



Interactive 3D Walkthroughs - A Discussion of the Challenges and Opportunities

Property developers and marketers are becoming increasingly interested in the potential of interactive 3D technologies to present new building projects to potential buyers, planning officers and other stakeholders. But realtime interactive walkthroughs present new challenges, compared to traditional 3D walkthroughs, and this paper intends to discuss these challenges, and the opportunities offered by interactive 3D presentation technology.

Two Types of Walkthrough : Pre-Rendered and Interactive

Essentially, there are two types of 3D walkthrough. Firstly, the pre-rendered type, where the walkthrough or flythrough is delivered as a linear video file, and the user just presses 'play' and then sits back to watch the action unfold. The path of the journey is 'pre-defined' by the 3D animator, and the visuals are often highly photorealistic and very detailed. This is the type of walkthrough and flythrough that we have become familiar with over recent years, published on DVD and in various web video formats, to present new property developments before they're built.

The second type of 3D walkthrough is the new 'interactive' option, where the user has control over the walkthrough, similar to a computer game environment, and can explore the virtual model at their own pace, and 'interact' with it in 3D space - rotating, zooming in and clicking on different areas of the model to extract the information they require.

Pre-Rendered Walkthroughs - An Explanation

The essential difference between traditional walkthroughs and interactive walkthroughs is in the rendering process. Traditionally, rendering is a stage of production that takes place once all the 3D modeling has been done, when all the materials have been applied, the lighting has been set up, and the camera path defined.

(If you have ever watched a 3D visualiser working within their 3D software, you'll know that the models you see onscreen during the modeling stage don't look like they're supposed to - they tend to be grey and blocky, with low detail materials and no lighting. This is because they are still 'unrendered' at this point.)

When all the 3D modeling and setting up has been completed, the computer hardware takes over, with the processors working hard to translate all the information in the 3D scene file into a 'fully rendered' 3D animation sequence, ready for viewing on the web or burning to DVD. The 'rendering' process turns the 3D data and settings into imagery that looks finished and real, and depending on how much computer processing power is available, it can be quite time consuming - taking days or weeks for very complex / highly photorealistic sequences of animation.

As we all know, animation is made up of static images played in very quick succession to give the effect of motion - usually at a rate of 25 frames per second. So, for each frame, the computer processors calculate the exact positioning of all the models in the scene, the look of all the textures and materials, and the lighting effects - shadows, reflections and bounced light effects, to create a realistic and attractive static image. The resulting static images (played back at 25 frames per second to create animation) are effectively just ordinary digital images - like jpegs or tiffs. While the content of the imagery may be '3D', the imagery itself is just ordinary '2D' graphics. This means it can be viewed on pretty much any computer, making no special hardware or software demands. All the 'clever stuff' has been worked out by the 3D animation studio's high end rendering processors, in advance, hence the term 'pre-rendered'.

Interactive Walkthroughs - An Introduction to 'Real Time' Rendering

The major difference for interactive walkthroughs, is that this rendering process takes place in real time - that is, 'on the fly', as the user interacts with the virtual models. This makes sense, because you couldn't pre-render a walkthrough if you didn't know which way the camera was going to turn next, or which part of the model the user would want to look at. The fact that the user has complete control over their movement around the 3D model, means that 'rendering' has to happen instantaneously in response to user-interaction. This type of rendering is known as 'realtime rendering', and the major difference is that it relies on the graphics processors on the local machine to make all the rendering calculations - the precise positioning of each element of the model, the shadows, reflections and so on. Whereas 'pre-rendered' animation will play back on pretty much any personal computer, 'realtime rendering' can make some pretty significant demands on the user's hardware and software capabilities.

Historically, this has been problematic, and has thwarted the potential of 'interactive 3D', because ordinary user's PCs were unlikely to have sufficient graphics capabilities to perform any decent 'realtime rendering'. Interactive 3D therefore had to be very basic, requiring only simple rendering calculations. No realistic lighting, no complex geometry, and no lifelike materials or textures - altogether not much good for property marketing applications, which call for highly realistic and attractive visuals.

