The Making of DIRT

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As many may have already guessed, upon observing me staring bleary-eyed at images and codes for more than ten weeks inside the tiny prison we call the "Media Lab," for my senior project I chose to make a computer game. However, it wasn't going to be another spaceship game or a poker game, I had made those before. This time I would attempt to model it after some of the games I currently play - the cool ones, with the flashy graphics and the amazing visuals. I wouldn't just be creating a game, I would be creating an entire world. Little did I know the project would become the challenge and the obsession that it did.

Initially, I had many different ideas for a project before I finally decided on making a computer game. From February 23rd to May 1st, I started planning and brainstorming. I began by making lists of my current hobbies and interests, to see if I could develop any of them into something I'd really enjoy for the next 10 weeks. The general areas were music (with and without a computer), art (with and without a computer), design/engineering, and programming. From these areas I thought of many projects, such as making a music CD, creating a sculpture, making an invention and selling it or making my own movie. I then thought it would be even better if I could incorporate multiple ideas into one project, such as combining music, computers, and video into a music video, or using computers and video to make a 3D computer animated film. I really liked computers, and I had been into 3D graphics, and it made me recall some project I had been attempting a few years ago. Back then I had thought of a computer game similar to MYST, that had some rooms, puzzles, and storyline. MYST was a first-person perspective adventure, and the purpose was to explore and navigate. I was very excited, and had drawn many images of the interior and exterior of the building. However, I did not yet have the hardware or the knowledge to make my dream become a reality. Deeply saddened, I let the project rest. Years later, I realized it was the perfect opportunity to pick up where my old sketches left off. I now had new knowledge and better computers, and I knew that creating something close to what I had originally imagined, was very possible. Making a computer game proved to be an excellent idea. In creating the entire "world", it would incorporate 3D graphics, some music and sound, a lot of art and programming,

and even some building design. Most of all, I knew it was something I would truly enjoy trying. I became excited all over again.

I was committed now. March 1st I filled out the "project planning guide" form. By March 3rd I was examining what facilities would be available to me; I could use my Macintosh computer at home with Pascal (a programming language), but it would be slow for making graphics, I could also use my PC at home with Extreme 3D to make the graphics, or I could use the Power Macs at school, which had both Extreme 3D and Think Pascal - the software that used the Pascal language. In the end I found myself using all three. I also determined that Mr. Porter could help me with the programming, and Mr. Mortali could help me with the computer art if I ran into any problems.

Since I didn't know too much about Extreme 3D, I began experimenting with the program. Through the course of my project, all of my work with Extreme 3D was the result of trial and error and experimentation. Initially I tried basic objects, like spheres and cubes, and added textures and shadows to them making them look more realistic. I sought some assistance in the "help" file for Extreme 3D, and I also found some tips off the internet. I quickly learned a variety of the tools and features of Extreme 3D, such as scaling, rotating, twisting, lathing, shading, extruding, trimming, editing materials, and manipulating the camera. Within a few weeks I was able to create images that were consistent with the quality I had imagined. It was very encouraging.

In the early stages of development the two main aspects of the game, the programming and the graphics, were created completely separate from each other. Starting March 6th I began the basic programming for DIRT - originally only a tentative title, but I never changed it. The meaning behind the name will be explained later.

> Please note: Since programming is often very tedious, and it can get very specific and confusing at times (especially to those who do not program in their free time), I will deal with a majority of my programming discussion conceptually. By simplifying the discussion of programming I am not implying that it was easy, or it did not require extraordinary amounts time - quite often it can take a few hours just to get one command operating properly! - instead, I am merely saving the reader some of the frustration that I was dragged through.

I already knew the basic "shell" components I wanted to include in the programming for my game. I wanted to create selectable menus - to include commands such as New game, Save game, and Quit, cursors resembling hands that would change according to the position of the mouse, rectangular mouse regions that would break up the image into different "hot spots," or "clickable"

areas, an About box, and an active window, for starters. I made the resources for the cursors, the windows, and the about box all in ResEdit. I used most of my knowledge from the Pascal course I had taken the first half of the year, however, when I forgot some code I needed, I would search for it on the internet at the gemma.apple.com site. Eventually I got all of these basic components working, and I was ready to move on.

