Using Digital Media to Teach Computer Literacy

Post-Production Analysis

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PROJECT DESCRIPTION AND GOALS

As computers become commonplace in businesses and homes, and as people learn to use them to write papers, surf the Internet, play games, and run programs with highly intuitive interfaces, the true complexity of the machine is being lost behind a veil of simplicity and usability. I fully support the need for computers the be accessible to everyone, and I understand that their interfaces need to be intuitive and simple in order for widespread accessibility to be possible, but I am concerned with what I see as a growing number of people who use computers constantly in their everyday lives, sometimes to perform incredibly complex tasks, who have absolutely no idea how the tool that they are using to accomplish their work really works!

As computers become more complex, the amount of knowledge needed to understand how a computer works is growing as fast as the technology. The purpose of this project is to provide computer users with an interactive digital environment through which they can learn about the many components that make up a standard desktop computer and how they all work together to accomplish the many tasks for which we use computers today. At the heart of this project is a desire to make a more advanced level of computer literacy available to anyone who wants or needs to know more, with the hope of expanding the knowledge base of the general public to include an understanding of what's behind the screen and inside the case. In the same way that it is common knowledge that a car is more than just a set of wheels and a body, but that it contains an engine and a fuel tank, and there are ways of determining if one car is better than another car by comparing its internal parts, so should the common knowledge about computers include an awareness of the CPU, the hard drive, and the video card, and the knowledge that certain computer functions require certain ratings on each of these and the computer's many other components.

In order to create an interactive environment that could be easily accessible and understood by someone who hadn't even seen the inside of their own computer before, I created an abstractly realistic

three-dimensional model of a generic personal desktop computer. Inside it, I placed models of the components that are common to all computers: the motherboard, the CPU, the RAM, the power supply, the hard drive, the CD/DVD drive, the floppy disk drive, the video card, and the sound card. Through an interactive Flash program, each component is able to be removed from the computer case, shown in three dimensions, and described in detail. All users of the program receive basic information on each component, including its purpose, basic functionality, and other relevant information. If a user wishes to know more about a specific component, they can receive further information detailing what they need to know if they are planning on replacing or upgrading the component, or if they need more information about the specifications in preparation for purchasing a new computer. Users who may have a different type of personal computer, such as an Apple computer or a laptop, get the opportunity at the beginning of the interactive program to view a an explanation of the similarities and differences between their computer and the desktop PC shown in the program. However, since market statistics show that over 91% of all computer users use the Windows operating system [1], and since laptops are not designed to be opened and are not easily upgradeable on a component by component basis in the same way that desktop computers are, the standard interface for this program is that of a Windows-based desktop PC.

In addition to the user-driven interactive project, I have also designed alternatives for people who are unable to use the interactive project or desire a different presentation of the information. Since this entire project is web-based, I wanted it to be as accessible to as many people as possible, so I also created a text-based series of pages with still images and all of the same information on each component in static text, and I created a video that uses all of the animation from the interactive portion, as well as a voice-over of the basic information, that moves through each component in a linear fashion. In this way, the information contained in the interactive program is accessible to people who don't have Flash, to those who do not have the computer or browser capabilities to run an interactive program or a video, and to the hearing impaired. It makes retrieval of more specific bits of

information easier, because a person who does not want to load up the entire interactive tutorial just to learn how a video card works can go to the text-based portion and read up on it, while someone who just wants a basic overview of everything without having to make decisions about what to look at can watch the video and get the exact same information in a more linear format. This approach also takes into account the different learning styles of different people – people who are visual or auditory learners will find the video and interactive portions more accessible, while those who learn better through text descriptions will find the interactive and text-based portions more useful for information retention.

My goal in designing this interactive environment with so many levels and so many different options for users is to embrace the idea that this knowledge is important enough that everyone should have access to it. This project is designed to teach its users about the importance of understanding what makes a computer work, and my research has shown that the best way to make sure a computer-based teaching program accomplishes its task is to make it accessible to any curious individual who wants to learn. This means providing a clear choice of options based on the user's reasons for visiting the site and what they expect to get out of their visit. For this reason, the alternative choices for accessing the information on the site are clearly spelled out on the site's front page and on the first frame of the interactive Flash presentation. Users are pointed to the different ways of accessing the information, and given an explanation of each option and the type of user it is designed for, so that they can make the best choice for them from the beginning, and so that they are informed from the beginning that there are many possible ways of learning the information I am presenting.

Ultimately, the goal of this project in its entirety is to provide anyone who visits this site the ability to get out of it exactly what they desire, whether it's a basic informational overview of computer components, an understanding of the technical jargon that can help them in their next computer purchase, or a handy resource for information about computers that they can keep coming back to over and over again. They will be able to access the information in a variety of ways, and they will be

assisted in their search by helpful pointers that will make their learning experience more directed, more informative and, hopefully, more enjoyable.

PRODUCTION STRATEGIES

In order to create this interactive project, I had to draw on all of the technical knowledge that I acquired while studying digital media. However, in order to create an interactive project that would also contain some educational merit, I had to first research methods of teaching through digital media and interactive environments. Unfortunately, I found very little conclusive research into effective methods of teaching through digital and interactive media.

