

As We May Build: The Design & Function of Online Virtual Space

by

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November 2010

Presented to the

School of Information Arts and Technologies

University of Baltimore

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Communications Design

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Abstract

*“There is no understanding of virtual space, only a loose collection of articles related to realism in rendering or behavior” – Lev Manovich, *The Language of New Media**

Manovich’s statement echoes a largely unspoken truth, that there is no understanding of what we may build in virtual space. This dissertation is specifically for designers, the builders of virtual spaces. Virtual space is both world and interface. It is a visionary medium in need of practical guidance. The ideas presented here stand on a foundation of HCI/usability, film theory, and hints of game design.

This dissertation consists of two papers, a functional prototype project called The Magic Classroom, and visual transcripts of three live presentations created in The Magic Classroom. Video of the presentations is available on the accompanying discs. Students from the University of Baltimore, The Art Institute of Pittsburgh – Online Division, and Alfred State University have participated in tests of and actual course sessions in the Magic Classroom. The Magic Classroom’s goal is to empower teachers, not replace them. It uses conventional, reasonably scaled learning environments as a base to teach from and develop best practices. It avoids unwieldy, student-led, dreamscapes. The presentation “The Design of Virtual Space” discusses the design problems and principles of virtual space, in a space that directly shows those problems and principles in action.

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Usability in Virtual Space: Lessons from Game Design

Abstract

This paper lays the groundwork for understanding issues of usability in three-dimensional virtual space within (and beyond) the context of videogame worlds. Broadly speaking, tasks within videogame worlds manipulate and extend usability practices in unique ways. Because videogames are a diverse domain, this paper focuses on role-playing games (RPGs), and uses *World of Warcraft* as an example. Also, to provide focus and connectivity to past HCI efforts, issues of usability in this paper center on travel, with an outreach to the design of virtual landscapes. The primary caveat is that videogames function differently than other production-oriented software.

Videogames prioritize user experience over task completion. They expect and utilize task failure. This simple change of priorities, a promoting of user experience over task completion, turns even basic behaviors like falling down, into very (very) complex interactions. Task failure and travel have been explored independently in the past. This paper uses travel and task failure in videogames as a starting position to understand issues of usability in virtual space, the true impact of narrative on usability, and to push virtual space beyond the current its construct of videogames and simulations.

I. Backstory, the Wisdom of Warcraft

While Traveling on a Zeppelin...

“It was early Sunday afternoon, and I was riding the zeppelin to the Undercity. A woman was standing uncomfortably close to the edge of the gondola. Before we reached the city’s sky tower platform, she leapt from the zeppelin. Silently she fell. She died on impact. With the knowledge of her death, a word crossed my mind – Noob*.”

This *World of Warcraft* player tried to cut a corner. She tried to make her travel task shorter by not waiting for the zeppelin’s designated stop at the sky tower. Yet she misjudged the safeness of the height from which she jumped, and died. This player was now running back from the graveyard to retrieve her body. Luckily, videogame death is not permanent; it is merely a delay in task completion. *World of Warcraft* teleports you to the region’s graveyard and forces the player/user, in a ghost form, to run back to their body. While dead, the player/user cannot speak with other players or interact with the world in any way. The player/user must reach their body in six minutes and accept resurrection, or additional game related penalties will be assessed.

Once alive, she would resume her original game related task of travel to the Undercity – a task delayed by a meaningless death. Having died in *World of Warcraft* in equally ignoble fashions, I pondered her loss. Was her death truly meaningless?

* NOOB, NEWBIE: “Any player new to the game. Some players consider it an insulting term.”

World of Warcraft Game Manual, Blizzard Entertainment (2006)

Falling as Travel Technique, Death as Task Failure

Death is the ultimate failure of a task. In the real world, designers go to great lengths to avoid any chance that a user may die. Games are different; death is part of the game (Rouse 2001). Death is an extreme example of task failure, but a useful one here. In the revivable, replayable, and fictional world of video games, death is only a temporary setback. Moreover, in the world of video games, designers utilize death as the ultimate penalty and they balance it against constructs that imply success. In a well designed game, all task failures support the user's overall experience and are used to create a sense of value in the completion of game tasks. This leads to some interesting choices in terms of design. The HCI issues surrounding our simple fall from a zeppelin are very complex. It is the failure of a travel task, through an unusual, optional, yet completely reasonable travel mode in games called falling.

Falling, travel, and death are a specific example set. To connect on the broader HCI practices to videogame design, a range of larger issues must be addressed. It is well known that videogames utilize less than optimal methods for completing tasks. Additionally, valuing user experience is nothing new to HCI/usability scholars. The key here is how prioritizing user experience above task completion opens the door to a cascade of design options and issues to be understood. The interplay of narrative and interactivity takes on new and far reaching significance.

The simplified list of core issues includes:

Failure – its use by videogames allows less than optimal HCI practices to be employed, if justified by narrative or motivational needs.

Narrative – which positions the user/player’s concept of task success/failure.

Aesthetics – which bridge the gap between the purely usable / HCI driven space, and the immersive narrative/story in which the user/player plays.

Motivation – the need to keep the user/player playing.

Our best option for connecting the list of ideas above to standard HCI/usability practices is in the well-studied domain of virtual travel and speed. Videogames like *World of Warcraft* employ numerous travel techniques. The first issue in our list above is, in a sense, broken down into the three issues that follow it. It should be noted that it is wrong to declare that poor HCI practices (nonfunctional buttons, overly complex displays, or hidden features) are appropriate in designing videogames. It is the ties to narrative and motivation that justify the possibility of failure and define success. This narrative justification of task success and failure is discussed in detail later in the paper, when HCI virtual travel taxonomies are directly tied to *World of Warcraft* practices.

Videogames are complex sets of rules and fiction (Juul 2005) geared to create play and the desire for play. This divide between rules and fiction (also known as ludic and narrative) is the basis for the use of terms narrative and motivation within this paper. Both terms, narrative and motivation, seem necessary to incorporate failure into a domain of rules and fiction. Games are also autotelic (Csikszentmihalyi 2001); all the activity in the videogame serves some purpose within the videogame. Every task and subtask has value and can be linked to issues of success and failure.

Even when a player/user is dead, motivational value can occur. In *World of Warcraft*, this comes from the fact that once you are dead – you cannot die. While running back from the graveyard area to their body, players may now fall from any height and survive. In an area called the Charred Veil, many dead players retrieve a small pleasure in their death by leaping over the edge of the high cliffs. This travel method offers both a shortcut to their body and the unique, previously unsurvivable, thrill of scenic downward travel.

Convention and Invention, Narrative Impact

Before addressing complexity of travel modes in *World of Warcraft* and connecting them to HCI taxonomies of virtual travel, it would be helpful to first provide one detailed example of the impact of narrative and narrative aesthetics on travel. Since falling as a travel mode has already been cited, it seems the most appropriate starting position. In a formal sense, the falling (or jumping) off a building often allows the player the quickest path to the ground. Therefore, falling can be seen as an efficient travel technique. It also requires little, if any, training (the basic concept of falling is well known to all human beings). This ease of understanding allows falling as an act of virtual travel and is utilized by players in many types of video games. From a usability perspective, falling allows for a more efficient method of movement when compared to common alternative presented in the game – the walking down of a long, narrow, often winding, set of stairs or path.

To understand the impact of falling as travel technique on the design of a videogame world, a journey back to the real, physical world is required. Consider the following thought experiment. If our ability to fall and survive occurred in reality – if human beings could literally survive falls of great heights, real world architects would invent different structures. These new buildings would exploit our ability to fall. These new buildings would become more usable. While it is unclear what these buildings would look like, any advantageous design modification in support of our new found ability to fall would certainly be utilized. Architects would invent a new element to add to their buildings, one that incorporates the real world ability to be uninjured by great falls. The design of stairs, elevators, railings, balconies, and rooftops would evolve. Places for people to land would be created by architects seeking to maximize this new ability to complete travel tasks more effectively. Like architects, many HCI scholars champion the following of such real world forces over metaphors that simulate past designs in the creation of interfaces (Gentner & Nielsen 1996).

Since videogames do support falling as a travel mode, it would seem plausible that their architecture, buildings, and landscapes would reflect and invent new elements to support falling. The casual observer is unlikely to notice these changes in architectural style that allow for falling as travel mode. Yet in videogames, like *World of Warcraft*, these elements and design styles do exist, but are not readily apparent. The answer to this invisibility of design lies in narrative and its impact on aesthetics. To understand the role of narrative and narrative aesthetics we must now leave both reality and the videogame world behind. Film studies offer a design space driven by narrative and narrative

aesthetics. The survivability of a fall, in a Hollywood movie, requires narrative intervention. A well placed awning or swimming pool to break the fall, some superpower, or a timely act of god. Examples are commonly found in blockbuster movies such as Indiana Jones, *Temple of Doom* (awnings), James Bond, *Thunderball* (swimming pool) and Superman, *Superman I, II, III and IV* (superpowers). In videogames the changes in style are hidden by the narrative, or more appropriately, the changes in architectural style are made to feel acceptable to the user/player.

Hiding an architectural style that supports falling as a travel mode is only the beginning of the relationship between narrative and user tasks. In film, buildings have no direct connection to real world forces. In fact, many structures are completely fake. Flat storefronts make a town, small scale models or digital creations make whole cities. The rooftops of filmic buildings may not keep out the rain; filmic doors will not keep out trespassers. Some doors will not even open. The force that guides their entire presence and whole of their design is narrative. Is the building modern or ancient Greek? Is the building clean or is it dirty and run down? These factors are driven by narrative and are determined not by invention, but by narrative convention (Carroll 1992).

It could be said that invention deals with reality, while convention deals with realism. In virtual space, setting up a design dynamic of realism vs. reality is appealing, but in videogames, much like in film, realism is subordinate to narrative (Bazin 1953, Bordwell 1985). Proof can be found in the fact that films are often most immersive, most powerful when they break the rules of reality. From the slow motion spin effect

highlighted in the Matrix movies, to the jump cuts used for two people in conversation on a television screen, unreal montage heightens the narrative power of the media.

Film highlights the impact of narrative and narrative conventions. Film is a domain dedicated to generating powerful user experiences. The clarity between film conventions and real world invention is shattered in the domain of videogames. The videogame designer's desire for immersion in a storybook reality is balanced with the rules, the play, and the mechanics of task completion. Suspension of disbelief is balanced against the player/users desire for maximum efficiency in task completion. Task efficiency within the boundaries of user acceptance (or the suspension of disbelief in games spaces), equals a sense of great power in the digital domain.

In *World of Warcraft*, travel modes not only use narrative conventions with ties to magic, myths, and science fiction, but they also extend and interweave with the design of buildings and landscapes themselves. Buildings and landscapes are not simply following realistic conventions in order to support the suspension of disbelief, they actively determine travel modes, user tasks, and end goals. Hidden behind the realistic conventions, the forces of invention, HCI, and usability are active. In the *World of Warcraft*, roofs and doors are designed in accordance to both the game's narrative and its usability needs. The lines between invention and convention blur. A videogame design aesthetic emerges.

Convention and Invention, Addition and Subtraction

Returning to videogames, new travel abilities, like falling great distances, should have an impact on design of environment in which the player/user inhabits. In *World of Warcraft*, buildings however do not reflect any new architectural developments that explicitly demand the leaping of users to the ground. Beyond a graphic-novel, fantasy feeling, the buildings in *World of Warcraft* visually reflect traditional conventions of falling equals death. Note the term visual, for there are in fact great changes afoot, but they are often hidden or not seen as additions, but rather simple things that are missing or whose function is subtly transformed.

A primary reason that the architecture of *World of Warcraft* does not directly alter itself to exploit the fullest potential of virtual space, including the survivability of great falls, is narrative. *World of Warcraft* is a storybook world, a world dependent on the suspended disbelief of the player. To visually acknowledge and design for this digital survivability of great falls, would remind the user of their own digital fauxness. The entirety of the *World of Warcraft* paradigm is wrapped in a magical story. Magic powers and mythic beasts are used to justify the player/user tasks and abilities, as well as the design of the videogame world itself.

It would be easy to declare that all new design possibilities that enhance usability simply reach back to narrative domains and the addition of magic, mythos, or science fictions for justification. That justification is false, as upon deeper study a second hidden path for innovation design emerges. Since to invent new elements solely by utilizing the

affordances of virtual space, and therefore ignore the game's narrative is not allowed, *World of Warcraft*, rather than add conspicuous architectural elements to support the survivability of great falls, *World of Warcraft* subtracts. Innovative design is not always the conceptually new, but can also come from the removal of the old and unneeded.

In the case of supporting jumps from places, railings are removed. In *World of Warcraft* cities like *Orgimmar*, caves in *Un'goro Crater*, and the Elven buildings in *Ghostwood*, structures support the leaping down of players/users and help speed them back into game play rather than require players/users to backtrack down paths they have little to gain from. In *Orgimmar*, falling allows travel across rooftops. The functionality of rooftops is no longer the reality based need to keep out rain, but is now tied to travel and allowing (or stopping) players/users from traversing them.

Other *World of Warcraft* omissions include rooms, especially in instances. Instances are special game play centered areas that focus on specific missions rather than support multiple general play tasks. Rather than utilize the square footage and construction costs to build compartments the way a real world architect would, instances tend to be a series of winding paths that connect with occasional larger spaces in which battles occur. This path-like approach to game architecture allows play to flow through the virtual space. From rooms we move to doors. Doors, which open and close in *World of Warcraft* are largely removed. To enter most buildings, players/users travel through open archways and complete their tasks with the interruption of having to stop and open a door. When doors do appear in *World of Warcraft*, a sense of narrative need also

appears. Doors segment game events, act as structural chapter or paragraph headings which serve notice that a new event will be coming. Doors, once an invention are now a videogame convention.

