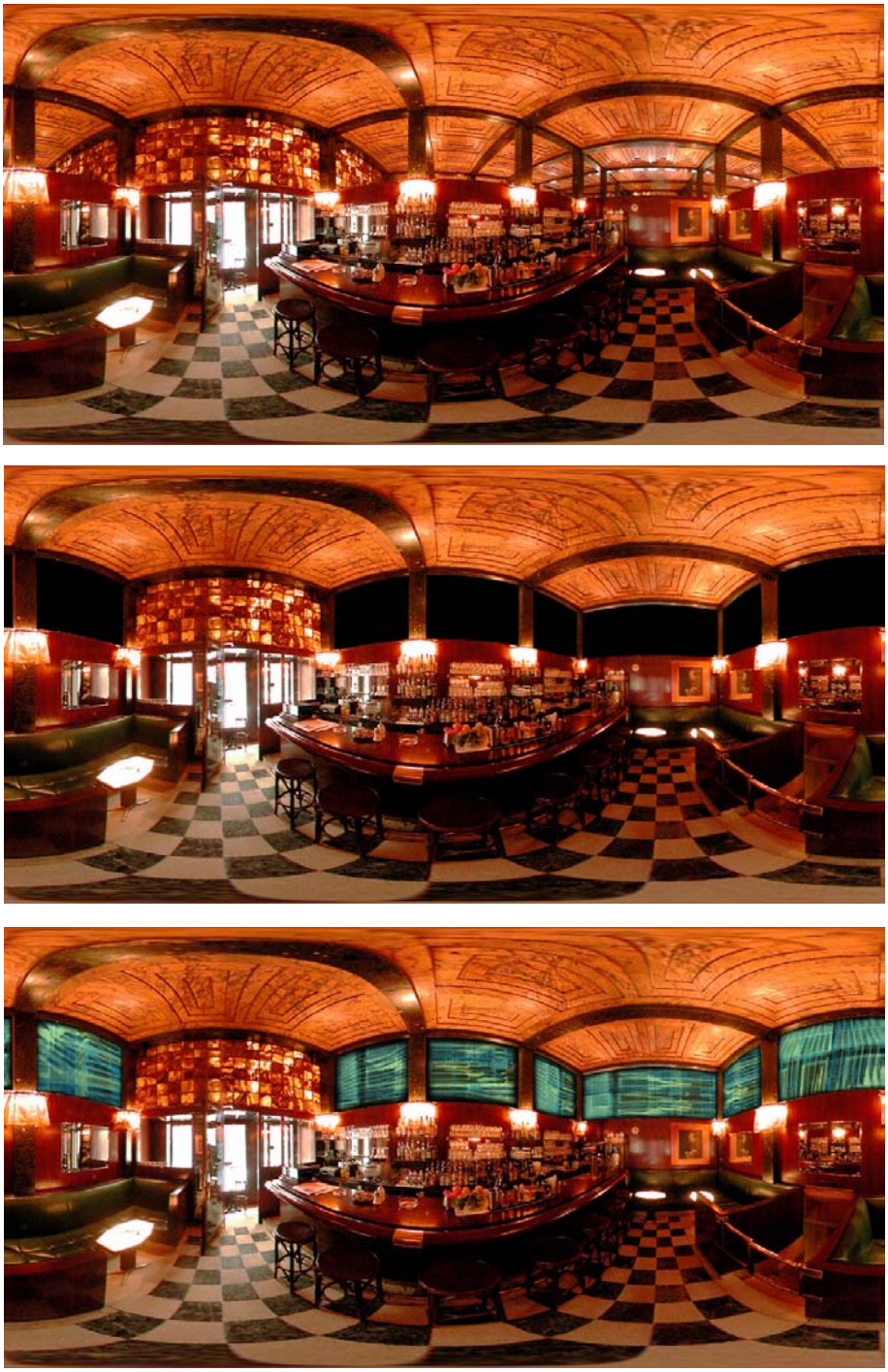

Figure 1-3: American Bar - Screenshots from the panoramic sequences

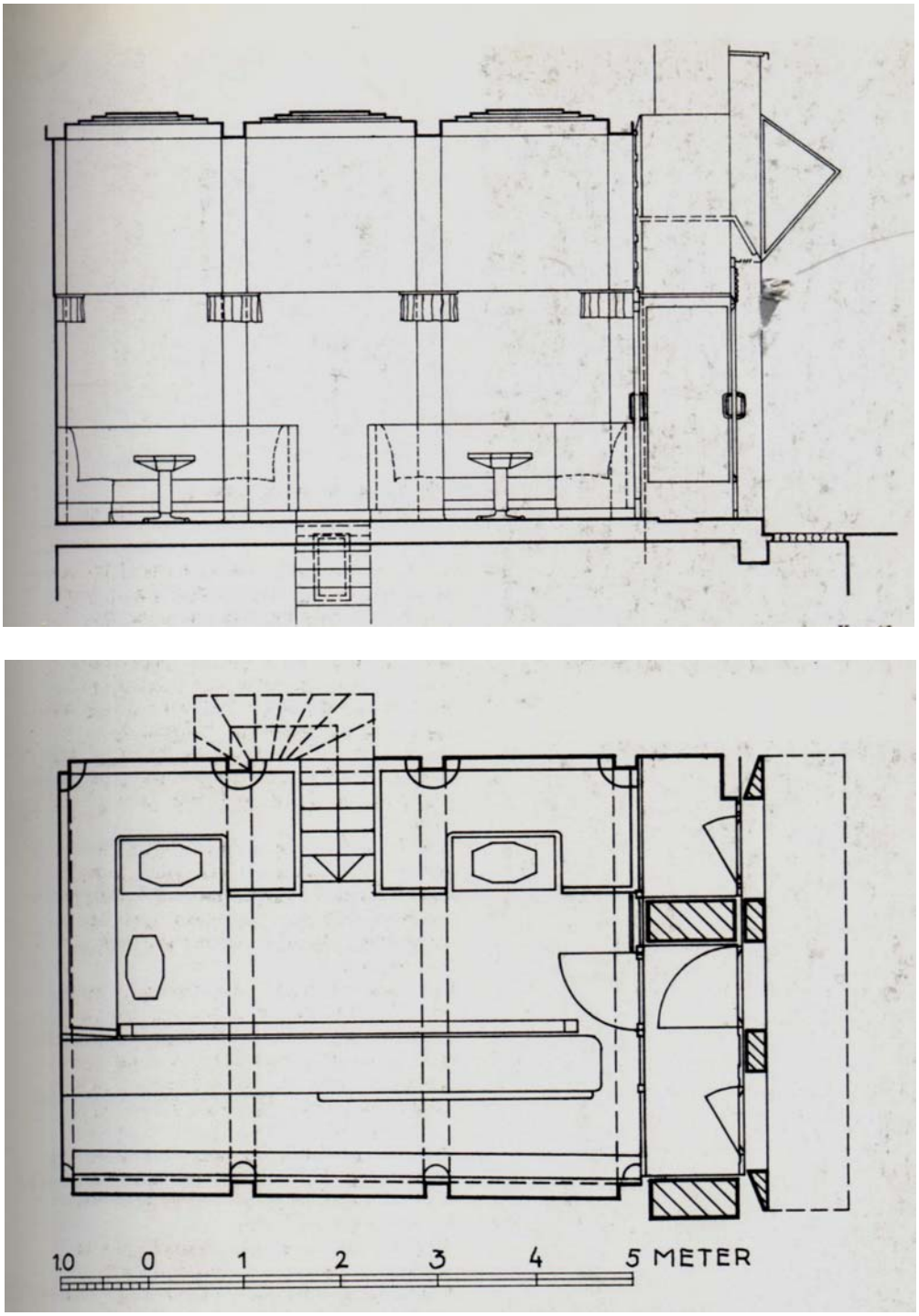

Figure 4-5: American Bar - Ground plan and section

The first panorama in sequence presents the spatial constellation (3.5*7*3.5 meters) as experienced by any visitor nowadays. The abundance of optical stimuli represents an extreme contraction to the confinement of the room. The true dimension of the visually extended room is only realized in connection with the furniture and the dimension of the floor tiles

The second panorama in sequence reduces the room by artificial dimming of the mirror band fields to the actually existing wall and floor surfaces. The mirrors at eye-level were left in order to avoid the impression of an “unnatural“ wall perforation.