Every time a new media format has gained public acceptance, from radio to television to film to video games, there has always been a flurry of research to determine its effectiveness as a teaching tool. And in almost every instance, teaching methods using new forms of media have been taken up as fads, then dropped because they lack the elements of interaction and personal feedback that students need in order to reinforce the information that they are learning. However, most of these studies have been done on young people in the early levels of their schooling, from primary school through high school, and there has been less focus on the learning patterns and habits of adults [2].

I decided early on that I wanted this project to be directed at an adult demographic, since they are the ones that are the most likely to need a more advanced understanding of computer hardware in order to inform their personal and business decisions in regards to computers, and also because they are less likely to be able to get this information by other means. In the year 2003, 76% of children ages 3 to 17 in the United States had access to a computer at home, and 83% of children used computers at school as well, up from only 36% of children with computer access at home and 61% of children who had access to computers at school in 1993. In 2003, only 7% of children in school (K-12) in the US did not use a computer either at school or at home, and more students use computers at school (92.3%) than at home (83.4%). This easy access to computers in an educational environment shows that children today are getting easier and earlier access to computer than their parents had, so they are learning about computers, how to use them, and how they work, within an educational setting [3].

In 1984, only 18% of adults used computers at home or at work. In 1993, that number had grown to 36%, and in 2003, 64% of adults use computers in some regular capacity [3]. However, those 64% of adults were children in 1993, 1984, and before, when access to computers as an educational resource in K-12 education was not as prevalent, so fewer of them had the opportunity to learn about computers as part of their standard education while growing up. Now, as they are bringing computers into their lives as adults, they need an easily accessible resource for learning about the computer.

In order to determine the best way to present this information to an adult audience, I researched the ways in which digital media tools and the Internet are used in adult education today. More studies in online learning have been done with adult students then with children because adult education has benefited greatly from the rise of the Internet. Adult learning is of a more focused and dedicated style then a child's – if they are taking time out of their busy lives to study a subject or research information, they want it to be fast, comprehensible, and direct [4]; hence the easy descriptions of the different ways the user can access this information as soon as they come to the site. A person coming to this site looking for specific information will be much more likely to stick around and use it to find what they're looking for if it gives them a quick customized road map to that information right from the start. Since the site is educational purely in an informational sense, rather than in a teacher-to-student collaborative sense, a variety of options for getting the information had to be provided right of the back, so that the adults who come to the site, who have presumably learned a lot about their own personal learning styles from years of education, can choose the medium – text, audio/visual, or interactive – that works best for them.

From these building blocks, I had the basic layout for my project. I chose to place it in an online environment in order to make it widely accessible to anyone looking for information about computers or computer hardware. I chose to use Flash for the interactive platform because it is the most widespread online software platform, used by approximately 98% of Internet users [5]. And, finally, I chose to create and render the computer and its components in 3ds Max and import the rendered

movies into Flash (rather than designing the graphics in Flash itself) because I wanted a high level of realism and a truly three-dimensional look to the computer in order to complete the illusion that the interactive program was a direct substitute for a real computer and not just a graphical representation. By modeling all the parts directly from an actual computer, I gave them location and dimensions, as well as photographic textures that correspond to what the user would see in their own computer if they were coming to this site to get some information before upgrading a hard drive or graphics card, making it easier for users of the program to carry the images directly over into the real world. This is a big advantage to photo-realistic modeling in tutorial programs such as this, and though my skills as a graphic modeler are not yet up to photo realistic quality, I abstracted the external components with which everyone is familiar and focused on highly detailed and photographically skinned models of the internal components that are the primary focus of the interactive environment.

My main inspiration for the design and implementation of the project in this style was the fact that I could not find any other program like it online, meaning that there is no program quite like this that is easily accessible to anyone looking for information on how computers work. In my research into educational software, I found that most interactive software programs are designed for children, and most adults use more of an analytical text-based approach when referencing information. This project, however, is designed to make adults comfortable with the computer as an object, which means that they ideally need to see each hardware element they are learning about as part of the greater whole. And while there are many informational websites out there that walk through the components of a computer in text-based and video form, as parts of my project will allow users to do, none of them go the next step further – giving users a virtual environment in which to examine the computer as a whole, as opposed to a list of pieces.

To return to the car analogy, if I want to change the oil in my car, I could read up on the oil filtration system, look at pictures of it and view diagrams of how it functions. But when I go out to my car and lift up the hood, there are a hundred parts in there that are not the oil filtration system. Some of

them may be connected to it, but if I only read up on the one system, I may not know that. It also may be difficult to find the oil pan if I don't know where in the car to look for it. In the same way, it's fine to explain about a hard drive or motherboard or video card in a vacuum if one only wants the information in a theoretical sense, but if one wants to practically apply knowledge of one part of a machine to the modification or upgrading of the machine as a whole, they will be at a disadvantage if they do not also have an understanding of how that one section of the machine relates to the whole. And while some people may retain knowledge better when it is given to them in a descriptive form, people as a whole still rely very heavily on visual reference for information, which is why a visual diagram is vital to the understanding of a computer as both a whole machine and a a collection of connected components.