However, with the passing of time and the growth of home computer gaming, we have witnessed huge leaps forward in the graphics capabilities of 'ordinary' PCs. These days, most home computers and even laptops come equipped with a graphics card powerful enough to run pretty serious 3D computer games - and interactive 3D walkthroughs call on exactly the same technology. This means that 'realtime

rendering' of high quality 3D scenes has become a genuine possibility, and property marketers can at last consider interactive walkthroughs as a viable presentation solution.

This is not to say that all barriers have been overcome. Though much improved, there is still a considerable limit on the amount and complexity of realtime rendering that user's machines can be relied upon to deliver. And if an interactive 3D scene calls for more processing capacity than the local machine can provide, the user will experience a significant slow-down in the performance of the walkthrough. They won't be able to move around the 3D model easily, the graphics will lag behind, and their experience will be frustrating and unsatisfactory. This does not make for effective marketing!

Optimizing 3D Scenes for 'Real Time' Rendering

The crucial challenge is to ensure that even a modest PC will be able to render the 3D scene quickly enough to display roughly 25 frames per second, so that onscreen movement appears as smooth and seamless as 'pre-rendered' animation. For large, complex or detailed 3D scenes of the type required for effective property marketing, it takes a significant amount of optimization to ensure the 3D models can be rendered in real time by a modest PC.

Firstly, the models need to be constructed in a way that minimizes the polygon count whilst conserving plenty of detail and realism. This can be achieved using single-sided polygons, displacement maps and other 'low poly' modeling techniques that have long been familiar to computer games designers.

Secondly, some of the lighting effects can be 'pre-baked' into the materials so they don't need to be calculated 'on the fly'. This means that some of the shadows and reflections are effectively 'pre-rendered' and then permanently overlaid onto the models before they are exported. This has the effect of fixing the shadows and reflections into position, so they look the same whichever angle the models are viewed from, but this is a small compromise which makes it possible to deliver highly realistic 3D models that don't require excessive levels of 'realtime' rendering.

Thirdly, scenes can be further optimized where necessary by reducing the number and resolution of texture files. These are image files that are referenced by the 3D models, carrying the colour, texture and pre-baked lighting effects relating to each item in the scene. By reducing the number of different files and their resolution, visualisers can minimize the rendering demands of an interactive 3D scene - though excessive optimization can consequently reduce the walkthrough's visual quality and level of realism.

Of course, optimization is only really necessary if you want the interactive walkthrough to run on anyone's computer. If, on the other hand, you only want to run the application on machines that you have control of, such as the computers in your marketing suite, or interactive touch screen kiosks set up specially for the purpose, then you can happily push the level of complexity, quality and detail to the limit. As long as your own machines are sufficiently well equipped with a powerful graphics card (a relatively simple upgrade option for most PCs), then the highest quality of interactive walkthrough will run smoothly without any problems.

It is also straightforward to produce several versions of the same interactive walkthrough, designed for use on machines of varying graphics capability, just as you might produce two different versions of a web video, for users with either dial-up or broadband internet connections. This has the advantage of enabling you to run a highly complex and photorealistic interactive walkthrough on a powerful computer, whilst giving other users the option of a less demanding version for their machines, instead of having always to cater to the 'lowest common denominator'.



Delivering Interactive Walkthroughs - Offline and Online

As well as having the option to deliver interactive walkthroughs in a variety of 'quality' versions, they are also available in a variety of different formats. The predominant format will usually be as an .exe file. This is a self-contained application file that doesn't require any special software to run, and which can be pre-installed on a specific machine or delivered via CD-rom or USB memory stick.

Crucially, however, it's also possible to deliver interactive walkthroughs over the internet, so that they can be embedded into a website and viewed online. Here again, there are certain challenges to be aware of. In particular, it is still the case that interactive walkthroughs will usually require the user to download a 'plug-in' before they can view the scene - a specific piece of proprietary software that needs to be installed onto the local machine to enable it to run the interactive walkthrough.

This shouldn't be a serious issue, as long as the user is prepared to put up with a slight inconvenience to view the content for the first time. However, it is something to consider, and is certainly another obstacle to the proliferation of interactive walkthroughs via the web.

