

The Importance of Virtual Environments in the Design of Electronic Games and Their Relevance to Architecture

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Abstract

Ever increasing complexity in architectural design and the need to deliver a cost effective solution requires the employment and adoption of innovative design methods. Although technological changes have entered the field of architecture at a slower pace, the recent adoption of 3D modelling, Virtual Environment and multimedia represent significant changes in architectural design, visualisation and presentation. These now include tools for conceptualisation, design synthesis, design presentation, desktop publishing, animation, Internet and hypermedia authoring. Uddin argues that *the major activities involved in the creative and dynamic process of architectural design deal with conceptualisation, visualisation and expression of alternative ideas through two-dimensional and three-dimensional model.* [1] This paper highlights the need for the employment of emerging computer based real-time interactive technologies that are expected to enhance the design process through better decision-making, higher quality communication and collaboration, error reduction, spatial awareness, interactive design and real-time visualisation.

It is suggested that valuable lessons could be learned from the electronic games industry that has pioneered, adopted, extensively utilised and in some cases discarded such technologies in their design and development process in an effort to deliver robust, well designed and compelling products. This paper studies the electronic games design process and draws parallels between architecture and proven games design practices that are likely to be of benefit to architects. The value of real-time visualisation and design tools in particular Virtual Reality interfaces should be used and given access to CAD model information and data are also discussed. Adoption and appliance of such integrated technologies over the Internet and emerging software and hardware technologies are outlined. Finally case studies from the architecture and construction industries, where such practices have been adopted, are also considered and the benefits are put forward to support the argument.

Introduction

Game design and development now encompasses the fields of real-time computer graphics, proto-

typing, visualisation and art, and it has entered new fields such as immersion, applied artificial intelligence and physically based modelling. In contrast, architects have only recently begun experimenting with digital media that reach beyond the purpose of presentation.

The architectural design process can be divided into the following phases: schematic design, design development, presentation and evaluation, detailed development and documents production, bidding and finally administrating construction. Although new technologies offer better and more diverse levels of situational awareness and increased support for meaningful discussions that assist decision-making, they have not yet been capitalised by the architectural industry. *The full potential of computing in architectural design will only be realised through the creation of a new model of the design process that is appropriate to the new design medium.* [2]

Development methods in games design

In games design and development efforts for reducing and containing escalating development costs and slipping deadlines are increasingly tackled through prototyping, good software analysis and design, the introduction of quality controls and through effective project management. Such methods include *Design Patterns* [3], the *Dynamic Systems Development Method* (DSDM) [4] and *object-oriented project management* [5] used in conjunction with *Unified Modelling Language* (UML) to guide all project team members through the entire project life-cycle.

The games design development process

Creating a successful game is challenging and involves expert skills from the fields of science and art. The nature of the game development process requires strong but flexible project management and involves a continuous need for visualisation in the making of decisions that usually lead to redesign, compromises and trade-offs during and prior to development. Game design can be broken down into four phases, pre-planning, detailed planning, project implementation and post-project review.

Pre-Planning

In pre-planning, the most effective way to come up with initial ideas for a game is by assembling a number of experienced game designers who have new ideas for characters, story-lines, animation sequences, original interface concepts, effective use of new technologies and are aware of market related issues. In design terms game levels may take unrealistically long times to build, may be complex or the sense of scale may be missing. Prototyping and visualisation tools at this stage is a key to get a feel of the product's looks and to quickly visualise ideas inside real-time virtual environments (e.g. Multigen Paradigm and Nemo).

Detailed Planning

In a complex project tasks are identified, categorised and broken down by a core team that should include the project manager, a senior programmer, a senior artist and the game designers. *The process of producing an analytical design and requirements document* [6] that had the input of all team members normally identifies hidden problems, their cause and effect, allow for stating and evaluating alternatives and finally for making decisions.

Project Implementation

Assuming that the project plan has been approved putting it into operation means that the project hierarchy will now have to ensure that the end results remain feasible and quality remains high. This is a highly dynamic phase as changes are expected due to shifts in the marketplace and rapid introduction of new unproven 'must have' technologies. As changes even in the best of plans are unavoidable the project team should have a contingency plan in place. Powerful real-time visualisation tools and design aids are vital during this process to quickly find solutions to ever emerging problems as well as to quickly model and communicate alternative designs.