World of Warcraft, architecture does support the act of falling as a travel technique. Defining downward travel, through the term falling, allows consideration of both intentional and unintentional acts, which is important as videogames support and utilize both task success and task failure. Falling can be a short-cut or it can bring death and so allow great heights to act as walls, boundaries that guide the player's actions and their knowledge of the world. The player/user can also fall into a pit of monsters, which, depending on the player/user's level, may be fatal or may be a short cut accessible by only higher level player/users. Falling is also unidirectional, so it affords a linear design element. Videogame level designers use space, through elements like falling to negotiate time (and therefore narrative) with the player/user. All of these past statements tie falling and its architectural impact not to the world of real world physical architecture, but the narrative aspects of videogame play.

Through this one example of falling as travel technique, it has been shown that narrative operates in a complex, flexible space, and is difficult to contain or cleanly evaluate. Even videogames like *Tetris*, which were created without narrative caveats, can find themselves having narratives mapped on to them by the player/user (Juul 2005). In a sense, all videogames contain narratives, but "some narratives will be more discernable than others" (Juul 2005). Juul's work addresses the ludic and narrative divide (reshaped

in videogames as sets of rules and fictions). This confirms the idea that narrative is always present, but is never is a complete explanation for the design of virtual space. A second related avenue previously described as motivation, warrants further HCI study. Motivation, like narrative, addresses user experience but not necessarily task completion.

Modes and Motivation, Becoming more Usable

“Players expect to fail” (Rouse 2001). This simple statement underpins the division between the domain of usability and that of video games. With failure not only an option, but a design necessity, interactive methods that usability scholars shun are suddenly given new life. The concept of modes is a major example. Despite their proven usability problems in interfaces and task completion (Sutcliffe, Ryan, Doubleday, Springet 2000), modes are commonly found in games. Modes including stealth, berserker, shadowform, and dozens of travel options and effects are found in *World of Warcraft*. The reason modes are acceptable in games is simple but multilayered. Videogame modes are tied to motivational (and narrative) forces.

During successful play, users gain new modes. The new modes empower the user to complete larger game tasks. In a sense, games become more usable over time. New modes are granted which increase the speed or killing power of the player/user, and allow for the more prompt completion of fictional tasks. This gaining of power also leads to another note on modes. Modes intertwine with the motivational needs of game design. Gaining modes that are more powerful is a strong motivator for continued game play.

The use of modes and the failure of some game designers in addressing basic tasks like travel opens the door to a common ground with general usability principles. The preceding pages addressed a range of issues. The common use of falling as a kind of short-term travel mode in videogames underscored the complexity of the domain. The role of narrative in defining forms of user ability, such as adding magic or subtracting doors, and the use of practices that cause failure, such as modes, shift videogames away from standard HCI/usability principles used to design interfaces and non-game software.

To more deeply address the divide between game design and standard usability and see how usability is applied to generating user experiences within the videogame world, common ground must be found. Speed and travel are issues found in both videogame and non-video game spaces. The latter portion of this paper goes into detail on the practices found in *World of Warcraft*. In that latter discussion, videogame practices of modes and narrative will play a key role, alongside current computer science and HCI scholarship on virtual navigation. Before merging narrative and motivation into past HCI scholarship on videogames and virtual travel, the limited nature of past scholarship and the differently purposed research of virtual travel, must be addressed. It is far too easy to assume that much of what has been written here has been addressed by others. A sense of past scholarship, blended with the preceding text past, lends a new context for interpreting studies of virtual worlds, and allows the continued use travel / navigation example in making a larger case for usability in virtual space and the real lessons of game design.

II. Usability and Games

Historical Separation

Early HCI scholarship on the usability of video games viewed them in simplified terms. It placed video games under the comfortable rubrics of its own academic domain “All video games are interfaces between the child and an elaborate scoring system” (Pausch 1994). While the whole of a game could be seen in the light of an interface tied to a scoring system, this approach clearly overlooks the roles of narrative and ludic demands in game design. The use of the term “child” to describe the player/user carries its own implications as to how HCI scholars once viewed this design domain.

This narrow focus of HCI scholars on video games as interfaces allowed them to apply standard usability principles in regards to video games as a whole, yet it kept them from approaching a broad range of game design issues. Past papers such as Steve Cornett’s “The Usability of Massively Multiplayer Online Roleplaying Games: Designing for New Users” does an excellent job of applying standard principles and practices to videogame interface evaluation. Measurements of success and failure were limited to a 2D interface. Acts of play – tasks within the 3D environment – were untouched. In the end, despite the common ground of humans, computers, and shared interest in the user’s needs and interaction, HCI and videogame design are most often kept separate.

“A generic feature of the two fields is the dedication to providing users what they want, but nevertheless there has been very little interaction between them”
(Jorgensen 2004)

“This relationship between theories of game design and traditional HCI evaluation methods has yet to be defined but definitely yields an exciting future”
(Pagulayan 2003)

Falling from a building may not be the best example to tie game activity and usability together. There is little usability / architectural scholarship on the design of buildings in virtual spaces. Much of the work consists of general statements, such as limiting user behavior and aligning structures for easier searches (Shneiderman 2003) or that realism may not always be the best approach (Poupyrev 2000). The most specific virtual research that has been done seems only indirectly applicable, largely because interest has been directed at novel input devices or travel/navigation techniques that overlook screen-based, mouse driven worlds (Bowman, Krufijff, LaViola & Poupyrev 2000) (Poupyrev 2000). While the act of falling is a valuable travel technique in videogames, HCI scholars of virtual space have not researched the value of falling. Comically, it appears to be a technique they wished to avoid.

The larger issue of travel however may hold enough overlap for our discussion. Thousands of HCI papers have been written concerning virtual navigation. The general focus of all of these papers relates to the improvement of travel and interaction in virtual

space. Given the novel techniques, range of possible behaviors, and variety of goals, it becomes necessary to pare down the issue of travel further. The one singular element that might lend significant HCI scholarship in regards to travel in virtual space is velocity – the issue of speed.

Velocity, Choosing an Example (Full Speed Ahead)

Velocity is a design issue confronted by HCI scholars (Bowman 2000). Designers of virtual space control the speeds afforded to the user in traveling through the space. Choice of speed or range of speeds can be a difficult task. Too slow and users will be unnecessarily delayed. Too fast and users may find navigation difficult to control, especially for short precise tasks. A range of speed can be offered by modes or continuous control. Yet, the use of continuous control places an additional cognitive burden on the user that may influence other tasks undertaken while moving. A number of specific speed modes can be used, but in general, HCI scholars have discouraged the use of modes as they can confuse and frustrate the user.

Videogames break from HCI efforts and may support continuous control when play is of a racing nature and the added cognitive control burden is factored into the balancing of task failure and task success. In contrast, RPG videogames like *World of Warcraft* do use travel modes. As *Warcraft* is the example of this paper and it uses a variety of videogame travel modes, a HCI driven taxonomical review seems appropriate.

Starting in the domain of past HCI studies of virtual travel, the factors that influence optimal travel speed in any given virtual space are linked to the following:

User Experience – User skill in managing speeds includes benefits of practice and physical reaction time.

Demands of Task – Straight travel, avoiding targets, gathering objects, gathering information, and/or interacting with fellow users.

Demands of the Space – An open field, a maze, rooms of a building, and/or a series of pits to leap across or vines to grasp.

Input/Output Devices – Joysticks, thumbsticks, mice, steering wheels, monitors, goggles, caves.

Technical Affordances – Processor speed, rendering speed, frame rate, internet connection (online game play only)

Software Affordances – Variable speed control, instant speed boosts, teleportation, guided navigation.

The factors above represent a methodology for describing the larger factors influencing how users manage velocity. Some are constant, such as Input/Output Devices and Technical Affordances. They do not change while the user is interacting. In contrast, User Experience is generally seen as a linear progression allowing for greater speed and diversity of behaviors. The Demands of Task, Demands of the Space, and Software Affordances can vary greatly within the space. It is these latter three factors that designers of virtual space have the greatest influence over.

On the matter of velocity, the subtask taxonomies of Exploring, Searching, and Inspecting do not have a direct influence. Given the great diversity of application and cognitive processing, the subtasks of Exploring and Inspecting are not an optimal starting point for connecting videogames to HCI/usability practices. Travel to a known location factors out the cognitive load of users' issues of having to interpret their surroundings. Focus on travel will be limited to Searching – task centered travel within a defined space.

Under Input/Output Devices, the question of Immersive, Semi-Immersive, and Non Immersive can be raised. Given that most games are screen-based, we can look to what is seen, in an ACM context, as Non-Immersive work. Unfortunately, most of the computer science research has focused on Immersive and Semi-Immersive domains, which is due, in part, to a focus on phenomenologically driven realism (Manovich 2001).

The last major taxonomy involves the manner by which users control navigation and speed. Five categories of interaction techniques can describe the means by which travel is controlled (Bowman 2000). These techniques differ from the factors above in that they deal with the actual user input.

Physical Movement – Walking, treadmills, stationary bicycles.

Manual Viewpoint Manipulation – Grabbing and pulling, leaning one's body to control both direction and speed.

Steering – Continuous specification of direction. Motion itself is automatic and speed is typically constant.

Steering Automatic – User specifies direction, but does not require cognitive or physical effort maintaining direction. Motion itself is automatic and speed is typically constant.

Target-Based Travel – User specifies a destination, system handles details. With or without transitional travel (i.e. teleportation)

Route Planning – User specifies a path to follow. The user retains the ability to adjust travel / destination while in transit.

Each of the preceding lists of taxonomies highlights the complexity of virtual space and the seemingly simple act of travel. These taxonomies need to be understood and defined prior to a direct review of videogame interactions and their possible use in non-videogame spaces. For the purpose of usability evaluation, travel in *World of Warcraft* appears to be an ideal candidate for a number of reasons. *World of Warcraft* uses the standard interface input and output devices of mouse, keyboard and screen (not a game controller). Unlike a racing game, the task of travel in *Warcraft* is not a goal in and of itself. Speed varies, but is not under continuous control (racing game). It uses dozens of modes instigated in a number of ways. Travel tasks in this paper are further limited to being a subtask of Searching, as in traveling between known points. Searching is a common task, one that also raises the importance of task completion in relation to user experience. In a sense player/users travel to places to begin missions, to play and generate user experiences. Searching therefore becomes more inherently connected to past standard HCI concerns of task completion than Exploring or Inspecting. Lastly, *World of Warcraft* also utilizes both Steering and Target-Based control techniques.

The next section enters into a more direct drawing of usability practices out of the *World of Warcraft* videogame. It is worth restating that videogames are not an interface connected to a complex scoring system. Videogames are complex environments centered on generating unique user experiences. Videogames incorporate task failure and become more usable over time. As shown in the detailed example of falling as travel technique, a range of design issues tied to narrative and motivation are present in videogames.

The larger benefit is not necessarily the application of usability principles to video game design, but rather how practices in video games are formed. From that, foundational principles applicable in non-video game related virtual spaces may emerge.

III. Usability and Travel in Warcraft

General Connections

World of Warcraft offers 70 experience-based levels. Players start at level 1. By completing missions and slaying monsters, they rise in level. At certain levels, players gain new travel modes. Without exception, these new travel capabilities always afford an increase in velocity. From a pure game play perspective, the link to increased velocity in the new travel modes is a motivational carrot for users. After the initial task of Exploration comes Search directed travel. *World of Warcraft* game tasks, or quests, typically require repeated Search directed travel to known and often distant destinations.

Greater speeds improve the task of Search directed travel. As the gaining of velocity is tied to player level, User Experience is addressed. The player/user gains new

travel modes upon proven mastery of past abilities. The player/user gains new travel modes after experiential demands have taken them to ever more distant areas of the game. The stair stepping of modes is tied to the growing travel demands of quests. *World of Warcraft* first manufactures a user need for increases in travel speed, and then fulfills that need. It is a simple and effective methodology. Many different modes of travel and sub-variations of travel modes are not only allowed, they are required. As these modes scale up, grow faster, the fundamental constructs of usability, limiting of user choices / degrees of freedom become enrobed in narrative and sculpted by the needs of play.

The techniques for travel fall under the headings of Steering and Target Based control. Users start with access to both techniques. Steering begins with two speeds, run and walk. Running, default setting, is used while users engage in a range of interactive tasks. This range includes most travel during combat tasks, travel within instances, and travel to NPCs (Non Player characters, with whom conversations, purchases, repairs can be had). The latter, and often Search directed task of travel to NPCs, requires close proximity to the NPC target before the second task of NPC interaction is allowed by the game mechanics. Running is also used for travel inside of buildings.

A slower walk mode is available, but no lesson in the game teaches its use. It is seldom utilized, as most interaction in the game seems effective with run speed (The exception being players in Stealth Mode). In terms of initial travel modes, one Target-Based Travel mode is also immediately available to the new player/user. This Target-Based Travel is a teleportation mode triggered by a Hearth Stone. Clicking on this object,

the user is teleported to their chosen home or Inn, which lies in a town where goods may be purchased and quests completed or initiated. An overall view of velocity and travel modes, in a loose order of availability to the player/user, is:

Steering Based:

*Running** – Default, and the most common, used for engaging in other interaction

Walking – Slower than running, available at level 1, seldom used

Bufs – These potions, magic items, or class traits allow for either small increases or short bursts of speed

Travel Forms – At level 20+ some character classes, Shamans, Druids & Hunters get a new ability, a travel mode that allows for 30 to 40% increase in speed.**

Mounts – At level 30 users can purchase an animal to ride. Speed increase is 60%

Epic Mounts – At level 60 users can gain mounts that offer a 100% increase.