Even in these early stages of development, by March 9th I was running into many problems. It became difficult to convert files from a bitmap format generated on my PC to a Mac format, and a conversion using Adobe Photoshop was needed for every single image I would transfer. My Extreme 3D files would transfer from PC to Mac, but not the other way, and the Media Lab, which I was relying heavily on, was closing at 4:00 PM everyday. Eventually, I would either work around these problems, and those of the future, or simply come to accept them.

With the basic frame of the game completed, I began thinking of how the needed information for individual sections of the game would be stored and brought up. I developed what I called the "spot and face" scenario, where every separate image or view of the room would be a "face", and any place the player would be able to pivot, and turn around, would be called a "spot". In a programming sense, this created a coordinate system that I could use to determine where the player's current location was, and where they were going to go. For instance, they might be at [3,4] and go to [4,4]. Soon a new problem developed, and I realized that I did not yet know how to get Think Pascal to use the large pictures I had been making. This required more code searching. Mr. Porter informed me of a function called "getpicture( )" which would enable me to show pictures on the screen. I later found that the pictures were too large, and the memory used for Think Pascal had to be readjusted.

At the same time, I made numerous sketches of rooms, scenes, and puzzles that I wanted to include in my game. I actually expanded the initial concept I had of the house to incorporate more rooms, and a dramatic stairway. However, on March 11th I had a conference with Ms. Gilman, and we discussed the motivation and passion I had, but the time I did not. I realized then that I would probably not be able to actually implement all of the new ideas I had been thinking. I scaled my hopes down slightly, and focused not on the entire house, but only on the first floor. By the 14th of March, I had stopped experimenting in Extreme 3D, and began creating the first room, which I called the "blue room." From what I had planned, the room required a desk, a chair, a fireplace, a switchbox, and a rug. I later decided that the desk should have a book, a lamp, and a pen on it. In

order to create these objects in Extreme 3D, they had to be "broken down" into simpler parts, almost like real-life woodworking. For instance, I created the top surface of the desk first, and the put the legs under it. I embellished the corners with posts I created using the lathe tool, and then cut a hole out for the drawer. I added finishing touches such as extra wood panels, and a drawer handle. Finally, I designated all the materials and pasted the finished product in the room. I scaled the desk and reoriented it until I was satisfied with it in the corner of the blue room. After many hours the desk was done. Over the following weeks, each of the other objects including doors, windows, and pictures - which I had forgotten initially - required the same process, and the more complicated ones required even more time. It was easy to see how the graphics part would become the more time consuming aspect of the project. I was quickly wrapped up in the aesthetics.

Simultaneously I was continuing the programming part of DIRT. I felt the "spot and face" idea was the best method to use, so I tried a variety of codes to get it to work. As always in programming, it was ideal to get the computer to have the most "recursion" as possible - that is, to repeat the same processes over and over again automatically, without the need for the programmer to write things over and over again in the program code. To use the maximum amount of recursion I needed to create my own data types (called the SPOT and the FACE), so the computer would recognize the information I would input. By March 14th, I had completed the shell of the "spot and face" version of DIRT, and it was able to test where the mouse was, change the cursors accordingly, activate the appropriate hot spots, and visit new faces all recursively using a procedure I created called "visitPlace". I showed Mr. Porter my work, and he said it looked "slick". I was very pleased.

Of course, with all my progress I encountered brand new problems. Time became an important issue as the tennis season started, and my other extracurricular activities and schoolwork began conflicting with my senior project time. Also, the sizes of all my files got larger for every new object I added, and I was no longer able to transfer my Extreme 3D files from home to the computers at school. Instead I had to render my images at home, and then transfer the completed images one by one in bitmap format to the Macs at school. One possible solution to the file size problem would be to use ZIP disks, or a writeable CD-ROM drive, but I did not have either of those available to me.

On March 17th I showed Mr. Mortali some of the work I had done so far, and he gave me some suggestions as far as perspectives and lighting. By the 20th I was still adjusting the details of

the fireplace, and I realized that I would not be able to finish the project as I had originally hoped. The creating of the 3D images proved to be very difficult. I was fine just creating objects and putting them into room, but in order to make everything look realistic, yet surreal, the proper lighting and shadows were necessary. I also added textural details to the floor and walls. However, the more details, lights, and objects I added to a room, the more time it would take the computer to render the final image. Sometimes it would take 15 minutes to half an hour just for one good image. But, my patience did pay off; the images looked great. They were just what I had imagined when I made the original plans for the game.