Project Close-Down

On completion a report outlining what the project has achieved is put together by an unbiased person or team. It comments with regard to project management, timeframes, availability of resources, co-ordination with regard to other projects, teamwork, effectiveness of procedures, etc. The purpose of such a review is to learn by experience and to find out how has the team dealt with unforeseen problems, what was the outcome good or bad, record any innovations and to finally provide a set of recommendations that may be useful in future projects.

SANDWARRIORS: A CASE STUDY

In Sandwarriors, (a flight based game developed by Astros Productions Ltd.) the environment is littered with populated cityscapes, tunnels and underground complexes where the player and computer units can fly or walk-through. Modelling such large areas posed a number of problems as each landscape numbered almost 300,000 polygons that needed to be processed in real-time to speed up conceptualisation and later to assist with the design synthesis process. Virtual prototyping and real-time visualisation were thought to provide the answer (since general purposes 3D modelling pack-

ages such as 3D Studio are unable to perform such tasks in real time). Custom written real-time visualisation tools allowed the designers (including non-technical team members) to quickly visualise spatial relationships, flight paths, discuss mission design and concentrate on content. The ability of non-technical staff being able to provide hands-on input in the design generated an array of new ideas that spurred creativity.

Architecture and the electronic games industries

Emerging and affordable computer based real-time interactive technologies are expected to enhance the design process through better decision-making, improved communication and collaboration, error reduction, spatial awareness, interactive design and real-time visualisation. [7] The electronic games industry has pioneered, developed, adopted, extensively utilised and in some cases discarded real-time technologies in their design and development process in an effort to deliver robust, well designed and compelling products to their customer base. Uddin argues that *the major activities involved in the creative and dynamic process of architectural design deal with conceptualisation, visualisation and expression of alternate ideas through 2D and 3D models.* [8] VR allows architects to develop richer content, increase their spatial awareness, appreciate scale and proportion and set a **mood** in their designs. Affordable VR software tools now allow architects to share photorealistic 3D models over the Internet. These include Autodesk's VIZ and Lightscape, the Unreal Engine, Navisworks and Architect III from Geometric Computing. Costs for a PC based hardware/software design and visualisation solution excluding CAD software (i.e. AutoCAD) range between \$2,500 to \$10,000 depending on the hardware and software purchased.

A number of factors in games design that can contribute significantly in architectural design developments have been identified as follows:

Planning

The process of producing games requires careful planning. Initial ideas evolve during brainstorming sessions and rely on original ideas, best technology and visualisation and prototyping tools.

Layout Design

Layout design is concerned with the way that areas are constructed offering natural and well defined breaks in levels, controlling access to certain areas and for adding functionality to spaces. Thus spaces are designed to accommodate the story line and events that are to take place within them to enhance game play.

Navigation Control

Environmental feel is important for achieving a high degree of realism and immersion. These may include atmospheric lighting, effective use of materials and textures, and fake facades viewed through windows to give viewers the feel that they are involved in something **bigger**. Facades may depict high quality visual scenes or well known landmarks to enhance and better place the virtual environment they depict. Flow is also important and while visual impact is crucial the designer should be aware of not cluttering or overwhelming the viewer with a great number of visual queues especially when first introducing him or her to a new environment (level of continuity).

Storytelling

One of the most interesting features that can be adopted from games is telling stories in an interactive environment. A game is made out of many single levels and every level contributes to an overall

goal, very much like a building. A building is designed by an architect to serve a purpose as well as the needs of its occupants. Storytelling for architectural design should be simplified in the sense that the participants understand the designer's motives as they have been expressed in the real world.

Optimising Digital Space

In the past designing and developing highly complex real time visualisation software tools in-house within the electronic games industry was common. However tools of this kind now exist and more interestingly both games designers and increasingly architects use them for design and visualisation purposes.

Conclusion

As architectural design becomes more complex and dynamic a new form of storytelling is required delivering a new level of interactivity and a more democratic relationship between storyteller and audience. Architects should draw from the games industry to add value to their design process as a first step to taking architectural design to its next stage of evolution. Real-time visualisation and design tools can offer added value in the prototyping and design stages as well as for re-examining original concepts and for creating and visualising viable alternatives during product development. The ability to assign relevant content at specific design stages makes VR an effective tool that stimulates creativity and reduces the abstraction between the virtual and real world. However tools of any kind should be seen as a mean rather than an end. Designers should not take implicitly past assumptions where information, rather than the creative use of information, was the scarce resource.

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