Design of a Virtual Shopping Mall: Some Observations

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ABSTRACT

In this paper, we share some of our observations for designing and implementing a shopping mall design (called Hikegaya) with 3D technology. We constructed Hikegaya using Hypertext Preprocessor (PHP), MySQL, Adobe Photoshop 7, Discreet 3D Studio Max 6, and ParallelGraphics VrmlPad. The methodology for design is discussed. With the existing technologies and with our use for prototype implementation experience of Hikegaya, we conclude that 3D applications for E-commerce are feasible.

1. INTRODUCTION

The 3-D technology and vector graphics are vary attractive in E-commerce. However, 3-D imagery has not yet been found entry in mass market of E-commerce. The reasons are many-faceted. Significantly slower page loading time (as compared to 2D images of the same product) and the inconvenience of having to download a 3D browser (e.g. WorldView browser for the virtual mall at http://www.envisage.tv/shopping/intro.htm) plug-in before one can view the mall have dampened the demand and potential growth in 3D technologies in the e-commerce industry.

1.1 3D Technology in E-Commerce

In November 1999, Boo.com was released in eighteen countries with great fanfare, after technical hitches held up its initial launch four months ago. It promised the easy and convenient purchase of high-quality, designer sportswear from the comforts of one's office or home, as well as excellent e-consumer experience in the form of 360º 3D views of every product, an animated Miss Boo who offered fashion advice and loyalty points for future discounts.

A Macromedia Flash plug-in was required to view the images within the multiple windows; the range of clothes, detailed image of one item that can be rotated or magnified, a Boo bag holding what was being purchased, a mannequin dressed in the clothes the e-consumer is considering as well as Miss Boo.

However at the time of the Boo.com launch, Macromedia Flash plug-ins were not as readily installed or used yet. Moreover, the late launch coupled with the stale advertising campaign alienated many potential customers while the website, which was considered "revolutionary" at the time, exacerbated the problem with slow downloading process of image-heavy web pages or pop-up windows, logging on, navigation and purchasing hitches, while inadvertently causing e-consumers' computers to hang. The site could not be seen by people who use Macintosh computers which are heavily used by graphics, design and media companies - surely one of the key markets for a hip online retailer like Boo[2].

Boo.com was later redesigned as a site that was easier to navigate. A version of Boo.com devoid of graphics and pop-up windows was also made available. Nonetheless, it remained too late for Boo.com, as disgruntled customers remained unimpressed, preferring to visit rival sites offering better service.

Boo.com's case reflects a significant issue that is gagging the potential of vector graphics and 3D imaging in E-Commerce; memory-hogging 3D files on top of a "skinny pipe" problem of e-consumers' slow download speeds, possibly alienating potential customers and indirectly discouraging possible sales. 3D technology may offer various advantages to a website, such as attracting interest as a novelty, while increasing the aesthetic appeal of the site, as compared to generic 2D e-commerce sites. However, as Mark Hurst from goodexperience.com argued [3,4], e-tailors are putting 3D features on their websites because it is now possible to do so, with the improved compression technology as well as increase in broadband users, not as a response to e-consumer needs.

He countered the application of 3D technology in e-tail, declaring that improved bandwidth did not necessarily make 3D an easy experience for customers because "the 3D experience is still slow and it may come only after a confusing plug-in installation process [3]". Users have to download a 3D browser plug-in in order to view the mall or the individual product, which remains an inconvenience to download, despite the increase in broadband connections. The browser download process may be a problem for e-consumers who either do not have compliant software (e.g. Macintosh operating system) or are not computer-literate enough.

The Boo.com case also highlights the issue of a good e-consumer experience, and its importance to the "stickiness" and financial well being of a website. Mark Hurst pointed out in his articles that "Companies are investing in 3D, at best a risky investment with little or no short-term upside, instead of getting substantial and immediate revenue gains from fixing more important (albeit less flashy) areas of the site". He felt that e-tailers should adhere and respond to their consumers' tastes and preferences instead,

"making a good experience for the customer – not for the technology vendor – is the ultimate e-business goal" [3].

