The Infliction of Reality Upon Virtual Architectural Models

Observation about real world objects and computed models

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Abstract. *The inevitable and obvious distinction between virtual and real worlds is a result of an assumption, that objects in computation are either digital or not. With new concepts like Mixed- or Augmented-Realities this simple standardized differentiation has become questionable. The infliction of real objects upon virtual models can not be ignored.*
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INTRODUCTION

As long as the handling of computers was limited to desktop computers the distinction between virtual and real worlds was easily made: everything on screen was virtual and anything else was taken for real. Rather than dealing with the physical constraints of the real world it was assumed that a copy of a section thereof modeled in virtual space would do as well. After all, such virtual objects could be modified very rapidly and easily.

CONVENTIONAL COMPUTATION

Similar to other machines like e.g. a dish-washer conventional computers were regarded as machine for designated tasks. As consequence there was a clear differentiation between digital data as related to this type of machine, and the real world. As a matter of fact there were simply no relations. The segregation of virtual worlds and the real world derives from this assumption. This simple distinction between digital entities and physical objects was shortsighted from the beginning.

Technical appearance

At first, it neglected the physical presence of the machinery as required to create virtuality. Any virtual model is somehow represented in a physical environment, or just as simple as it is, computers as physical objects of our world are needed to display fictitious objects as virtual.

Secondly computational actions are affecting the reality. The only question is to what degree a computed calculation triggers a reaction in the real world. While a simple computer stands still on the desktop and only provides some lighting and noise a joystick with force-feedback is already different. At the other end of the scale total immersive simulators can establish an impressive physical appearance on its own like e.g. professional flight simulators require designated buildings.

Because all these physical elements only serve the purpose of presenting virtuality their presence is ignored on a regular base, as long as technical constraints do not impact the quality of the presentation.

Virtual appearance

Besides this general observation a closer view into virtual architectural models reveal comparable occurrences, assumed the distinction is valid, of the amalgamation between real and virtual worlds. Virtual worlds build after the real world inherit general principles from the real world, like the concepts of color and perspective, or in gaming, of gravity. In a sense reality acts as prototype for this kind of virtual models. Virtual architectural models appear almost as their real world counterparts. Compared an absolute virtual world would be, by pure logic, unimaginable and cannot be discussed.

The inherent assumption of separated worlds are based on concepts of conventional computation. Although not true, they provide a simple model to work with digital models.

REALITY AND VIRTUAL WORLDS

However, this technique is on its way to become historical. More modern computational forms like mobile computing, interactive furniture, smart spaces, social navigation and/or ubiquitous computation might provide some suggestions or theories. The technical boundaries between the reality of the devices and the virtual worlds they provide are already blurred.

Mixed- and augmented-reality

In the fields of Mixed- and Augmented-Realities, for a long time a niched field of computational research, the intermingled nature of virtual worlds and the real world has been accepted and a decent theory has emerged and is now established.

In general AR-systems, according to Azuma (1997), have to fulfill three conditions or criteria:

1. The system combines the real world with a virtual model
2. It allows for interactive access in real time, or, in other words, is aligned in time.
3. It is registered and aligned in space.

Milgram's continuum

In 1994 Paul Milgram and Fumio Kishino published a short paper introducing a continuous space between the virtual and the real environment, which is now best known as Milgram's continuum. It describes a line between virtuality and reality. Instead of iterating through discrete distinctions this continuum simply allows for other forms of the evaluation of computational models. The continuum covers all possible constellations.

The definitions combined with Milgram's continuum are satisfactory for a technical community. The one-dimensional Milgram's continuum has been proven as solid and is common grounds in AR and MR, even if some of the emerged derivate theories only obfuscate the simplicity or loose the focus on the princip.

AR- and MR-devices

As long as the development of AR- and MR-systems is mainly focussed on technical improvements to provide perfect simulations more is not needed. In these systems the physical parts, or better, the physical tangible parts are regarded as technical shortcomings. While wearing HMDs (Head-Mounted-Displays), earplugs, gesture controls and other immersive technologies provide a submerged computed experience with real sensations the devices are still unwanted. Computers in backpacks are a burden, heaters are ugly and so on. All devices disturb the imagination.