Flying Mounts – At level 70 users can purchase or earn fast mounts that can fly, these are only usable in the new Outland area***

Epic Flying Mounts – At level 70 users can purchase or earn very fast mounts that can fly, these are only usable in the new Outland area***

* moving requires the holding down a of key or use of the auto run - a toggle key that engages any pre-selected mode and causes the player/user to move. Auto run requires steering.

** all speed increases are measured as percentages of run speed

*** flight raises new design issues that the original areas of *World of Warcraft* were unable to cope with. Interestingly one issue is an attack strategy where a flying player exits flight mode, falls to the ground, and attacks an enemy player by surprise. As noted in the introduction, falling is a complex travel behavior.

Target Based:

Hearth Stone – Teleportation to a single pre-chosen destination.

Flight Paths – Guided point to point travel on flying animals.

Portals – An ability gained by magic classes, they can summon other characters to their current location.

Ships and Zeppelins – The domain of *Warcraft*, the world of Azeroth, is currently divided into two “continents.” These vehicles allow for travel across this digital distance. Both methods move away from their initial locations, and then teleportation action occurs bringing users in view of the other continent.*

Falling – Short-term downward travel.

General details of *World of Warcraft* player/user control of views and perspective are worth noting, as the player/user can adjust their view during Steering based travel. The majority of travel is done in third person perspective. Users can zoom into their character and assume a first person viewpoint. Few seem to do so. Despite the greater sense of presence and immersion, users opt for the more efficient and usable third person view. Third person perspective allows for a higher and more complete view of the user’s surroundings. Especially important is that it provides a view of what is behind the player/user. The viewpoint can be separate from the user’s avatar, in terms of rotation. Right clicking and rotating allows the player to view his character, the axis of rotation, from any angle. In addition, the third person perspective has a default straightening effect. This straightening effect returns the user’s field of view to their line of travel.

* List compiled before the release of Burning Crusade and Wrath of the Lich King. More variations on the above themes may now available.

Forward travel brings the user view parallel to the direction of travel – unless the right mouse button is held. This approach allows for visual exploration without commitment to a travel direction, and conversely easy shifting to a travel direction based on visual exploration.

Lastly, the viewpoint's distance from the player's avatar, while controllable by the thumbwheel is also limited. Both in general distance, approximately 15 meters, and by any obstruction, the viewpoint may encounter. Obstructions include the inside of roofs, branches and even high walls. Any obstruction pushes the viewpoint towards the viewer's avatar. This helps maintain the immersion, by not allowing users to see through a structure's geometry in an odd or overly unrealistic manner in addition to keeping the player/user's character visible and more controllable. The usability of third person perspective has driven it to become a part of the aesthetic of videogames. Third person perspective is acceptable not by the literal narrative within the *World of Warcraft*, but by the larger cultural narrative of videogames. It is an example of the blurry line between invention and convention. To address invention and convention from a more stable direction, a review of *World of Warcraft's* use of narrative in its interface design may be helpful.

Narrative Ties, Visual Indication of State

From cursor changes to show state, and menu item hotspots that glow on mouseover, to the color and image coding of webpages that add site locational cues and contextual support to the data on the page, interface designers use visual cues to reinforce

changes in user position and state. Often in videogames, there is not a singular indicator for a player/users state or mode, but a rich blend of standard menu interface visuals and audio mixed with narrative-based visuals and audio. The *World of Warcraft's* 2D interface positions indicators of state in the upper right menu. As the player/user enters various travel states, a small visual icon of the state is shown.

Beyond the standard menu indication, *World of Warcraft* draws inspiration directly from psychology rather than usability. While *Warcraft* draws on intuitive themes to indicate speed, the field of psychology opens the door to counter-intuitive slowing of speed to indicate velocity as seen in the TV show *Six Million Dollar Man*. *The Matrix* shows some novel ideas on how to visually relate speed to users (Duvall 2001).

In *World of Warcraft*, the more common approaches found in Steering-Based travel include, the kicking up of dust and debris, motion blur, glowing feet, wind streaking. These are all metaphors for active speed. Typically the latter three (all but the kicking up of dust) are also tied to a narrative of magical enhancement. Target-Based travel, the act of teleportation, includes a glow – typically from the hands of player/user which move in an preprogrammed act of faux spellcasting. All players/users can teleport to one Inn, designated by them. Further Target-Based, point to point travel can be done by the warlock class using the Ritual of Summoning. A visual of a portal, an image of the destination embedded in a two meter circular spatial distortion, appears. The three players needed to support the ritual all auto-animate in a magical gesture at the portal and the distant player being teleported/summoned visually fades into their location. Since the

World of Warcraft often places player's quests inside of instances and quests within instances typically require a group of players to complete the quest task, special Meeting Stones are placed outside of them. Meeting Stones are part of an inworld interface and can be used to summon other players/users to that instance location. Some travel modes that are tied to magical narrative driven items, utilize cartoon or film-like special effects to steer the user's mind to an association with speed and the acknowledgement of state or mode (Duvall 2001).

Beyond cartoon speed effects and portals, *World of Warcraft* indicates changes in some travel modes by visually adding objects and elements. One addition is the shape shifting of specific character classes into faster travel forms. Shaman characters have a ghost wolf mode in which they become a fast transparent wolf. Druid characters have a cat mode. With the new mode comes a narrative driven visual change highlighting the new mode. At level 30, *Warcraft* characters get mounts. At level 60 faster, and more decorated, "epic" mounts are available. Both mounts and epic mounts are character connected, narrative driven. Some examples include ogres riding wolves, the new mythos of taurens riding kodos (big cow people on the backs of big dinosaurs), humans riding horses, and of course undead humans having undead horses. Target based travel modes include use of ships, zeppelins, gryphons, hippogryphs, bats and wyverns. Each mode has a unique connection with the *Warcraft* storyline, either a classical mythos ogres riding wolves or a new mythos taurens riding kodos. All mythoi are accepted by the larger videogame narrative and share a common HCI usability based travel function. Aesthetics merge the diversity of the narrative storylines with the needs of HCI activity.

Limiting Behavior at Greater Speeds, Connecting Dots

There is a common thread among computer scientists and HCI researchers regarding 3D interaction. It is that by removing unneeded user's choices or properly limiting user behavior, they can increase the usability of the interface (Shneiderman 2003). This can be restated as:

1. Minimize the number of navigation steps needed to accomplish tasks. (including treks between points and the subtasks of rotation and repositioning)
2. Avoid unnecessary visual clutter that distracts from or inhibits user tasks.
3. Simplify object movement; use predictable paths and less than 6DOF (Six Degrees of Freedom)

Removing and limiting choices that users would find difficult to manage at higher speeds (and would also adversely effect game play) is a standard practice in video games. *World of Warcraft*, like other games, places limits on the interactive behavior of users while in higher speed modes. To do this *Warcraft* applies narrative driven rationales for some limits and allows for in-game penalties for others. An example of narrative driven limitation is to allow only the running mode behavior inside of buildings and most instances (these special questing areas – are typically indoors, like a dungeon). This limitation is enforced by the software and automatically transforms a mounted player/user character into the unmounted run mode when building or instances are entered. Trying to mount inside a building and most instances will only bring a message of its unavailability across the center of the player/user's screen.

Players, even those who may not own horses, understand that horses and other mounts are not typically used inside of buildings. By limiting the speed of indoor behavior to essentially one speed and temporary magic-driven increases (also called buffs), *Warcraft* designers can build structures optimal for that speed.

All higher-velocity, steering-based travel modes have limitations. The modes which involve shape shifting (ghost wolf for the Shaman character class, cat for the Druid character class) limit the user from casting magical spells, conversing with NPCs, creating magical items, and number of other, but not all, in-game interactions. In the special player vs. play areas, such as Warsong Gulch, characters in animal formed travel modes can still capture the flag and win the game. They can still attack other players, but in travel form, they typically do less damage.

The target based travel modes follow three separate methodologies. Flight paths (also called taxis in the game's 2D interface), Ships and Zeppelins, and Portals. Flight paths are faster than Steering modes. Flight paths are point to point travel, with transitional movement between locations specified by the game designers. Player/users mount a flying beast, a beast who in terms of narrative controls the path and speed while in flight. General interface tasks are allowed, but player/user movement is limited to rotation of viewpoint. Rotation provides an unique interactive-cinematic user experience as the player/user's path is, in part, plotted to be visually dramatic. The larger limitation of *World of Warcraft* Flight Paths is that they require the user to use Exploring based travel to discover where travel end points are. Players/users must find the Flight Master,

the NPC character at an end point, before being allowed to use a Flight Path in the future. The requirement of discovery, finding the Flight Master, effectively limits new player/users from having immediate access to the entire *World of Warcraft* continent. High level areas feature monsters that are especially attracted to low level characters (in a radial effect called aggro), and so player/users are limited by level in terms of where they can safely travel. The gaining of new Flight Paths becomes a motivation perk, one that makes the *World of Warcraft* more usable. Low level users risk high level monsters only once as Flight Paths allow for safe future travel. The opportunity for failure of travel tasks is firmly integrated into game play and is a measured part of the user's experience.

In addition to travel, Flight Paths impact usability of the game space in a unique way. They help teach users the spatial relationships and distances between points, then allows for quicker travel between them. Players actually fly along these paths seeing all the land below. This reinforces their spatial understanding of the world. Lastly on Flight Paths, this transitional travel, the seeing of the land below, does impact travel time. Despite greater speed, compared to Steering modes, some Flight Path journeys can still take several minutes.

The next highest velocity is found in Ships and Zeppelins. This method is limited to a few locations and is used to span the great ocean between the two digital continents of Azeroth. Unlike for Flight Paths, no prior knowledge of the destination is required. Ships and Zeppelins limit the users under the same rules as being inside. Players can fight and create items while on these vessels. The time of travel is brief, once the Ship or

Zeppelins arrives and is boarded; only a minute passes before a teleportic transition occurs bringing them in sight of the coast of the other digital continent. In a sense, our past design statement on subtraction is applied here – the bulk of the ocean is removed. The issues of subtraction, touched on here, also casts the third method of Target based travel, Portals and Hearthstones, in a somewhat different category.

Beyond Limits, Enabling Travel Task Failure

Some Steering and Target based travel modes are designed to enable travel task failure in certain, generally combat related, circumstances. An example of enabling travel task failure in a Steering mode can be seen in the Hunter character class. At level 20, it receives the Aspect of the Cheetah travel mode. *World of Warcraft* limits the Aspect of the Cheetah travel mode's usage by adding a negative behavior. If a player/user in that mode is struck (typically, but not always in combat), the player/user is disoriented. The users travel speed slows to a walk and their defensive ability is lowered. While the higher priority for the game designer may be balancing combat-directed game play, the subtext is that travel Aspect of the Cheetah mode is best suited to Search Based travel.

Hunters also get Aspect of the Pack mode which allows them to share their more speedy travel mode with members of their group. When any member of a group in Aspect of the Pack mode is struck, the entire group is disoriented. Clearly the speed of Aspect of the Pack mode is not applicable to combat situations. Task failure, tied loosely to narrative titles is again utilized by the *World of Warcraft* designers.

With an eye towards task failure and subtraction, Portals and Hearthstones can now be addressed. Portals and Hearthstones allow for nearly instantaneous travel. In fact, no time is spent in travel, as it is a teleportation mode. In the narrative, it is a magic spell that is cast. The limitations of this method include simple issues such as the of time needed to cast and time between castings. Several seconds pass while the character gestures, visually indicating a process is occurring, and then the travel event happens. In addition, variations on teleportation modes have in-game limits such as a recharge time, magic items needed, or in the case of portals – two other characters in addition to the caster to assist the process.

From the usability perspective, teleportation could be instantaneous. All of these modes might be more efficient if made more immediate. The time spent casting the Portal spell, could be tied to state change and viewed as a narrative-driven transition statement. In a world that exploits failure, however, the longer than perhaps needed casting time allows for interruption. Time is not needed for successful action, only for unsuccessful action. Players who are losing a battle or in a tough situation cannot instantly retreat. Other enemy users (or monsters) get an added shot at killing the teleporting user while the casting time passes by. The software could easily move characters throughout the game world, but by allowing for failure by some, *World of Warcraft* increases the value of task success for others.

Some portals, as now applied in the *Burning Crusade* expansion, also raise a new and interesting design change in the buildings within *World of Warcraft*. Whereas this

paper began with falling and its impact on buildings and landscapes, the opposite mode of generally upward travel is found here. The architecture of the *Blood Elves*, uses teleportation devices, *Translocation Orbs*. These orbs allow player/users to teleport up and across buildings to gain access to higher floors. Ramps and staircases (much like doors, railings, and rooms), are, occasionally, subtracted from the architecture and replaced by a magical device. In a sense, *Translocation Orbs*, point to an evolution in the design of buildings within *Warcraft's* videogame aesthetic. If the future involves a role for *Translocation Orbs* and an associated shift in the design of virtual buildings and landscapes, what of the most primitive human travel mode. What is the impact and role of the oldest and most common real world travel mode – walking?