The third panorama in sequence replaces the Loos’ mirror band by an abstract picture motive suggesting the atmosphere of a series of monitors displaying images in the ceiling area. Which motive is displayed is of no importance in this context, it is only the possible expansion of space by means of application of an artificial world of pictures that counts.

6. Conclusions and Outlook

This project aimed at getting acquainted with the possibilities of an “alternative“ utilization of Cubic-VR technique concentrating on renderings of the "American Bar" of Adolf Loos in the course of an exploration. The result can be viewed with any available internet browser in form of Cubic-VR panorama sequences with any available internet browser [6] and normally does not call for any further installation procedures. The possible degrees of freedom in viewing and the resulting intuitive navigation are impressing.

Regarding the virtual reduction attempt (Panorama Scene 2) as well as the subsequent supplementation by adding picture monitors (Panorama Scene 3), one doubtlessly will acknowledge highest effectiveness to the room extension of Loos at a considerably low effort (Panorama Scene 1). The viewer’s attention inevitably is drawn to the overhead area. The room’s horizon is shifted above the wood paneling. Loos’ original “shine room” is instantaneously converted into a “living room” by shading the mirrors. The horizon appears at eye level. The magic of the glamorous bar seems faded out. Panorama Scene 3, the last in sequence, shows that the implementation of the picture monitors shifts the point of gravity of the inner-spatial structure to the bottom. A situation of that “situated beneath the surface” is created, surely also depending on selection of picture. Loos’ architectural setting proves to be remarkably clever, considering the fact that not only the room benefits from the optical extension but also scale and horizon of the room experienced recur towards the fabricated illusion space. Satisfactory results greatly depend on the combination of “archi-” tectonic structure and reflection.

A spatial illusion in the spirit of Adalbert Ames could lend itself as a follow-up of this project matter. Practically no relevant publication on spatial illusion will manage without referring to the so-called Ames’ room. This “distorted room” was erected at the University of Princeton giving the impression of being a rectangular room configuration when viewed only with one eye. According to the ground plan shape it, however, is an irregular quadrilateral in an oblique position. The phenomenon is to be explained as follows: The three walls making up the room are vertical, the corners of the room, however, are not right-angled. Additionally, the floor is lower in the corner farther away. Even if we can perceive the illusion phenomena occurring in situ at the intellectual level, the combination of model picture and technical draft by means of viewing will prove tedious and difficult for the layman. By means of Cubic-VR technique a relevant explanation of phenomena could be issued more

comprehensively and expeditiously, by e.g. anticipating a “room-ability” from the very beginning (constructively).

Further explorative implementations could also be presented within the framework of reconstruction activities regarding former Viennese synagogues, as numerous suited (computer-assisted) 3D-modelings are already available.

Acknowledgements
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References

[1] Stellingwerff, Martijn und Breen, Jack, "Applications of Optical and Digital Endoscopy", in Proceedings EAEA 1995 - Vienna, pp. 55-68
[2] Further information regarding Cubic-VR on the Apple-homepage, cf. item "Quicktime": http://www.apple.com/
[3] Hotten, Robert D. and Diprose, Peter R., “From Dreamtime to QuickTime: The Resurgence of the 360-Degree Panoramic View as a Form of Computer-Synthesised Architectural Representation“, in Proceedings ACADIA 2000 - Washington D.C., pp. 155-162
[4] Rukschcio, Burkhardt and Schachel, Roland, Adolf Loos - Leben und Werk, Salzburg: Residenz Verlag, 1982, p. 459
[5] The software-packages Panoweaver and PTViewer Scripter were implemented in this project: http://www.easypano.com
[6] The outcome can be viewed under URL: http://info.tuwien.ac.at/raumsim/hsjs