Receptive devices

The sensing and tracking devices are still not acknowledged. They deliver informations about the real world to be apparent in the virtual worlds. As example the position of a user provided by a positioning receiver is transformed as the apparent position in a related virtual model. The most basic application would be a navigational tool. It provides a virtual world, its maps, based on the physical location of the whereabouts of the device. Going further applications can be imagined where a user acts as a pointing device in the real environment as e.g. in locative games. Another examples are the necessary markers of AR-systems in the real world. Without contradicting Milgram's continuum the case would be inverted. Not a user in front of a computer is perceiving a virtual model, but a virtual model reflects the physical appearance of a user and its surrounding.

Utopian design
An often unnoticed point is of more general nature: Architectural models have almost always an inherent aspect of Utopia. An imaginary architecture acts not only as the perfect design but also as the realistic blueprint for a future building. It means, that another dimension is introduced: time: Further elaboration shows the complications: The projection of a virtual model in architecture does take place either towards the future or towards distant places, imagining that at some time of the future or at some point in space the possibility of transforming virtual models into real world objects must exist. The final goal for virtual architectural models as future buildings is their realization.

INFLICTIONS
This leads directly to the observation, that there are three mentionable cases where the physical reality may inflict virtual architectural models:

1. Reality as blueprint for virtuality
2. Reality as appearance in a virtual world and
3. Realization as final goal for virtual models

All of them suggests, that the assumption is at least questionable, that there are virtual worlds and a real world. Looking at some examples may stretch the argument that it is all about worlds.

Immersive augmented reality
Some really progressive and forward-looking AR-systems cover the sensory organs of their users completely. These immersive AR-system like the 'Tinmith'-system (Pierkarski, Gunther, and Thomas 1999) or the 'lifeClipper'-project (Torpus and Tobler 2011) submerge their users into unique experience. There are no doubts that these systems are very effective and, if functional, can furnish real sensation.

Besides the already mentioned shortcomings of technical devices, which are numerous here, there is an additional, almost minor side effect: Any user of these system needs a guide.

Because any recipient, only one at a time, is neither in the real world with all his/her senses nor in a protected environment to consume a real virtual experience such a scoutmaster must be present as precaution. The company introduces all possible disturbances the presence of another lifeform can purvey, and more important, may arguably reside in both the virtual world and the real world. Milgram's continuum can cover this, but this is not really the point.

Historical preservation
Destructed historical buildings as source of virtual models have the beneficial side effect that as virtual models they are not a fiction but a recall.

A fascinating project is the projected reconstruction of the Bamiyan Buddhas in Afghanistan (Janowski 2011), because it is not only prominent and of large scale, but also the remembrance of their destruction is still vivid. The documentation of their original state is reasonable good (Grün, Remondino and Zhang 2003).

Although prominent and largely published elsewhere, the virtual nature of the preservation is ignored. At first glance this aspect seems very similar to the technical appearance in conventional computation, but in itself the case is different. To cut it short, there is no questions that all models of the Buddhas are now only virtual.

CONCLUSION

Instead of arguing hence and forth alongside the Milgram's continuum, the more important question is, if the distinction between virtual worlds and reality is relevant at all. Multiple realities like VR, AR, MR and so on embrace only concepts of holistic models without respecting the consciousness of a human being at the perceiving end of the line.

In information technologies some ideas are already forming. The interaction between user and machine is no longer restricted to mouse and keyboard as input with screen and speakers as output devices. User interfaces are now considered as generally based on human interactions and computed results are a part of the action flow. The concept of HI (Human Interface) or HUI (Human User Interface) in the post-desktop era of computation renders the distinction between a 'digital' and a 'physical' world almost obsolete.

Another suggestion would be to substitue 'virtuality' with alternate concepts already at hand. Instead of referring to 'digitality' or 'virtuality' more comprehensive terms and definitions like 'imagination', 'fiction' or/and 'ideas' can be used. Their advantage is their long-standing theorization in humanities. They are also a common component in planing theory, and as such in architecture. Referring to a sketch as an idea sounds much more natural than referring to it as a virtual models.

Virtual computational worlds and with them virtual architectural models are viewed as ideal, pristine and immaculate. They are simply perfect because they are, only as models, not bound to our real world. In other words, they are viewed as heavenly or divine, while our earthly buildings afflicts us with their shortcomings. It seems, that a merely religious pattern of the occidental culture has been transformed into a technical classification.

If the conclusion is, that the problem is already solved, because it is a renamed discussion about built and unbuilt architecture, then this particular discussion has either no point at all, or is part of a very familiar general discussion in architecture, which already is going on for ages.