Walking, the Lost Mode

Walking is available in *Warcraft*, but it rarely used. To push the lost point further, walking is in fact a penalty used to balance the tactical advantage of stealth. (*Rogue* and *Druid* class characters walk in stealth modes). Running is the default game setting in *World of Warcraft*. Interestingly, we could say that *Warcraft* is a world without walking. The most basic of all real world travel modes seems unneeded by the videogame. If videogame design is to impact the design of non-videogame virtual spaces, the concept of walking may need to find a new functionality outside of *Search* based travel.

VI. Conclusions

Usability in Virtual Space

There are a broad number of statements found in this paper. Many ideas, such as the relationship of games and failure, limiting user behavior to gain usability, and HCI discouragement modes are well known. Interconnecting these ideas becomes the hallmark of this paper. A basic list of conclusions is as follows:

1. Videogames prioritize user experience over task completion
2. Prioritizing user experience greatly raises the importance of narrative and motivation.
3. Realism is subordinate to narrative and motivation.
4. Aesthetics link narrative and HCI forces. Done well, aesthetics hide their HCI role.
5. Because videogames support task failure, interaction methods discouraged by HCI scholarship find new life. (i.e. modes)
6. Gaining new modes becomes an integral part of long term play in some types of videogames (i.e. *World of Warcraft*). They allow for new and greater challenges (as well as past failures) to be overcome.
7. Granting new modes becomes a motivation tool of videogame designers.
8. Videogames become more usable over time. New modes in videogames allow quicker and larger fictional tasks to be completed.
9. Some interactions, while more efficient if immediate, are delayed to give opposing forces time to cause failure (Hearthstones - Teleportation). Some delays are also

artificially added to mimic a real-world sense of creation or construction time (Casting of a portal or Summoning Spell - Teleportation).

10. Standard HCI practices of limiting user choices and behaviors become intertwined with modes and narrative concepts. (i.e. limiting optimal travel speed by forbidding mounted travel modes inside of buildings)

11. Addition of new elements – In videogame worlds abilities are linked to narrative titles and become conventions, often of magic (Hearthstones) or some in game technology (Zeppelins).

12. Subtraction of elements – Rather than add conspicuous new elements to support new behaviors or improve task completion rates, videogames may opt for a removal of unneeded real world elements (Railings, Rooms, Doors).

13. Maintaining the suspended disbelief of the user/player is an important factor in RPG videogames. This factor helps drive the concept of removing unneeded elements rather than adding new elements.

14. Non-storybased, productive, virtual spaces deal with suspended disbelief differently than RPGs or storybased worlds and may not be as affected by aforementioned narrative issues. They can utilize narrative without being bound by narrative.

15. The abstract issue of mixing inventions and conventions within virtual space remains an open question. Given that videogames are sets of fictions and rules, the role of narrative is greater than what can be expected from non-videogame spaces. In non-videogame space, the matter could be seen in the less complex form of realism vs. reality.

16. As marketing and economic factors impact the creation of film, and real world HCI projects, their impact on videogames and virtual space is worth considering in future.

The larger lesson to be gained from studying videogames may not lie in efficient task completion and the inventions that promote task completion, but in experience management and the role of narrative conventions. Videogames seek to manage the difficulty of tasks – rather than remove said difficulty. They incorporate motivational, narrative and user experience into their design. Usability issues are present within the videogame world, but the preceding factors change the nature of their application.

Videogames, via their economic and social dominance, play a major role in the development of non-videogame virtual spaces. New users tend to interpret virtual space as a videogame environment. As users become more sophisticated, more accustomed to the broadening variations of interaction within videogame worlds, the ability of non-videogame spaces to utilize those abilities also grows. Players mature and become users and virtual space breaks the grip of game limitations. What may evolve is an outgrowing of many of the narrative, experiential, and/or motivational limits placed on virtual space by the demands of game design. Much like the modern desktop and its ongoing use of narrative labels applied to elements such as files and folders, the power and functionality underlying these digital constructs outstrips their narrative labels and implied limitations.

The speed of this act of growth is open ended. Designers of non-videogame virtual spaces, may still need to take into account narrative, experiential, and motivational elements in creating their spaces. Standard usability practices still apply, but in lines of conceptual grey, a blurring of the relationship of user experience and task completion is underway.

Further Study, Experience and Completion Conflict

“Improvement makes straight roads, but the crooked roads, without Improvement, are roads of Genius.” - William Blake

One subject deserving more research is the conflict between task completion and user experience. In successful videogames, user experience and task completion are in harmony. In successful software tools, like Adobe Photoshop or iTunes, user experience and task completion are in harmony. Yet in designing innovative virtual spaces that are neither videogame nor software tool, this conflict between task completion and user experience emerges.

For example, in section 3.4, the casting time for spells is described as needed to enhance user experience by allowing for the chance of task failure. In any non-videogame interface, the addition of time to a user task would seem absurd. Often usability professionals use GOMs (Goals, Objects, and Methods) analyses and constructs like Fitts Law to reduce task completion times. Whenever possible, steps in a task are removed. In contrast, user experience often adds steps. This is acceptable in systems like videogames that prioritize user experience over task completion, but leads to problems in non-game systems.

In non-game virtual worlds and spaces the role of task completion in rises in importance and the usefulness of failure is lessened. Without a game's structure, questions of true goals and multiple goals arise. Is travel to an end point the goal (task

completion) or is the journey to that goal (user experience) of greater importance? The quote by William Blake at the start of this section sets the tone for just how deep this question truly runs. Standard usability seeks the straight road, while those concerned with user experience in games run along the crooked path. Designing a virtual space that allows for both an immediate completion of the journey and enjoyable exploration on the way to a journey's completion is a deeply complex and often conflicted design challenge.

The depth of this conflict between user experience and task completion has been hidden behind academic labels and the presumptive application of 2D and 3D forms. The academic label of a virtual interface focuses on task completion. The academic label of virtual environments focus on user experience. In most academic texts virtual interfaces and virtual environments are considered separate uses of virtual space. They are discussed as separate ideas in different chapters of the same book (Shneiderman 2004). The idea that virtual space is both interface and environment is lost.

The second factor hiding the conflict between user experience and task completion is the presumptive application of 2D and 3D forms. 3D forms are seen solely as an environment and 2D forms are seen solely as an interface. In videogames the interface is seen as the 2D elements, the window frame of buttons and menus surrounding a 3D environment centered on the screen. HCI and usability rules apply to the 2D interface elements while the rules of narrative/storytelling guide the design of the 3D environment. This 2D interface and 3D environment construct is convenient, but very harmful to innovative design. Declaring that 2D and 3D forms play certain functions is to

say that form dictates function. This is untrue. In broad terms then, the focus on realistic forms creates a design perspective that limits possible functionality. Only functions that fit realistic forms are deemed acceptable, and a cycle of failure leads individuals to assume that only ever more realistic forms are the solution. Meanwhile, the power of the digital space and the affordances of mouse, keyboard and screen are discarded in favor of faux realism, and the user experience of roleplaying rather than task completion.

Lastly, if good interfaces are transparent to the task, what does that mean for 3D worlds that strive to be the opposite? The opposite of transparent is immersive, as in the all surrounding, always present videogame space that guides the users actions as opposed to being completely interfacial, wholly subordinate to the user's wishes. Such questions are difficult to address, but addressed they must be. Academia seems to have lost its leadership position in the design of virtual space. To move forward, hard questions must be answered and the conceptually cowardly hiding in concepts of realism (Manovich 2001), simulations, and games must come to an end. Form must again follow function.

Notes

Additional support provided by Vizzini, Goonie and members of my *World of Warcraft* guild, Corrupted Destiny on Skywall Server. A short discussion of a early draft of this paper can be found at <http://corrupted-destiny.guildportal.com/>

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The Magic Classroom: A Multi-User Web3D Learning Space

Abstract

The Magic Classroom is a web3D learning space. It is a synchronous online environment capable of presenting diverse forms of educational content. The Magic Classroom's methodology positions presence, realism, and immersion as tools for moderating student behavior and achieving educational outcomes. Secondly, the Magic Classroom explores the strengths and limitations of digital worlds — the impact of mouse, keyboard, and computer screen on the design of virtual space. The key to the Magic Classroom is deceptively simple; the teacher's avatar is empowered like a videogame character. The teacher's avatar shape-shifts into 2D slides, 3D models, and 3D worlds. The result is a native space blending interface and environment design.

Introduction

The rise of technologies like Second Life highlight the value of synchronous web3D as a tool for online learning. Problems with asynchronous systems such as the lack of presence (teacher, social, student) and the lack of student motivation to complete assignments are, in part, addressed by synchronous web3D. (Aldrich 2005; Clark and Kwinn 2005) While approaches and levels of success vary, countless books and papers offer praise for the application of immersion, presence, simulation and synchronicity in regards to learning (Aldrich 2005; Clark and Kwinn 2005).

To move forward is not to restate the potential educational value of web3D, but to consider the design of a web3d space that delivers that value. A space that exploits the HCI principles of structuring data, managing cognitive load, and removing unneeded steps in interactions [3]. With a focus on design, the Magic Classroom is software agnostic. The shape-shifting of the teacher's avatar is a simple reprogramming of gestural code and can be done within Virtools, Second Life, Shockwave 3D, or Active Worlds. The Magic Classroom uses ABNet, an X3D platform.

The best way to engage the Magic Classroom is to simply walkthrough the prototype's initial lecture: *Darwin: A Man and His Times*. Questions of HCI and design choices are addressed in the section that follows the walkthrough. A preliminary usability study has been completed and it addresses the HCI claims of the Magic Classroom. This paper then concludes with a brief look at the implications of the Magic Classroom and the impact of freeing web3D avatars from faux humanoid form.

This paper is laid out as follows:

I. Introduction

II. Visual Walkthrough: Darwin a Man and His Times

III. Theory: Design Choices and HCI Considerations

IV. A Preliminary Usability Study

V. Conclusions

II. Visual Walkthrough: Darwin a Man and His Times

The Magic Classroom Darwin: A Man and His Times' lecture is a culture of science presentation geared to college level students and a class size of 10-15. The lecture itself is introductory in terms of interactivity. Not shown in the images is the use of VoIP (Ventrilo) and to save space, the text chat window is removed from images. It also is important to note that the Magic Classroom does not dictate educational content or form; it simply allows the teacher / instructional designer flexibility in creating / conducting virtual presentations.

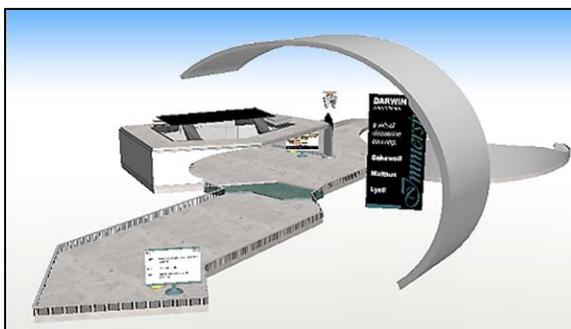


Figure 1

Magic Classroom, Students enter lower left and participate in the Presentation Ring, upper right.

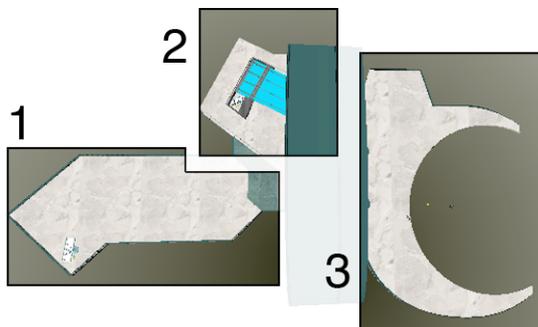


Figure 2

Three Functional Areas, 1. Landing Area, 2. Class Storage, and 3. The Presentation Ring

Functions of each Magic Classroom Area.

1. The Landing Area is the entry point into the lecture hall and an open space for student social interaction. It is a simple, comfortable, and realistic area designed to welcome students as they come to class.
2. Class Storage holds course information and provides notes on lectures. Currently contains two digital kiosks. More information or it could with added chairs and couches become a student lounge.
3. The Presentation Ring is the primary lecture space. The teacher, in the center, shape-shifts into 2D slides, 3D models, and 3D environments. The Presentation Ring can act as a portal into larger 3D environments. Students typically stand on the edge of the ring, unless asked to explore a 3D environment.

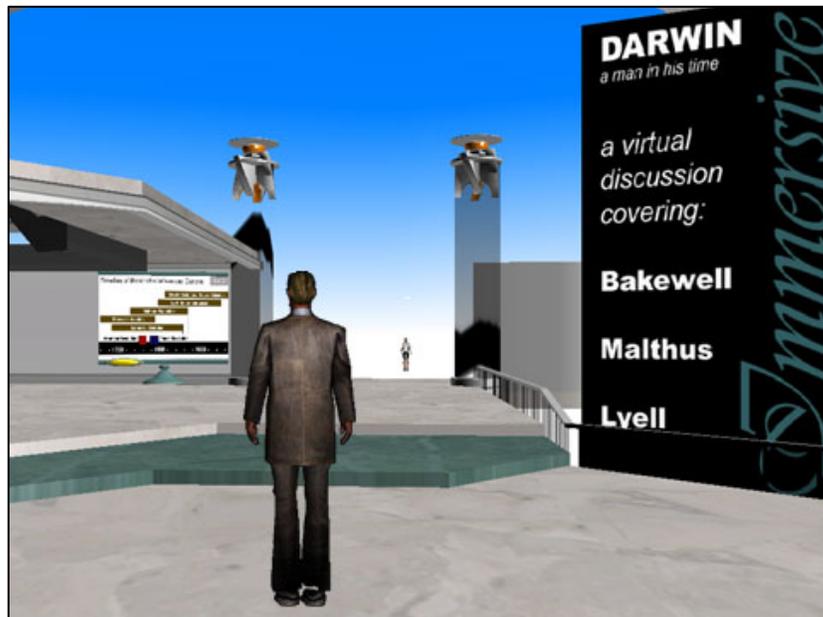


Figure 3

A student walks a short distance to class. This walk is meant to encourage a sense of immersion.