1.2 Good E-Consumer Experience

A good customer experience fosters customer interest, and prompts them to buy, therefore increasing the conversion rate, i.e. ratio of buyers to shoppers. It also encourages repeat customers to make future visits as well as ensures long-term loyalty through word-of-mouth referrals to friends and relatives. It can even help boost offline sales, if the company has brick-and–mortar locations complementing the site.

On the other hand, as can be observed from the Boo.com case study, a bad customer experience is likely to result in the e-consumer turning to the competition instead, with little incentive to return to the site, which had failed to meet his needs. Since e-consumers are likely to warn off other potential customers about the features lacking on the site, the site could possibly suffer even more significant damage just from a single bad experience.

A great customer experience, according to Creative Good's white paper "Building a Great Customer Experience to Develop Brand, Increase Loyalty and Grow Revenues" is ensured by four key criteria; security, navigation, selection and price. Selection and price have been important considerations long before the Web. But security and navigation, which repeatedly appear in e-commerce surveys as key issues, are especially important on the Web and are both driven by the customer experience [4].

In this paper, we introduce the concept of 3D virtual shopping mall: Hikageya. We wish to include some of the demands for a good customer experience in Hikageya.

2. E-SHOPPING MALL: HIKAGEYA

2.1 Concept and Business Structure

Hikageya combines both 2D and 3D elements to suit its target e-consumer audience, i.e. teenagers and working adults. The needs of less computer-literate e-consumer with the higher purchasing power can be easily met with quick navigation links to purchase and product, 2D visual images and detailed, yet simplified product information, while the younger or more computer-literate persons can enjoy the mall walkthrough and chat interaction with prospective sellers as well as each other.

Hikageya also aims to harness customisation and personalization, the two powerful magnets drawing customers to e-commerce, by streamling operations and filtering content and information to apply to the individual e-consumer taste and preferences.

2.2 3D: The Virtual Shopping Mall

The main objective of the design of Hikageya is to produce a 3D shopping mall that customizes, personalizes and realistically represent a "physical, brick-and-mortar" shop. Retail items can be picked up at the e-consumer's clicking of a mouse for closer examination and return to their original positions thereafter, i.e. fulfilling the Selection aspect of the good customer experience. In Hikageya, we provide all product information on the accompanying 2D online shop and website so that e-consumers can make an even more acute decision.

The e-consumer explores the 3D store in real-time by moving a simulated observer's viewpoint through the 3D environment and by interacting with 3D animated objects, such as the retail items, which provide links to other text, image, audio, video and 3D data available via the WWW. Since HikaGeya displays images of a 3D environment smoothly and quickly enough, an illusion of a real-time immersive "walkthrough" is achieved, providing the e-consumer with an intuitive and natural 3D user interface for information exploration.

2.3 2D: Customization and Personalization

The 2D website is to serve as a backup support for the 3D mall, as well as providing access to it via user registration and login. The website contains all the relevant minute information about the retail items, e.g. complete photographs, reviews and synopsis of a novel, so that less computer-literate e-consumers can also make informed choices. Customer profiles are tracked and updated in a MySQL database via the website interface.

The customer profile contains the e-consumer's personalized data, as well as that of related individuals, such as people in his own age group, so that HikaGeya can offer him the selections and information that is of potential interest to him as well as categorizing the relevant products dynamically to match each specific customer profile. The customer profile is updated either through user activities (e.g. explicit responses onsite or shopping list creation) immediately in the database, analyzed and referred to for targeted recommendations to e-consumers at the 2D store.

3. HIKAGEYA: ANALYSIS AND DESIGN

3.1 Methodology and Feasibility Study

The goal of the Hikageya is to produce an online shopping mall, targeted for Windows operating system that allows consumers to simulate real-time "window" shopping, finalize sales transactions, as well as attempt "realistic" communication with the shop proprietor and other e-consumers. This goal is achieved by:

➢ Research on architecture, landscaping and interior design,

➢ Create the database for the retail items, shops and customers, demonstrating their relationships through queries and functions on the user interface,

➢ Design and model the mall, shops and landscape in 3Ds Max to substantially reduce modeling time (otherwise in VRML),

➢ Implement lighting, anchors, and other VRML nodes after importing the models from 3Ds Max,

➢ Integrate the 3D mall, and 2D store user interface under one website, to facilitate accessibility and time saving.