From March 24th through April vacation I was devoted to completing the majority of the objects I was constructing in Extreme 3D. Encouraged by the results of each new image I was able to complete a bookcase full of books, a switchbox, a rounded-back chair, a pen with holder, a detailed rug, a portrait frame with overhead light, a telescope, a bed with bedspread and pillow, a nightstand, and the windows and doors I would use throughout the house. I modeled some of the styles of the furniture after old photos I had, and pictures from books about the Victorian era. The chair reflects this style especially. In addition, I was inspired by the book, From MYST to RIVEN: the Creations and Inspirations - a book that explained all aspects of the development of MYST and its sequel.

In order to make my objects I often had to teach myself new "tricks" in Extreme 3D. One of which, texture mapping, proved to be very useful. With "texture mapping", I could take an image I had made in a paint program, or a piece of art I found on the internet, and "wrap" it around whatever object I was working with to add more detail. In order to get the lines on the rug, the words on the open book, or the symbols on the pages in the desk drawer, I made an image in my paint program, and then used texture mapping. I also learned "skinning", where a material is stretched over a wireframe object like plastic-wrap. This technique enabled me to create the wavy surface of the bed sheets, the pillow, and the pages, which added to their realism.

On April 7th, Mr. Porter requested that I make a presentation about programming to the Board of Education. The focus of my discussion was more on past projects than on my senior project, however I did touch on DIRT toward the end of the presentation. I spoke for a few minutes and then fielded questions. It was good preparation for the presentation I would have to make for my senior project.

Around April 11th I began considering the connections between the objects in the game, and some of the "puzzles" they might include. I wanted to have a switch that would turn some lights on or off, a drawer that could be opened and pages that could be lifted to reveal codes, a bookcase and books that would reveal more about the purpose of the game and the plot, a fireplace that would be a "secret" transporter, a number panel that would require the correct combination to work, and various other puzzles that would hopefully get implemented given more time. These thoughts led me to question the entire purpose of the game, so I began to develop the plot. I had originally chosen the name "DIRT" because, initially, I wanted the player to begin the game as if they had risen from the dead. They would start the game and the only thing they'd see would be... dirt. It would then be their job to explore the house, to figure out who they are, and what they're supposed to do. They would slowly realize by exploration that they were the owner of the house - a smart, old man - and their greedy sons had killed them for the property and the money, but were not clever enough to figure out the ingenious puzzles and riddles he had created to safeguard his treasure. I changed the role of the player later, making them only an exploring traveler. The player would then have to solve the puzzles created by the old man, piece together the correct combination, and unlock the safe that houses the mansion's treasures. Even though "the resurrection" never got implemented, the name remained.

By April 18th I had created 13 completed images that explored the insides of the blue room. Even though it was extremely time consuming to create them, they looked very good, and it was extremely encouraging. Coming back to school on the 20th I was ready to add the images and information into the programming of my game. The two independent processes became one. I took the images I had created and transferred them to the Macs using 3 disks. They needed to be modified slightly using Adobe Photoshop to preserve the correct brightness and contrast I had worked with initially. I then loaded the images into my resource file in ResEdit. However, when they were loaded onto the screen from within my program they were incorrectly sized, and I needed to go back into Adobe Photoshop to resize all of them. This conversion was needed for every image I would later use. As expected, the file sizes got too large again, and I needed Mr. Porter's help to allocate more memory to the programs I was using. That week I also put some images onto the internet (at http://www.connix.com/~pnjg) which served as a "preview" of the game, and I got positive feedback from some people I knew over the net. I also completed some images of the room next to the blue room, called the "green room." However, they did not get used until later.

Over the following week, starting April 26th, most of my time was spent getting my Pascal program to recognize the data for each image. For every new "face" or scene, the program needed to know where the image was being stored, when to bring the image up, what hotspots it needed to activate, and what places the player could go from there. For some areas, the program needed to know if the player could do anything that would effect the rest of the game, such as operating a switch that would open a door somewhere else. I used global variables to handle these operations, and it was tedious, but effective. Soon, another problem arose. I was adding so many images and data that Think Pascal would run slower, and it required more memory. Eventually I was no longer able to run my game through MacManager, and I needed to log off every time I would work on it. I successfully implemented the switchbox, the drawer, the doors, and the secret passage in the fireplace. Also, as a luxury, I added a title screen, and on May 1st made it so the game could be viewed through two different sized windows, to accommodate larger and smaller monitors.