The shape-shifting of the teacher's avatar and its role in a virtual PowerPoint-like presentation may seem unusual or unnecessary at first. Further explanation of the HCI/usability factors in play are discussed later in this paper. For the moment, follow the presentation, observe the array of educational content afforded by this methodology, and consider the ease in which it is presented to and used by the students.

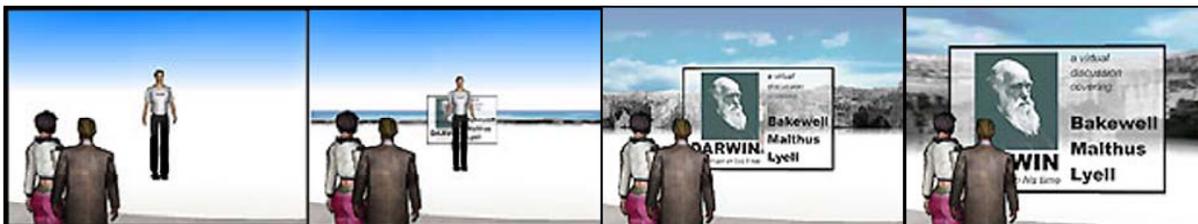


Figure 4

A series of images showing the teacher's quick initial transition from faux humanoid form into a 2D title slide with rotating background panorama.



Figure 5

Advancing like a PowerPoint presentation, the teacher shape-shifts into a series of slides. Above, an image highlighting the "English Enclosure Movement" which inspired both Bakewell and Malthus. The fence in the background reinforces the sense of enclosure.



Figure 6

At the end of each subsection in the Darwin lecture, the teacher returns to human form and addresses broader student thoughts or questions.

In addition to 2D slides, the teacher shape-shifts into 3D models and small 3D worlds. In the Darwin lecture, this is often done in a series. Simple models are replaced with similar but more complex models. Background panoramas are added to address issues of cultural content. In some cases, 2D slides even transition or morph into 3D worlds. The goal is to mix the ease of 2D PowerPoint presentations with the immersive and dynamic possibilities of 3D virtual space. This mixture of 2D and 3D is meant to bring out the best aspects of both and to use whichever form best suits the educational tasks in the lesson. The idea that all 2D or all 3D is best is rejected.

Interactive behaviors are tied to the individual models and are generally unshared. Each student gets to manipulate and explore the individual models in their own way. 2D slides have unshared billboard behaviors so that they always face individual students. Like 2D and 3D, shared and unshared behavior is determined by the needs of the lesson.

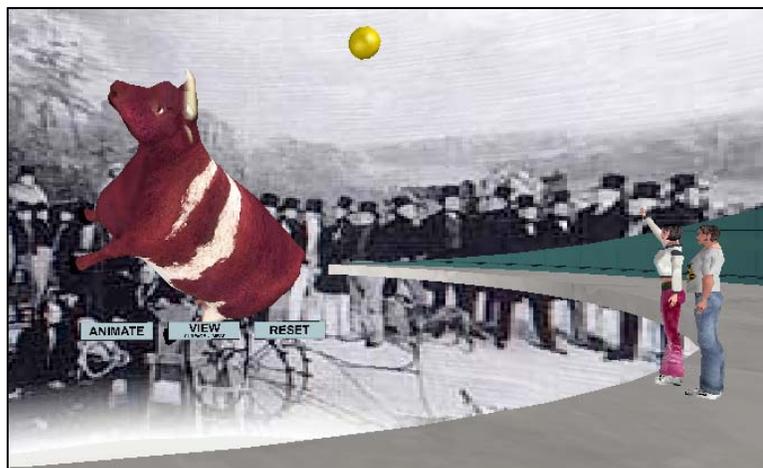


Figure 7

From the section on Bakewell, beef and cattle breeding: the teacher's avatar as cow. The buttons below the cow allow students to see a "meat view" of the animal. This model leads to a discussion on economics driving animal breeding and to blue bloods in English culture.



Figure 8

From the section on Lyell and geology, teacher a small explorable 3D world (presented within the ring) The model is the Temple of Serapis, which Lyell used to prove a theory of gradual geological change. Students are asked to gather information and discover how Lyell accomplished this.



Figure 9

From the section on Lyell and geology, teacher as interactive rock strata. Students are asked to explore the model and explain the changes in the fossil record and address the issue of extinction in a religious context. As the student descends the rock strata, fossils of animals become progressively simpler and less like today's animals.

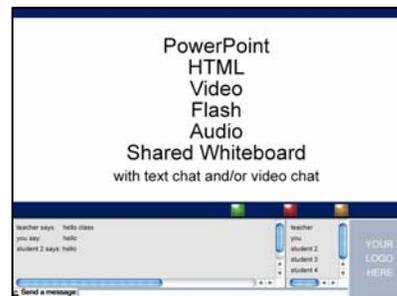


Figures 10 & 11

From Malthus and survival of the fittest, teacher as slide and world. To highlight the population concerns of Malthus and English society, The 2D chart of Malthus's equations rotates beneath the feet of the students and hordes of poor emerge as he predicted. Like the nobility of England, they are confronted with a fearful vision of overpopulation. Students are asked to connect both theory and fear in support of Darwin.

III. Theory: Design Choices and HCI Considerations

The design choices and HCI considerations of the Magic Classroom run an interesting balance between the forces of realism and those of reality. One example is the initial walk to class. Given the digital nature of the space, it is possible to have the system automatically place students directly in the presentation ring. From a GOMs perspective, direct placement is a more efficient method of positioning students than walking, yet walking to class has value. Walking to class, the idea of free travel over a short distance, was felt to add a sense of immersion, social presence and opportunities for social interaction. Granted, this balance is guesswork, but the underlying utilization of the digital reality of virtual space blended with application of behavioral mechanisms generated by realism seems worthwhile.



Figures 12 & 13

On the left, HorizonLive, a synchronous 2D educational software package. While HorizonLive effectively delivers educational content, social presence is not visually reinforced. On the right, with Magic Classroom avatars positioned, aspects of realistic student behavior, like raising hands to ask a question can be explored. The 3D space also appears to foreshadow / support the use of abstract educational 3D models / worlds during the lecture.

The Magic Classroom's HCI goals are the flexible presentation of information, the management of cognitive load and ease of user interaction. The Magic Classroom does not dictate content, it provides new options for designers. Options include screen filling 2D slides, interactive 3D models (presented in series to ease complexity), background panoramas (for context), small focused 3D worlds, or using the ring as briefing space linked to larger, fictional worlds or simulations.

In support of user interaction, the principles and the digital realities that guide the development of 2D interfaces also are in place within the Magic Classroom. Some of the principles are:

- 1. Minimize the number of steps needed by users to accomplish their tasks.*
- 2. Avoid unnecessary visual clutter that distracts from or inhibits user tasks.*
- 3. Simplify object movement; use predictable paths and less than 6DOF (Six Degrees of Freedom)*
- 4. Organize groups of items into aligned structures for easier access*

(Shneiderman 2003)

Removal of the ground plane beneath the teacher was a step away from realism in favor of more flexible presentations and better management of cognitive load. From a visual perspective, the ground plane takes up valuable space on the computer screen. The slides and models of the Magic Classroom would have almost their entire bottom halves cut-off or be forced to be made smaller to fit with a flat ground plane. Small worlds would be forced to share the ground.

Alternative, realism-based, approaches such as stadium seating or simply asking students to look up at larger models are possible, but hold interactive drawbacks. Looking up is not simply an extra step; it forces the viewer to see the bottom of the model and limits views of the top. In contrast, the Magic Classroom centers large interactive models in front of the students. Granted, stadium seating would allow for centered models and provide the teacher with a pleasing place to stand, but in the Magic Classroom, the teacher shape-shifts into the presentation, so the value of a place for the teacher to stand seems questionable. In the end, the ground plane in the presentation is seen as unnecessary visual clutter that interferes with the presentation of slides, models, worlds, and panoramic backgrounds.

The charge of unnecessary visual clutter is again made with the teacher's avatar. Holding the human avatar and educational content on screen consumes valuable visual real-estate. If too close, the teacher's body will cover / conflict with the 2D slide or 3D model. If the teacher is set to the side, travel by the teacher on and off stage becomes a real and burdensome navigational task.

For students, the value of the teacher's human form avatar is largely in the visual reinforcement of social presence. Its eyes, hands, legs are representational rather than functional. Being representational it conveys information through gestural expression. The Magic Classroom modifies gestures into a mode better suited to mouse and keyboard – a PowerPoint presentation. Combining teacher with content is clearly efficient.

IV. A Preliminary Usability Study

Twenty Juniors in the Simulation, Design and Entertainment (SDE) program at the University of Baltimore were given class time to participate in a preliminary evaluation of the Magic Classroom. Students were broken into four groups of five and presented with *Darwin: A Man and His Times* as a live lecture. Results stem from a questionnaire (short answer, true-false, five point Likert questions) and group discussions afterwards. Unfortunately for data analysis, the screener showed that nearly all students had prior online learning experience and played videogames on a weekly basis. Therefore, Likert data is presented without consideration for subgroups.

Immersiveness, presence and the impact of the shape-shifting teacher:

Changing the teacher's body was confusing	0%
Changing the teacher's body was unnecessary	15%
Teacher felt present at all times	4.5
Teacher felt present only when I saw their body	1.5
Teacher felt more present when I saw their body	3.5
The space was immersive	2.6

During the group discussion, an unexpected factor emerged as a leading supporter of teacher presence – Voice over IP (VoIP). Hearing the teacher's voice throughout the shape-shifting lecture and having the teacher respond in real-time to questions effectively reinforces teacher presence.

A second reason for teacher presence arising from students is harder to describe. In general, students felt they had already been exposed to this type of digital interaction and the Magic Classroom was merely a step along a path. Students discussed videogames and their use of shape-shifting characters. A few noted mythology, science fiction and comic books as references for shape-shifting. Others considered that the PowerPoint metaphor is nothing new. There was also a broad discussion on how communication tools like Instant Messaging (IM) and cell phones connect people without visual support. Granted, the student's digital design backgrounds did seem come into play. Also then, like many of young Americans, they are individuals born into a digital world and raised on the internet, their expectations of reality are perhaps more flexible than previous generations.

One theoretical explanation for the Magic Classroom maintaining teacher presence is hidden in the previous paragraph. Some scholars believe that celebrating the affordances of the media breaks presence and immersion (Murray 1997). The Magic Classroom, however, does not pretend to simulate a fictional, story world. Teacher and students are not role playing. Therefore shape-shifting does not unsuspend the belief in the teacher as the students are only asked to believe that the teacher is using their avatar to communicate and share knowledge. Like Instant Messaging, students understood that a real person was present. Perhaps the initial human form teacher was enough to introduce the students to the idea of the virtual lecture. It became a departure point from which magical shape-shifting could reasonably occur. Once again this is guesswork, but the preliminary results appear supportive.

The low, almost neutral level, of immersiveness was explained by students by poor 3D modeling. Better 3D modeling seems an easy solution. Asked about improving immersion beyond better modeling, students noted that in future lessons they would be more comfortable with the Magic Classroom and this might influence immersion. A theoretical factor may be the Magic Classroom's lack of fiction or storyline

General Views & Preferences:

Understanding the space was easy	4.5
Following along with the instructor was easy	4.8
I would discard the shape-shifting teacher & use only large virtual games	1.5
An educational game would've taught me more	2.3
An educational game would be more engaging	3.2
Would be a useful part of a larger online course	4.9
I want a mix of the Magic Classroom and games	3.6

SDE students have considerable experience building and being taught through educational games. They see potential with games, but feel it has yet to materialize. In contrast, traditional instructor led methodology within the Magic Classroom seemed to resonate. Several students offered suggestions to increase the instructor's power in the space and where to place limits on student behavior.

Two issues were raised by students. One was a request to review the lecture in progress, to go back or forward on their on terms. They suggested a separate pop up window. The second issue called for more exploration and student-led interaction. On the surface this appears to conflict with the instruction led methodology, but proper management of a classroom does not equate to removing opportunities for student led learning. This second issue was also tempered by their realizing this was also their first class in the Magic Classroom and that more complexity was possible.

V. Conclusions

The Magic Classroom, as an exploration of virtual space design, opens a window into a conflict between realism and reality. As virtual spaces separate themselves from games and simulations, new native forms and structures will emerge. Some of the forces that will affect these new native forms of virtual space drive conceptual conflicts such as realism / reality, interface / environment, human avatar / informational node. The design principles here are new and in some regards confusing, but newness alone is no reason for dismissal. The Magic Classroom, seemingly simple on the surface, relies on these very design principles. As a whole these principles are more complex, useful, and complete most other theories of virtual space. Furthermore, the data collected from University of Baltimore students leaves no doubt that these principles work and that the Magic Classroom is a viable platform for online education.