Five software languages and programs are used for implementation of Hikageya, viz., Hypertext Preprocessor (PHP), MySQL, Adobe Photoshop 7, Discreet 3D Studio Max, and ParallelGraphics VrmlPad. We chose them , after giving a due

consideration to the tools available on the market for creating 3D worlds, e.g. blender3d, Extreme3D, for their exporting and importing tools (to and from one another's file types) as well as their mutual compatibility with each other.

3.2 Hikageya Design

The design approach for Hikageya is divided into four phases, according to the major aspects of the project, such as website, mall, software and database design layouts.

3.2.1 Mall Design

The first phase of the design involves the "realistic representation of the mall, landscape and other models. To obtain ideas on the final outlook and effect of the mall, some requirements analysis and related survey has been done. The final design model for the mall is as follows. The overall theme of the mall is open sky; therefore the ceiling and sides of the mall are covered by glass to enhance the skylight effect, though there will be lights set up to illuminate the mall at "night". There are four shops in total, with two shops occupying each of the two floors. They include an electronics store, a CD hut, a bookshop and an art gallery. A concourse and podium joins the shops on each level, with a staircase running between them.

3.2.2 Website Design

HikaGeya means "House of Sunflowers". The theme of the mall evolves around this flower, featuring bright colors and features reflecting this association (Figure 1).

3.2.3 Software Design

We model software to achieve a high level of quality in our finished product.

High quality is a product of ease of development, results of modelling prior to development cycles, better user documentation and less bugs through better testing. Development can be drastically reduced by proper software modelling and documenting.

Figure 1 Hikageya Login Page

Software design for Hikageya utilized the spiral model. This model allows us to progressively complete the software design and implementation. A use-case diagram (Figure 2) shows a number of external actors and their connection to the use-cases that the system provides.

3.2.4 Database Design

The system (Figure 3) consists of sales items, each having an inimitable identifying number, an item description, sell and cost prices, transaction status. Attributes unique to each category of products (e.g. books, art, and electronics) are also listed. Each shop entity possesses its own shop name, description, address and registration date, while information about the customers include their unique, auto-incrementing id, name, gender, address, status, account balance, password, avatar name and birth date.
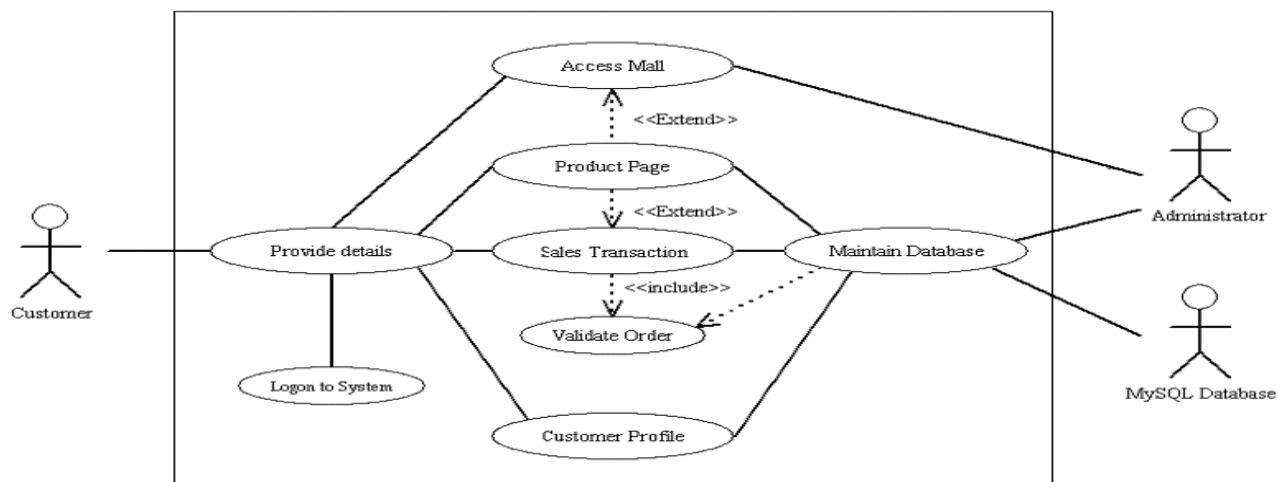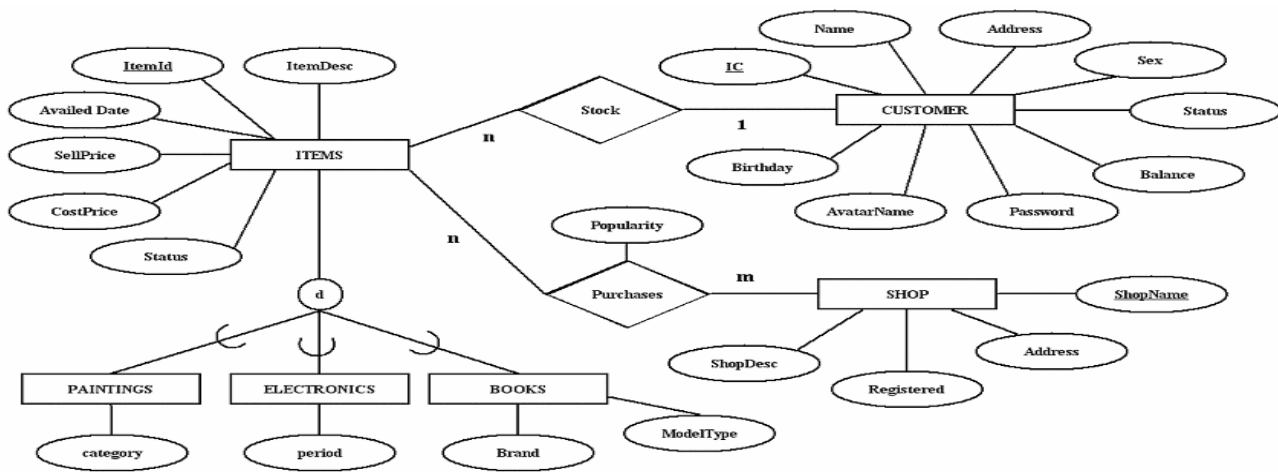