Starting the week of May 4th, I realized how much time I had spent, how much progress I had made, but how little time remained. I had created 38 images, showcasing the blue and green rooms, and the many objects inside them. However, I still needed the red hallway that would connect them together. Since no major action would take place in the hallways, I made the area fairly simple. I realized that by evaluation time, May 18th, I was not going to be able to finish any new rooms for my game in Extreme 3D. The rendering was simply too time consuming. I was satisfied in developing the areas I had created, polishing up the programming, and making the game playable, even in its unfinished form. On May 9th I made a list of all the things I would have liked to include in the game, but I realized, after working on the hallway, I would only have time to make one out of the six items functional. Also, I did not have the time, or the knowledge to add the sound or music I wanted. I had created an ambient song for the game a few weeks ago, and it sounded great, but it would not get used before the 18th. However, I would still be able to play the song during the presentation, if desired.

For the last week of my project, starting May 11th, I chose to finish the hallways, the number panel, and make the game load its images faster. The number panel was the key to opening the green room, so I felt it was the most important part I needed to complete. I went back into Extreme 3D to finish the hallways, doors, and panel. After I added the images for the panel into my resource file, I had a total image count of 65. Initially, the game would load all of these images at the very beginning, which would take a long time, and too much memory. I changed it so the

program would load the images for a certain room right before the room was entered, and remove the images from memory once the player left the room. I used the command "ReleaseResource( )" to finally achieve this. May 14th I also added some code that would handle all of the pictures associated with the number panel, and change the numbers according to which buttons the player presses. This panel was the most interactive part of the game thus far. By the end of the week I had compiled the source code and the resource file into one large application, and DIRT was as "ready" as it was going to get. With a final image count of 65 pictures, DIRT was a large game, with a total file size of 11.4 MB.

I had a general idea of how I wanted to present DIRT to my audience. I had requested the overhead computer projector from Mr. Porter a few weeks before, and I thought it would be a good idea to make the game available on all computers in the Mac lab, through some sort of login, so everyone could have some "hands on" experience with my project after I explain it. I would also have some diagrams depicting the various resources I used to create the different aspects of the game. By May 17th I had made the diagrams, printed out the source code, prepared my journal and visuals, and was ready to make my presentation. I hope it goes well.

In the process of making DIRT, and going through all the tasks necessary to create a computer game, I have contributed months worth of work and dedication, and have probably sacrificed hundreds of hours, with no exaggeration. Aside from the information I have gained while learning the necessary programming codes, I have learned many things about myself, and the world of programming computer games. I have found that it is easy for me to obsess about things that I enjoy. I got hung up with the aesthetics of the game very easily, as I have found myself doing at various other times. However, if I did not have the desire and the passion to make this game, I would not have gotten as far as I did. It is one thing to create a "game," and it is another thing to create a whole "world." It requires more thought, planning, and inspiration. The makers of MYST don't even call it programming, they call it "world assembly." I have a new appreciation for the painstaking detail that is found in some of the computer games I have played. To mimic the level of detail of the game MYST, for example, would take years. I had no idea so much different software was required to connect all of the different aspects of the game. The programming was difficult at times, and tedious at others, and Extreme 3D was often very annoying to work with. I

now appreciate any work people do with 3D graphics, as I know firsthand how difficult the software can become.

Even though the graphics aspect of the game was not the most difficult part, it was definitely the most time consuming. It would take hours just to complete the construction of a scene, and then take another hour just to render it to disk. No, I did not finish as much of the game as I had originally intended, and there were many parts of the game that are still yet to be implemented, but nonetheless, I was still able to make my dream come to life. After my presentation and my evaluation I will continue to work on DIRT, as it has become my obsession. The program is at a point now where I can expand it endlessly, adding more rooms, more floors, or more buildings at will. I am slightly upset that I could not finish more of the game for presentation time, however I have still impressed myself with the amount I have completed so far. It took a team of 20 people four years to complete the game RIVEN : the Sequel to Myst, working non-stop, around the clock. Comparing these figures to one student, working in his free time, for only a few months, the results are still pretty good.

These past few months have been frustrating, difficult, and time consuming, but they've also been rewarding, exciting, and fun. I have truly enjoyed seeing my dreams finally come to life. I look forward to watching as the audience dives into the world that for so long has remained only in my mind. As I watch their expressions of amazement and wonder, I am reminded that it has been such an enriching and deeply satisfying experience.

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