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Presentation Transcripts: The Magic Classroom

Abstract

The key to this dissertation is The Magic Classroom. It is a functional prototype that utilizes all the theories expressed in this text. The first paper, *Usability in Virtual Space: Lessons from Game Design*, discussed the blending of HCI and Filmic principles that are put to use in the Magic Classroom. The second paper, *The Magic Classroom: A Multi-user Web3D Presentation Hall*, walked through an earlier presentation on Charles Darwin and shared some of the design possibilities and problems of the space.

This last section shares the transcripts of three new presentations. The true materials being submitted for this dissertation are the presentations themselves. These transcripts are offered as means for easier review. The presentations highlight the flexibility of the Magic Classroom across multiple subjects. These subjects are:

I. 3D Lighting and Camera Techniques – Part 1

II. Package Design – Shampoo

III. The Design of Virtual Space

Each presentation has video a walkthrough in the accompanying discs. The transcripts that follow largely match the words spoken during the presentation. Thus, the style of the text here is casual and is not meant to stand as a formal paper.

Each presentation covers a separate educational topic and explores unique aspects of the Magic Classroom. *3D Lighting and Camera Techniques – Part 1*, was designed for an Art Institute of Pittsburgh – Online Division (AIP-OD) class on the same subject. A series of 3D models with interactive lighting were presented to the students. Each model touched on a specific type of light or feature of light that could be manipulated. The presentation focuses on the tools of lighting and only mentions application of the tools.

Package Design – Shampoo was done as an assignment for an AIP-OD course called Dimensional Design. Students produced thumbnail and semi-comp designs of their shampoo graphics. Students were given JPG texture maps for a virtual model of a shampoo bottle. In Photoshop, they adapted their designs to the JPG. By replacing the texture guide with their own, students got to see their work in 3D, on a virtual bottle without coding or 3D modeling. In the Magic Classroom, the sketches and thumbnails were reviewed. Virtual shampoo bottles, texture mapped with student graphics, were critiqued. Lastly, the virtual shampoo bottles were placed in an aisle in a virtual supermarket. Students then explored their work in its natural location, the store shelf.

The last presentation explores the *Design of Virtual Space*. It is in essence a doctoral defense created inside the very virtual world it seeks to explain. Pictorial and interactive, it places the audience in a position to experience firsthand the ideas expressed. It shares the joy and the hassles of travel, the acceptability of the teacher shape shifting, and the functional issues of a virtual chair. Blends film and HCI/usability theory with virtual examples, it goes where no 2D presentation has gone before.

I. 3D Lighting and Camera Techniques – Part 1



1. Welcome

Welcome to a presentation on 3D lighting and camera techniques. This is part 1 of a 2 part series. We will focus on the tools that 3D modeling software offers. In part 2, we will focus on applying what we learn here. This presentation covers 3DS max, but the larger ideas, if not the actual terms, apply to all 3D worlds.



2. Tools

Tools for lighting 3D worlds include: Types of lights, light parameters or features, and other parameters like shadows and materials. Keep an eye on potential use of the lights and how they can fill or paint the scene with light, how they can support a story or mood, how real or unreal they feel and lastly, how we can use multiple lights to light a space.



3. Light Types

There are 3 basic types of lights. Omni, Direct – which is short for Directional, and Spot Each type projects rays of light from a light source in a different fashion. Take a moment and consider how these differences in direction allow for different levels of control in how light fills the space.



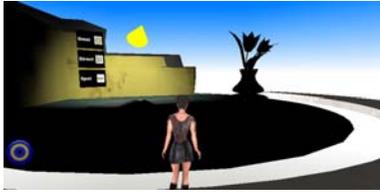
4a. Omni Light

Click on the buttons in this model and watch how different lights fill the scene. The top one is the Omni light, it fills the scene evenly. Look at the walls and the floor, they are the same tone and they feel very flat and very fake.



4b. Direct Light

Direct lighting is in the middle. Notice how the surfaces are different tones. Because Direct lights shine in one direction, with rays that are parallel, the light each surface gets varies based on angle. Rotate the model and see how surfaces that face the light are well lit and surfaces at a steep angle are less lit. Direct lights offer more control over how a scene is lit. Use them as Key lights, or lights that shine on the most important aspects of a scene.



4c. Spotlight

Spotlights can really make objects stand out. They, in themselves, can also stand out and look fake. I just said that Direct lights are key to lighting a space, and that low Omni lights are great for filling the scene. Spotlights can finely target an object or area.

Of course, it also depends on whether your scene has lamps, streetlights, or any 3D modeled object that pretends to be a light source. Just remember, you get to choose where those lamps and streetlights go, so don't feel trapped by your 3D model. A general bit of advice: Don't line things up or make everything at 90-degree angles. 3D worlds all too easily feel fake. Having mainly flat 90 degree surfaces and lights lined up with those surfaces adds to that fakeness. Be organic and natural.



5. Features

Once you have a light in a scene, you have a great deal of control over how it affects objects and surfaces in the scene. These features allow much more control than you have over any physical, real world light source, so it may take some getting used to. The basics are the Multiplier, Far Attenuation, and Near Attenuation.



6a. Multiplier 1

This is a Multiplier example. Slide the grey button to change the Multiplier value.



6b. Multiplier 2

The light level in the entire space rises and falls as you slide the button. Remember that a low level light can fill the scene, while other lights can shine on or bring out objects or areas that are more important.



7. Far Attenuation

In contrast, Far Attenuation is the distance the light travels. Slide the grey button to watch the light grow outwards from the light source. Note that the light level, or Multiplier, is constant or even in the areas that are lit. There's a little fading on the edges, but not much. We can address how the light fades / falls off from the source using Near Attenuation.



8. Near Attenuation

Near Attenuation controls how light fades over distance. Multiplier sets the starting level and Far Attenuation is distance, but Near Attenuation controls what happens between the light source and its outer edge.

The slider here only gives a hint of what's possible. In a web browser it's difficult to show. Slide the grey button and get a sense of the changes. In the real, physical world, light fades like this. Look at the gradation on the surfaces, there's more depth and more realism here than in the previous models which felt flat.

Use Near Attenuation, and use it wisely along with Far Attenuation and Multiplier to make even a simple scene feel rich and real.



9a. Falloff 1

Light levels fade in other ways beyond the previous example. In this model, the edge of the light that is parallel to the source fades or falls off. Previously we used distance that was perpendicular to the source, but here it's parallel. Slide the grey button to make the edges of this spotlight sharper then back to softer.



9b. Falloff 2

Do you see how this differs from Attenuation?



10a. Color 1

In a 3D world, we can easily color the light. Little hints of yellow and red can warm a scene so that it feels sunlit and outdoors. Deeper warm yellows and reds bring a sense of candles and firelight.



10b. Color 1

Cool tones can lend a sense of mechanical, sterile-ness to an office interior. Blues can push feelings of cold, and Greens, when pushed can add a spooky vibe. Slide the Red, Green & Blue buttons around to create different tones.

To recap, you can use different lights like Direct, Omni, and Spot. You can control them through features like Multiplier, Far Attenuation, and Near Attenuation. You can tint and color your lights. Also, you can combine multiple lights with multiple features to correctly light your scene.

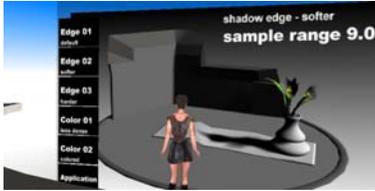
Use a low level, or Multiplier, Omni light to gently fill the scene and a Direct light to bring out areas, objects that you need lit. Follow the lamps and models of lights in your scene, but remember that you control where they go as well. Think about angles and levels other than 90 degrees. Be organic.



11a. Shadow Default

If you thought your control of lighting was just about lighting, think again. Shadows play an important role in your space. Among other things, shadows help connect and root objects to the ground. Objects without shadows sometimes seem to float. Also, if you have multiple lights you may wish to turn off the shadows the lights cast.

In this browser 3D package, we don't get to do shadows. So here's a quick slideshow. The top, Edge 01, is the default in 3DS Max and it's a sample range of 4.0



11b. Shadow Soft

Raise the range to soften the edge



11c. Shadow Hard

Lower the range to make it harder. Think about your scene and what you are trying to convey. A strong edge stands out and becomes an object its own. By mirroring the 3D object, it adds power and punch to the object. Simple scenes with powerful themes or messages can benefit from strong shadows



11d. Shadow Density

Like light, we can change the level or color of the shadow. Lower the Density and you lessen the shadow. Some scenes don't need strong shadows. Gentle and natural scenes or scenes with many complex objects may look better with soft subtle shadows that fade into the background.



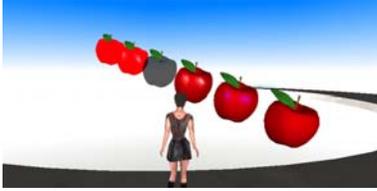
11e. Shadow Color

Color is an odd control here, but we often do odd and unreal things in our 3D worlds. Coloring a shadow is a means for that oddness.



11f. Shadow Use

The final shadow issue is not a feature or control, but a consideration for application. Think about scary movies you've seen. Shadows play a huge role in making you feel the way you do. Shadows add to scene. They don't have to be scary either, they can add depth and detail in subtle ways. When you place lights in a scene, take a moment and think about the shadows they create and how you might use light and shadow to enhance your scene.



12. Materials

One last topic is materials. Look at these apples, some are shiny, others are missing shadows. One is transparent and the light goes through it. Beyond the lights and their own features, we control how the lights affect each material. A simple choice of a light or dark surface will influence how light affects an object. This general surface color or property is called Diffuse color. Going deeper, you can make the material shiny and control exactly what type of shine. This is called Specular color. You can make the material not even need light to be visible or set a minimum level of it to always be seen, this is Self-Illumination. In general, you create the material first and simply try to be as close to its real-world counterpart as possible. If the material doesn't work in the scene the way you wish, don't be afraid to tweak it.



13. Closing

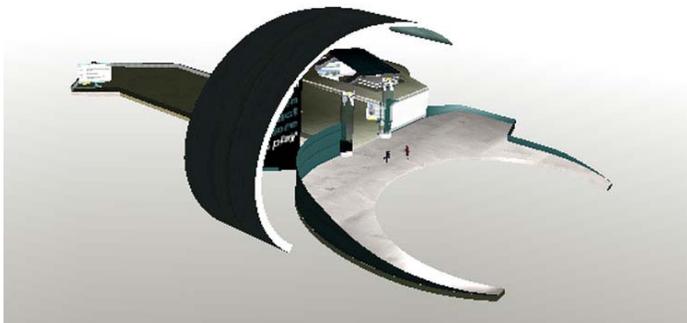
Any general questions before I recap this session?

We covered a great deal of ground. Materials and shadows are as important as light itself. On light, we discussed how to control it through Multiplier or level, Far Attenuation or distance, and Near Attenuation or how light level fades over that distance.

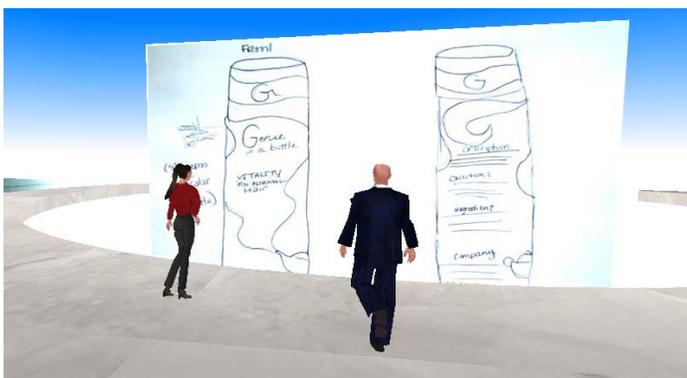
There are 3 primary types of lights. Omni, Direct, and Spotlight. New 3D modelers often spam their scenes with Omni lights. Please avoid this, don't overfill or wash out your scene with light – it's almost like dumping a bucket of light into a scene. Be painterly, use Direct and Spotlights like paint brushes to bring out the depth and story of your scene. Be organic and try not to line things up. *Looking forward to seeing your work - Good Bye.*

II. Package Design - Shampoo

Because this was a critique session that required students to express their design ideas, no generic transcripts are possible.



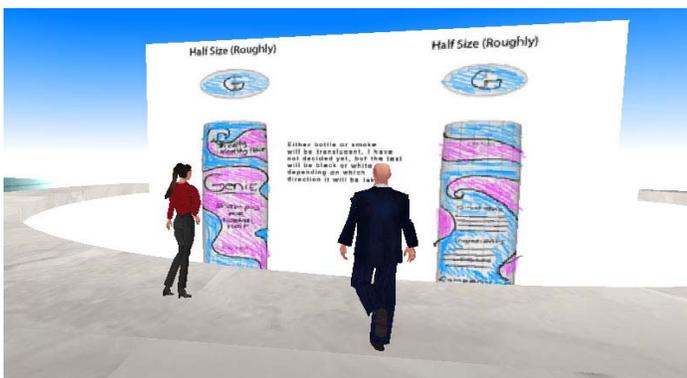
0. Overview



Sketches are shown, early ideas and guiding concepts are discussed. This student chose “Genie” as a brand name and sought to wrap a large colorful, cloud-like, genie emerging from a lamp graphic to the bottle.

The tagline is “Genie in a Bottle”

1. Sketches



Semi-comps are shown. The shape of the cloud and the lamp have changed. Color has been added. Graphics on the cap are more dynamic.

2. Semi-Comps



3. Bottles

The Semi-Comp graphics are revised and placed on bottles. Normal and Dry hair are shown here.