Figure 2.   Use-Case Diagram for Hikageya.

Figure 3. E-R diagram for Hikageya Database

4. IMPLEMENTATION

The 3D mall is implemented in VRML and 3Ds Max, while the website, http and PHP, on a Pentium 3 mobile machine with 192MB of RAM (with additional allocated virtual memory due to 3Ds Max consuming a lot of memory resource). The platform is Windows 2000 and later.

4.1 3Ds Max Generation of Models

The architecture, landscape and shop interiors are modelled in 3Ds Max first before exported as .wrl format to VRML for modification, animation and other improvements. The mall is created level by level, starting with the shops on each level, their sales items and their interior decorations, the concourse area, before finally the ceilings and the mall exteriors.

4.2 Database and Website Programming

The database is created using the database engine, MySQL, with six tables, namely Books, Customer, Electronics, Paintings, Purchases, and Shop. Paintings, Electronics and Books inherit attributes from a parent table, Items, while having their own individual attributes. Purchases is the new relation created for the M-N relationship of Customer and Items. Its foreign keys are the primary keys, ItemId and Ic, of relations Items and Customer, respectively, and its primary is a combination of both keys.

The website is created using PHP and HTML. A Flash clip was introduced at the login page as well. The website provides both explicit and implicit filtering of information for customers, so as to bring forward the items that the users are interested in, while leaving the less relevant data beyond their immediate environment (i.e. interface).

5. CONCLUDING REMARKS

Virtual tours, zoom features, personalized 360-degree 3D rendering have become a more enjoyable experience for e-consumers. The concerns (like the security, navigation, etc.) of e-consumers are important for 3D applications for e-commerce. With the existing technologies and with our use for prototype implementation of Hikegaya, we conclude that 3D applications for E-commerce are feasible.

At present, 3D technology is largely associated with the gaming industry. It is more important for existing companies in 3D technology industry to cooperate and prosper together instead of struggling to find profitability and its niche on its own. The partnerships between individual companies dealing with 3D technology specializing in certain types of content, such as gaming, entertainment and e-commerce would be able to ensure the ubiquity of 3D as a whole as well as the rapidity of their own respective growth.

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