REFERENCES

Anders, P 2007, 'Designing Mixed Reality: Principles, Projects and Practice', *Proceedings of the 27th ACADIA Conference*, Halifax, Nova Scotia, Canada, pp. 276-283.

Anders, P 1999, 'Envisioning Cyberspace', McGraw-Hill, New York.

Anders, P and Lonsing, W 2011, 'AmbiViewer: A Tool for Creating Architectural Mixed Reality, *Proceedings of the 2005 ACSA International Conference*, Mexico City, Mexico, and Washington DC, USA, pp. 292-299.

Azuma, RT 1997, 'A Survey of Augmented Reality', *Presence: Teleoperators and Virtual Environments 6,* Berlin, Germany pp. 355-385.

Back, M, Chiu, P, Miyazaki, J, Horikiri, K., Newman, MW, Naohito, O and Huang, J 2005, 'Ubiquitous computing in next generation conference rooms: interweaving rich media, mobile devices, and smart environments', *UbiComp 2005 Conference*, Tokyo, Japan.

Belcher, D and Johnson, B 2008, 'MxR: A Physical Model-Based Mixed Reality Interface for Design Collaboration, Simulation, Visualization and Form Generation', *Proceedings of the 28th ACADIA Conference*, Minneapolis, MN, USA, pp. 464-471.

Clayton, MJ and Weisenthal, H 1991, 'Enhancing the Sketchbook, Reality and Virtual Reality', ACADIA 91, Los Angeles, CA, USA pp. 113-125.

Grün, A, Remondino, F and Zhang, L 2003, 'Automated Modeling of the Great Buddha Statue in Bamiyan, Afghanistan', *ISPRS Archives*, vol. XXXIV, part 3/W8, Munich, Germany, pp. 11-16.

Janowski, J 2011, 'Bringing Back Bamiyan's Buddhas', *Journal of Applied Philosophy* vol. 28, no. 1, Wiley Inc., Hoboken, NJ, USA, pp. 44–64.

Lonsing, W 2011,'Architectural models in urban landscapes: Synthesis of markers and virtual structures', *Proceedings of the 10th International Symposium on Mixed and Augmented Reality*, Basel, Switzerland, pp. 109-110.

Lonsing, W 2004, 'Augmented Reality as Tool in Architecture', *Proceedings of the eCAADe Conference*., Copenhagen, Denmark, 495-499.

Lonsing, W 2005, 'Viewing Ambispace', *Proceedings of the eCAADe Conference*., Lisbon, Portugal, pp. 477-482.

Lonsing, W and Anders, P 2005, 'Three-dimensional computational structures and the real world', *Proceedings of*

the 16th CAADRIA Conference, Newcastle, Australia, pp. 209-218.
Lynch, KA 1960, '*The Image of the City*', MIT Press, Cambridge, MA, USA.
Maeda, N and Scott AM (adv.) 2011, '*Future of the past: augmented history, preservation as a catalyst for transformation'*, Thesis (M. Arch.), MIT, Dept. of Architecture, Cambridge, MA, USA, [*http://hdl.handle.net/1721.1/63052*].
Milgram, P and Kishino, F 1994, 'A Taxonomy of Mixed Reality Visual Displays', *IEICE Transactions on Information Systems*, vol. E77-D, No.12, pp. 1321-1329.
Pierkarski, W, Gunther, B, and Thomas, BH 1999, 'Integrating Virtual and Augmented Realities in an Outdoor Application', *Proceedings of the 2nd IWAR*,Washington DC, USA, pp. 45-54.
Regenbrecht, H, McGregor, G, Ott, C, Hoermann, S, Schubert, T, Hale, L, Hoermann, J, B Dixon and Franz, E, 'Out of reach? – A novel AR interface approach for motor rehabilitation', *Proceedings of the 10th International Symposium on Mixed and Augmented Reality*, Basel, Switzerland, pp. 219-228.
Seichter, H and Schnabel, MA 2005, 'Digital and Tangible Sensation: An Augmented Reality Urban Design Studio, *Proceedings of the 10th CAADRIA Conference*, New Delhi, India, vol. 2, pp. 193-202.
Torpus, J and Tobler, B 2011, 'lifeClipper3 – An Augmented Walking Experience', *Proceedings of the 10th International Symposium on Mixed and Augmented Reality*, Basel, Switzerland, pp. 73-82.
Wagner, D 2007, '*Handheld Augmented Reality*', Dissertation, Graz, Austria.