It's interesting to see how the use of a template influenced the design. This is tighter, less flowing than the prior version. The Genie lamp bottle on the lower right gets lost.



4a. Shelf 1

The bottles, now on a shelf, are compared to existing brands,



4a. Shelf 2

In the distance, patterns emerge. Designs from individual bottles form defined blocks of color. Labels link and standout to create a “Billboard Effect”. In the distance, this student's design leaps off the shelf, and hopefully into the hands of the customer.

Repeats for next student

III. The Design of Virtual Space



The teacher enters the classroom and walks to the presentation ring. Next, the teacher greets the students, positions themselves in the center of the ring, and starts the presentation.

0. Entry



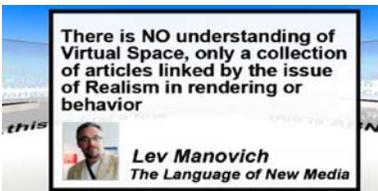
Welcome to a presentation on the design of virtual space. This won't cover programming, art, games, sociology or education. It's virtual 3D design, what we can and should be building. What should it look like and what it should do.

1. Welcome

This presentation will offer some guidance on the forms and functions of virtual space.

Where to start this discussion is a problem.

Film and media scholar Lev Manovich might be useful.



There is no understanding of virtual space.

Most developers build dollhouses and play dress-up with avatars.

They can only mirror the real, physical world.

They lack the understanding to do more – it's a problem.

2. Lev Manovich

In this discussion, we'll acknowledge the mouse, keyboard and screen. We'll acknowledge that this space is digital and exists inside the computer. Take a moment and consider, we live in a world becoming more and more virtual, yet inside the computer, the place we can most exploit the power of our technology, most people sadly only recreate the past.

We can't go into detail here, but briefly, Manovich's sources cite narrative/storytelling as a reason we can't look to past realism...

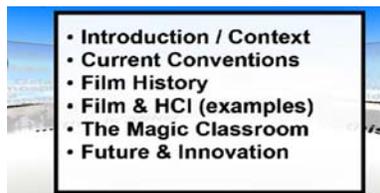


3. Form, Function

So we'll cover narrative and storytelling - through film
We'll acknowledge the mouse, keyboard, and the digital nature of virtual space - through interface design, usability, and HCI.

This 3D virtual world is an interface in which we share, access, and experience a broad range of information.

The underlying key to understanding virtual space is that form follows function.



4. Overview

Here's an outline, we are doing introduction / context now.
Current Conventions, realism and the problems of functions trying to follow forms. That's what happens, beautiful worlds are built, but they don't function the way designers want, and they assume the fix is more realism.

Film History/Theory will help define the relationship of function and form in regards to narrative and realism. Next, we add HCI, Interface design, and examples of those principles. Then we'll talk about what you are seeing here, my apologies for making you wait. Lastly the future, the larger range of design options and methodologies for innovation.

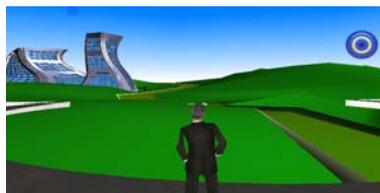


5. Break

Any questions before we leap in?

Current Conventions, this will cover much of what you already know and feel.

We need to discuss it as it acts as a foundation.

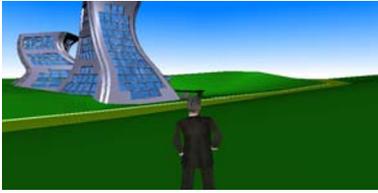


6a. Campus 1

Most people build big worlds, and most universities build large campuses. Fun to explore and travel through at first.

We can and should exploit this joy of exploration and the sense of immersion it brings.

Follow me to the other side of those buildings.



6b. Campus 2

There's a thrill of the seeing a new space, being immersed in it.
 People expect more good things to follow.
 Games are like this.
 You run around, quest, and do things in the space.

But, travel for the sake of travel is rarely a quest.
 Virtual space isn't a videogame. So there are differences.



6c. Campus 3

Group travel is often awkward. Movement can be a problem, even lining up from place to place takes more time than it should. This screen would be fine in a real world, but here positioning yourself to see the screen is a problem.

Games like World of Warcraft use unnecessary travel as a penalty.
 When you die, you run back from the graveyard.
 When you level, you get faster and faster travel modes.
 Most instances, special quest areas, provide short cuts for leaving the area. So players don't have to backtrack.



6d. Campus 4

Do you wish to walk back to where we started - the presentation ring? You can push the page down key and return there instantly.
 Free travel is fun the first few times, but depending on our goals, it can be tedious and even hinder us.

To look at travel and goals, it's literally the timeless question of what's important, the journey vs the destination. Both issues are valid, but goalwise they can conflict.

Getting there quickly and completing the task has HCI overtones.
 Getting experience from the journey, taking time to see, if not smell the roses, touches on issues of narrative and storytelling.
 Luckily, we don't need to solve the question of journey vs. the destination. We only need to acknowledge its here and occasionally make a choice.



7a. Conference 1

Like here, I'll remove the journey and bring the next destination to us. Many people build simulations of conference rooms. Here's one I see often. Most universities have at least one conference room with a projection screen forced into it. New technology and old existing spaces don't always fit.

Virtual worlds are the newest of the new technology and comically, only the idea of old spaces exists.



7b. Conference 2

These old spaces do serve a narrative function, like role-playing. Role-playing can be valuable – even if the role you play is sitting in a chair and pretending to be in a meeting. There's no denying that providing a social and human presence to online interaction is a core benefit of virtual space, a benefit that targets the problems of separation, disconnectedness, and the loneliness in online interaction.

The trick is to balance the benefits of social interplay with more effective interaction. Use the remote control on the table to start the video. Having trouble positioning yourself or clicking on the blue button? Are you unclear on who should do this action?



7c. Conference 3

Is the problem the mouse interaction, or is the remote, a tool designed for the real physical world, inappropriate here? Does the remote fit the narrative; yet fail as an interface element. Is it usable? Do you see a trend emerging?

These are current - known issues, and most people cite more realism as a solution. But let's to be clear, copying the real, physical world doesn't always work.

To close out this current convention section, let's get creative and connect narrative with innovation rather than limitation.



8a. Gallery 1

Artistic spaces show images and art, they may ask users to do new things. Artistic spaces can defy reason, yet appear reasonable. Viewers expect and accept a greater level of newness and novelty here, as opposed to a role-playing game set in the middle ages. Buildings need to look like castles, and new things need to fit a narrative of magic and wizardry.

Here in an art gallery, we have a tank balanced on a woman's fingertips and fighter planes frozen and floating unsupported in space. Travel up the stairs; note our video playing in the treads of the tank, then jump down off the wing of a plane.



8b. Gallery 2

Does the idea of an art gallery allow for more creative and innovative designs? Does art allow you space to explore? Is the idea of or the narrative behind an art gallery responsible for this flexibility in design? Is it like the narrative of a role-playing game only with a twist? If so...

Did the idea or story/narrative of a college campus or conference room on some level impede creativity? Does realism hinder some types of innovation?

Art galleries are spaces to share, access, and experience a broad range of information within. They are interfaces of sorts – but aren't all virtual worlds like this? We'll talk more about art galleries later in the presentation.

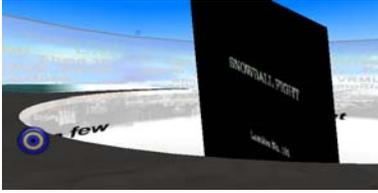


9. Break

So having fun so far? Any questions?

We've seen current ideas and opened the floor to questions of narrative, storytelling and HCI/usability. Seeing a difference is easy, but bringing them together and unifying them is very hard, so perhaps some history and examples from a better-known media will help clarify things.

Let's move on to Film, here's a film clip from 1895.



10a. Film 1

Film was once a new media, with unknown properties.

Turn your avatar and watch the screen. I've added a little behavior to add that new media feeling.

Think as old filmmakers once did. Think about what you might do to improve this short clip. Add audio. Add color, Improve and smooth the frame rate? Make it longer?

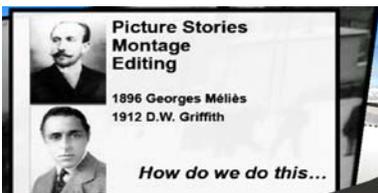


10b. Film 2

In essence, you want more realism, much like today's developers of virtual space. But today's films have color and sound and yet still may not be any good.

We want a compelling or amusing story to be told. One tool for storytelling is to edit the video, to cut the film into pieces and make a montage, to make new meanings and more powerful stories. Consider how film is cut from person to person in a scene with people talking; think about jump cuts, close-ups, long distance crane shots, pans and zooms.

This cutting of film is not realistic, it is a language that needs to be learned. In the beginning, learning was hard. Filmmakers faced a conceptual challenge, a hurdle very much like the one developers of virtual space face today. Let's explore how they handled things, starting with Georges Melies.



11. Montage

Melies was also a theatre owner and magician. One day he miss-cut his film and when it played, he saw himself disappear. It was an "ah ha" moment, cutting film to create new and stronger meanings.

People knew they could cut film, move the camera at first in short clip-like films called nickelodeons, but that was usually for a special effect.

Twenty years later, Griffith starts to codify this cutting of film into a narrative toolkit. Twenty years after Melies, Griffith was still

criticized for cutting up his films. The close-up, the pan, cutting from person to person in a scene with people talking, all things we know and understand today were then seen as bells and whistles, unneeded or wrong.

So what about today and our new media?

We have an abundance of virtual bells and whistles, but there's no structure to the language, to the toolkit. Narrative affects editing, but that doesn't seem to work here.

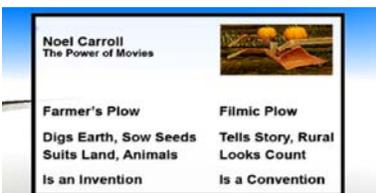


12. HCI

This is where we add HCI – principles of human computer interaction. This is still an interface.

In fact, move your cursor around, then consider David Heim's idea of your Avatar as a Network Cursor. The avatar moves in 3D, like your cursor does in 2D and positions you to interact, to see information, or to share information. There's more to it but it's a start. For now, think about what you've seen here so far. Nothing completely new, but the worlds and slides are presented in a way that minimizes movement. The ring before you guides to its edge and positions you to see the content in an optimum way. The slides face each individual, unshared behavior. It can turn because you stand at the edge.

Like Griffith, we need to build a new coherent language of these abilities. Like montage, pull innovation from the bells and whistles of the past.



13. Farm, Film

So then, HCI-usability and film-narrative. These don't always fit cleanly. We talked about the journey and the destination earlier, now let's go deeper, and deal with this issue in regard to individual objects.

Consider the plow in a farmer's field and a plow on film. Same shape, same form but very different functions. Their

difference is clear, but it gets muddy when we discuss the functions of a virtual plow.

The image is from World of Warcraft, and it's a filmic object. It does not even move, it just serves the story. In film, the plow's form is driven by the needs of the story, old, new, broken, Japanese or American. It's a convention usually supporting an idea of rural life. Conventions are arbitrary; they only require the acceptance of the viewer to function. Consider how new conventions come into being. Let's just say it's tricky, they sort of evolve and ride waves of popular culture.

Inventions, while often hard to come by, require no belief to function. We change the plow's form to better suit the soil, the animals, the technology – we invent new forms that follow its function.

A virtual plow is both invention and convention. To gauge the impact of being both, lets open up to virtual chairs, folders, and books. They might be better to discuss than a plow. They have more current social and informational value attached.



14. Chairs

First, note Magritte's "This is not a Pipe" image on the chair – like the pipe, that's not a chair. We could talk theory, French Post Structuralism, and virtual space as a collision of signs and signifiers, but frankly, that's just not helpful in finding a solution. I mention it here only for the academics in the audience, and to further frame the gravity of our problem.

For clarity, let's start with the image of a folder. In Windows, we know it's a convention, an icon. It holds a set of files. We had to learn this convention. Steve Jobs was able to take this idea from Xerox who didn't understand it and build an empire. So these aren't trivial matters, it's just that in 3D, it gets complicated.

The folder was simple. The books here are harder. These books

actually link to topics in Yahoo's database. Unlike the folder, in 3D we can envision opening and using the book. It's a stretch, but we want the book to somehow be a book. We want more from the 3D book than the 2D folder. Now, the computer links to a site as well, but consider using the computer inside a computer. Consider using a mouse to press keys on a virtual keyboard when you have keys in front of you. Do you feel the craziness, or at least the conflict?

The chair is a different matter; we want social interactions and comforts in our virtual experiences. Sitting helps create a sense of comfort, and this is the story we are telling ourselves. Its function is narrative and narrative relies on conventions. Conventions are arbitrary, and we can already see an evolution in the design of virtual chairs. The chair's original function, based on a physical need to sit is gone and in virtual worlds, standing is becoming socially comfortable, becoming a convention, and yet the chair is unlikely to disappear completely as it plays other roles in virtual space.

Let's see how HCI / Usability is affecting the virtual chair and virtual space.



15. Presentation

Here's a screen capture from an immersive education meeting in SL. Mostly human avatars are watching a PowerPoint-like presentation.

Look at the chairs. They are simple slabs, floating in space, no legs, back, or cushions, yet they function, they position the audience. They place the users in the right place to watch the show. The realism of the space supports a convention that those on stage are authorities and will be leading the presentation. Combined with the stage, chairs make the audience stay put, and lower their expectations for interaction. Like our presentation ring that stops you at its edge, realism shapes behavior.