Bear in mind that most new web technologies initially require the installation of a special plug-in, and that users are fairly familiar with this experience. The BBC iPlayer, the IKEA Kitchen Planner, iTunes and online Flash animation are all examples of web content that require plug-ins to run - though Flash has now become so widespread that it comes pre-installed with most web browsers these days. The plug-in only has to be installed once, the first time the user accesses the online content on a particular computer - from then on, they can access the interactive walkthrough without any interruption or delay.

The Advantages Offered by Interactive Walkthrough Technology

As with any new technology, there are some obstacles to overcome in the early stages of the proliferation of interactive walkthroughs, but demand is nonetheless growing. Users are demanding increasing levels of interaction and reactivity across all digital and online content, no longer satisfied with sitting back passively to absorb information. So what advantages do interactive walkthroughs offer over traditional 'pre-rendered' presentations?

Property Marketing - Giving Control Back to the User

When it comes to property marketing, interactive walkthroughs provide developers and their agents with a way to engage with modern audiences in a way that has not yet been fully explored. For those that want to be at the cutting edge of new technology, interactive walkthroughs offer a way to capture the attention of users with something new and innovative.

In terms of user experience, interactive walkthroughs call for a new level of engagement, where the user is asked to make decisions about what they want to look at, and to interact with what they are seeing on screen. By putting the control into the hands of users, developers are able to make new properties accessible to potential buyers and other stakeholders, and thereby engender new levels of trust. When a potential buyer can navigate their own way around a virtual model, they can really examine all the details and access all the specific information that interests them, rather than merely being presented with what the developer wants them to see. Of course, this does depend on the level of detail and realism of the virtual model, but, as outlined above, it is now possible to deliver exceptionally detailed, accurate and reliable 3D models, so that every aspect of a new property development can be communicated with clarity.

Interactive walkthroughs are also a powerful way to make property marketing websites more 'sticky', giving website visitors a reason to stick around and explore what's on offer. As well as being published online, interactive virtual tours are ideal for use with touchscreen kiosks in the sales office or marketing suite, enabling the sales agents to present a new development in an effective and exciting way. Interactive walkthroughs can also be distributed on CD-rom or USB Memory Stick, and will run on any ordinary PC.

A Powerful Design Tool and Planning Aid

Proposed developments can be modeled in 3D using the CAD drawings as reference, and then published using interactive 3D technology. Planning officers can therefore be provided with the development model as an .exe application, which they can interact with - rotate, manipulate, zoom in and out, view from all angles, change materials, view at different times of day etc. Interactive 3D technology makes the virtual model truly interactive, and provides an accurate and detailed impression of the proposed development in the context of its surroundings, enabling developers and architects to communicate effectively with colleagues, investors and other decision-makers.

Promoting Leisure & Tourism Destinations

Using interactive walkthrough technology, hotels and leisure destinations can publish a virtual model of their facilities on their websites, and on CD-rom, for visitors to explore before they arrive, helping to generate interest, excitement and confidence in potential guests. Buildings and destinations can be recreated to the highest level of detail and realism, inside and out, to offer a genuine impression of the ambience and space, complete with sound and lighting effects. Ideal for shopping malls, hotels and theme parks, interactive walkthroughs enables owners to promote their facilities to a truly global audience.



Interactive Maps & Virtual Cities

3D Virtual Cities are a powerful visual tool to communicate locations effectively, enabling visitors and residents to locate and explore the places they wish to visit. Interactive technology makes it possible to deliver 3D Interactive Maps that provide a clear and compelling overview of the town or cityscape, which can be viewed from any aerial position, with a variety of interactive overlays to highlight key features or facilities. Ideal for use as a promotional tool for attracting tourism, as a way-finding system, or as an information resource about future development and regeneration, interactive 3D models make places instantly accessible to people all over the world.

Notes

This paper is intended to introduce the facts about interactive 'realtime' technology, and to provide a straightforward explanation of how it works. For further information, or for the answer to any specific queries, please don't hesitate to contact iCreate.

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iCreate is a property marketing studio that has recently launched the iViewer, a tool to deliver interactive walkthroughs for a range of purposes. <http://iviewer.icreate3d.com>