Even a hint of realism is enough, and a simple shape can become a chair. HCI and usability supports simpler shapes. Virtual spaces on a screen, driven by mouse and keyboard, are interfaces. Visual realism gives way to the needs of the user to effectively interact.

The rule here is a reduction, a removal of the unneeded rather than new inventions. Consider narrative and story, removing the unneeded is easier than inventing the new. We can extend this example beyond chairs.



Removal or reduction is not the same as abstraction. In the fantasy World of Warcraft, there are very few doors. Doors are removed. They hindered user interaction, they required extra mouse moves and clicks without benefit or connection to the users goals.

16. Doors

For reasons solely of Usability and HCI, doors are removed. Note the story, the narrative supports doors - but the lack of doors does not suspend the disbelief of the user. We see the start of another convention, like chairs without backs or legs, we see buildings without doors. Doors when used serve a purpose of real division. That division is of information. Some doors function like hyperlinks, again HCI / Usability. Others, like those with narrative ties, segment the user experience, and denote a change in story or subject matter. Beyond doors, buildings themselves are evolving.



We see structures themselves open up; doors become archways, ramps and balconies lose their railings, and within a computer screen, a room's walls feel tight, constricting, and unneeded. Safety and support are non-issues and the architecture reflects this.

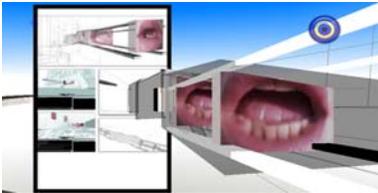
17. Walls, Railings

In a world with flying characters or characters that can't be injured, objects like railings and walls hinder movement, hinder users from reaching a desired location. So they are removed. In the virtual, we see the rise of new conventions. We see new conventions arise as items are removed, often unknowingly, and space itself evolves based on the issues of narrative and usability

that we've been discussing.

As these new conventions take hold, and become accepted as real, it's laughable to declare that the process will stop, that it will shut down. We will continue to build on these new conventions as we did the old ones we first carried over from the real, physical world.

To see the possibilities of the future, let's look to the art gallery. Here are images of a gallery and a gallery room by Patrick Keller.

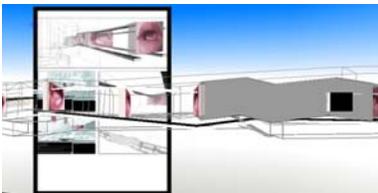


18a. New Gallery 1

Again, I don't wish to call this abstraction. Abstraction has many meanings. I wish to focus on the practical.

The important element here is the definition of space without realism. There are no faux chairs, shrubs, or light fixtures. Like the previous examples, they've been removed. Removal raises issues of what to build.

Here we see a building defined by breaks and bends, angles and elements that repeat. Virtual space rejects worlds solely made of 90-degree angles. Most games do this too. Rather than fill a space with unneeded elements, they create more organic forms, in a language punctuated by realistic objects. Space is largely open and easy to traverse or interact within.



18b. New Gallery 2

Much of this space feels overly artistic in nature, but in art, there are hints of useful design elements and keys for future development.

The lines here, stretched like taut ropes, help define the space. We can use lines in other ways.

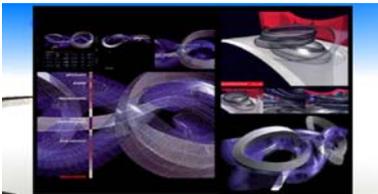


19. Museum

In Cristiano Bianchi's Science Museum, lines are used to frame kiosks and installations. Other people use faux glass, which raises the question of function. Clearly, the glass is used like the filmic plow – to create a sense, a narrative of an object in a museum. Functionally faux glass interferes with the goal of the museum, to share knowledge. It literally separates users from the knowledge in a vain attempt to protect a virtual object that needs no protection. Its silly and worse – most museums want hands on interaction, but can't allow it.

The lines here serve to frame the object in the 3D dimensional space and that's all that's needed.

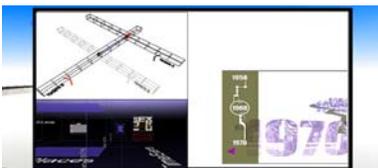
Also note the image on the left holds a menu, a menu like you might find in a 2D interface. Blends of what we consider 2D interfaces and 3D environments are being used by many, many designers.



20. Mobile Space

Some art spaces push further than others do. Asymptote's Virtual Guggenheim uses rooms that flow like blood vessels in a moving, morphing structure. While this was largely a rebellion against static real world architecture, it raises a few points. Lines linked with transparency, or even as textures on surfaces, can help define a space. Also, look at the interface, lower left. In the distance, spaces take on a 2D flatness and the overlaying of common interface themes becomes possible. In essence, main street becomes main menu. It's a bit different and grander than Cristiano's menu on the previous slide.

As for mobile architecture, Cristiano Bianchi's takes a stab at grand ideas, as his space becomes a database.



Two works are here. On the left is Cristiano's work. The X-axis has columns dedicated to each member of the band the Sex Pistols. The Y-axis has rows that track individual years. In essence, the Y-axis is a timeline. The point at which the user

21. Data Space

stands in the space materializes. The corresponding row and column also tracks the user. It is an immersive database with band member data from a given year surrounding the viewer.

On the right is Timeline, my own project and an experiment in manufacturing user experience. The user chooses to enter in the 1970's or the 1950's. That initial experience colors their perspective on the 1960's. The heads-up display tracks the user in time. When space is mapped to information, to pure data, other in-world displays, mini maps etc, still fulfill the role of adding cognitive placement and support.

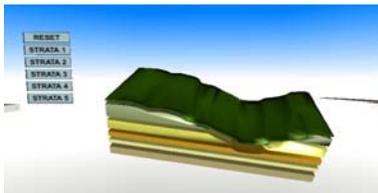


Before we discuss the next section Magic Classroom, let's recap. We've talked about the roles of narrative and usability in determining what we build. Film history and the gradual acceptance of montage highlights the difficulties in moving forward. Yet we know we will go forward.

22. Break

Principles like reduction, angled spaces, use of lines, mobile architecture, and blending databases, interfaces and environments have been shown. Main street as main menu and avatar as cursor are useful metaphors for envisioning future worlds. It's a lot to get. For now, understanding the possibilities is enough.

As for this space, the Magic Classroom, you've heard some HCI principles behind it and seen slides, objects, rooms, and a college campus presented. Let's do more here.

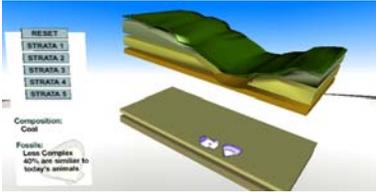


Here's an example installation from the Immersive Darwin presentation. In this course, students explore rock strata; find fossils, and other data. Students are asked to relate their findings to Darwin's theory of evolution and to the teachings of the church.

23a. Kiosk 1

You can rotate the rock strata, select different layers to explore by clicking on a strata button. Mousing over the rocks, shells, and fossils will bring up different facts about each. Facts known to

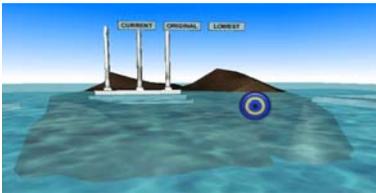
those in Darwin's time.



23b. Kiosk 2

All behaviors are unshared, so your exploration is your own. The goal was to present a reasonable amount of information, make interaction easy, and be able to pull a number of specific points from it. Note how the removal of the floor allows this large installation to be easily accessed by students, students who don't have to travel to learn.

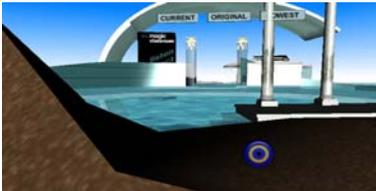
Recall the issues of travel and position from earlier, from the campus environment. How could this be presented in that type of realistic space? You saw a campus, a conference room and a gallery earlier. Now let's try an island.



24a. Explore 1

Exploring small environments, like the Temple of Serapis also for the Immersive Darwin presentation, allow for small focused educational activities.

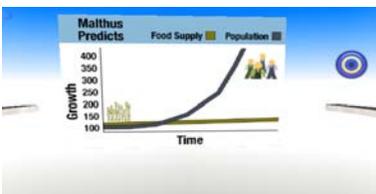
Travel here is short and the island holds only one secret.



24b. Explore 2

Managing complex group behavior is problematic in most virtual worlds. Learning how to use smaller spaces and activities with small groups has value.

Unshared behaviors can be problematic as well, but again exploring and resolving the different uses of shared and unshared behaviors has value for designers of virtual worlds. Again shared is everyone sees your action, unshared is action only you see.



25a. Slide to 3D 1

One more from the Immersive Darwin presentation.

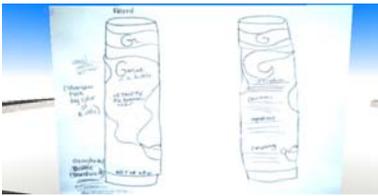
2D charts and graphs can feel abstract.

This slide on Malthus's prediction of population outstripping food supply is clear, but passionless.



25b. Slide to 3D 2

In the 1800's it was a passionate political issue. To instill the sense of fear felt by the upper classes, we can flip the slide and watch a population explode. 2D becomes immersive 3D and who wouldn't want this in their real world classrooms.



26a. Shampoo Art 1

My beta tests of this material at the University of Baltimore were overwhelmingly positive.

Now the last series of examples. This set was used in one of my current online courses. I had my art students design shampoo bottle graphics. We critiqued the entire process here in this Magic Classroom.



26b. Shampoo Art 2

They did thumbnails. They did semi comps.

My students normally never meet, so this virtual critique was a big hit. In small groups, we discussed their ideas and development process. My students also enjoyed seeing their work on giant floating billboards.



26c. Shampoo Bottle

I also gave my students a template texture map for a 3D model of a shampoo bottle

They took their designs into Photoshop and mapped their work on to the template I provided. They can now see their designs in 3D and come to understand how graphics really wrap around the bottle.



Once we have a 3D bottle, we can explore putting it on a shelf in a faux 3D supermarket.

Granted this is simple, but it does show how the package would look alongside existing brands. How blocks of color form and design elements link a line of products together. How those forms and links emerge and shift with changes of distance.

We can do signage for buildings, detailing for racecars, fabric choices for furniture or clothes the same way. Simple 3D modeling packages can open the door to interior design and other courses. In the end, a lot is possible.

27d. Shampoo Aisle



Wrapping up, we have shown current approaches of campuses and conference rooms. We've discussed their use and shortcomings. Ideas of narrative from film & HCI/usability from interface design have been expressed. Examples of art galleries and of actual lectures have been presented.

28. Break

Yet, there's much much more to say, and we can only go so far in one session. So let's close with a few common and some uncommon ideas.



29. Business City

Companies like IBM have built worlds like this one to extend their business activities. You can see the architecture opening up with respect to the new travel possibilities like flight and teleportation.

Columns become like the lines discussed earlier and frame space. Without gravity, structures can float. Without injury, users can leap from buildings.

These abilities force a new architecture, not determined by the weather, physics and the material strength of steel. This architecture is driven by the standards of interface design and touched by narrative desires.



30. Learning Space

I don't begrudge those who want an island paradise. Jokaydia, shown here, is a beautiful place dedicated to education. We can't forget the role of stories and narratives in shaping our needs, and our desires for virtual worlds. A peaceful place to work, an artistic escape, or a dramatic reminder of the real world, many things are possible in this virtual domain.

Speaking of possibilities, let's go to the edge.



31. Virtual Concert

My friend Adam Nash built this music concert. The space was a black void, the audience gray balls with white name labels. The musicians, well, their avatars became instruments, and those instruments were huge abstract architectural structures. The red is all one person's avatar.

My avatar is Steve 2.0, just below Wilma.

When you think of MTV and real, physical world music concerts, It's easy to declare that a virtual stadium and an assigned seat is not the future. Like art and education, music allows for an easier departure point for innovation.



32. Laundry Girl

Adam's virtual concert may seem like too much, but his work built off my old poetry. Here you see an image from a virtual poetic performance called "Laundry Girl". It's a shape-shifting avatar and it provided the inspiration for everything you've seen so far.

Yes, poetry is a serious and powerful development tool. If you've come to understand the role of narrative in shaping virtual space, consider the impact of unconventional narratives. These novel, artistic texts use realism and yet push spatial design beyond the limits of realism. Poems are a tool for discovering new informatic structures, patterns and processes. If you have any doubts just take the challenge and build a virtual poem.

As for the avatar, we discussed the collecting and purposing of known behaviors into a larger language, much like early film montage. We already see people pushing past the human form. Look back to the cloud-like character; he or she was in the image of the virtual chair discussion. The only question is how to use

this ability, what do we gain, what do we lose?



Vendors of virtual worlds encourage you to build dollhouses and play dress-up with avatars. By encouraging some options, they limit others. This is a problem as they encourage realism as seen in the conference rooms and campuses we discussed at the start.

33. Closing

We need to push past the current conventions, treat realism as a tool rather than a goal. We need to look at both narrative and usability in the design of our virtual spaces. An honest design approach centered on the idea of form following function is key. The simplest way to expose yourself to the issue of form and function, to the role of realism, is to build, to get creative in art, music, or literature. Don't be afraid to break new ground. If building a single poem scares you, ponder the following:

Start small think graceful

Rhythm expression line break

Don't fear the Haiku