THEORETICAL AND CULTURAL CONTEXTS

On a scale larger than a simple desire to educate people about the wonderful complexity of computers, I see this project as a personal contribution to the fight against the willful technological illiteracy that I see as being so pervasive among people today. While people have been eager to embrace new technologies, there seems to be very little desire to understand anything about the technology they are embracing. I consider this to be a problem on many levels: first – ignorance of the capabilities of new technology can lead to complacency about its use, which can lead to an inability to speak out about the misuse of technology by governments or corporations; second – a lack of understanding of all of the aspects of technology, both harmful and beneficial, can lead to people limiting the advancement of beneficial technology because of misplaced or manipulated fears of what the new technology is truly capable of; third – there are far too many people who have never been told that an understanding of technology is within their grasp, and that even a machine as seemingly complex as a computer can be easily explained to anyone who has a passing familiarity with its capabilities to begin with. So why are each of these problems so serious?

As the knowledge base of the human race grows, as our technological capabilities advance, and as the number of people on the planet continues to grow, the acquisition of knowledge has become highly specialized. People study for years to become experts in extremely specific fields of study, complex production processes are broken down and spread apart in order to improve efficiency, and many people work each day as cogs in giant industrial or corporate machines, never knowing what the person in the next office is doing and finding it hard at the end of the day to describe their job to anyone outside of their department. It is no surprise, then, that people find it difficult to see the importance of taking time out of their busy days to enhance their knowledge above and beyond what they need to do to get by. If you know the exact steps that you need to do to get your computer on in the morning, to check your email and browse your favorite websites and run whatever program your

company designed to store data and crunch numbers, why should you care about the inner workings of that little black box? Your company has people who know, and if it doesn't work one day, all you have to do is call them up and someone will come over, do a lot of incomprehensible stuff, and it will work again.

But how many production hours are wasted in companies around the world by employees with that attitude? How many companies fail to update to modern software or equipment because they are afraid that their employees, who know every computer action by rote, will be unable to adjust? How many innovations are unable to occur because of obsolete technology that no one thought to upgrade? And how much further could we have progressed if people were all able to take a more nuanced approach to technology rather than a simple "technology is evil/technology is our savior" black-and-white approach? These are important questions that anyone who uses any type of technology to enhance their life needs to ask. They also need to ask, "Has my computer ever done something I couldn't understand, but took someone else only a second to fix? Have I ever wanted to do something on my computer that it couldn't do, but I didn't understand why? What are my reasons for having technologies such as a computer, cellphone, television, video game system, or MP3 player? Have I made informed decisions as to the types of technologies that I choose, and do I support the advancement of these technologies to better forms? Do I know what each of these technologies is capable of, where advancements could take us, and what dangers there are in future or current use of these technologies? Most importantly, have I answered these questions with logic and reason, looking at all the facts and becoming informed on all the issues?" These types of questions are the ones whose answers will move us a significant step closer to solving the three problems I addressed earlier.

But what about the problems themselves? As mentioned earlier, it often doesn't seem necessary to people to know every detail about how their computer works, because as long as it works and they can use it to accomplish their daily tasks, knowing or not knowing about its inner functions will not affect them all that much. However, this type of complacency is carried over to more aspects of their

lives than just their work with computers. The idea that only “experts” can know something and that everyone should just listen to “the authorities” and leave the understanding to “the smart people” not only sells a lot of people short, but it can lead to bad decision-making from the general public. The first two problems I see with a lack of understanding about technology are two sides of the same coin: a lack of understanding leads to both fear and complacency. Out of fear comes a desire to limit technology, and out of complacency comes an apathy towards its advancement and use. The important thing to recognize about both of these positions is that it is not the positions themselves that are flawed, but rather the lack of logic and reason that goes in to formulating the position that someone chooses to take. It is important for us to question the safety and validity of advancements in technology that have the potential to do harm, or advancements that have no real redeeming values, but these decisions must be made based on the facts available, not based on a gut feeling, or a pundit's rhetoric, or on a politician's say-so. We live in a democracy, we take part in the political, social, and economic future of our country, and we owe it to ourselves and our fellow citizens to be intellectually informed about the decisions that we will be called on to make, including those pertaining to new technology.

This leads into the third problem, which is the one that this project was specifically designed to address. There are far too many people out there today, going about their lives, using computers and other technology every day, who believe that they are unable to understand the technology that they are working with. Some may go so far as to see a computer as some sort of “magic box” that has qualities such as “intelligence” and is “smarter” than they are. The danger in this line of thinking is not just that it can lead back to the first two problems of fear and complacency, but that it can also lead to a subsuming of the computer's actually functionality under the “qualities” and “personality” that a person may ascribe to it. The idea that anyone who does not work in IT or computer science cannot truly understand computers can also lead to the marginalizing of office workers and a reluctance to upgrade hardware and software because of the damage that it will do to the productivity of a workforce that has not learned how to use a computer except by rote memorization of tasks. An increase in the general

knowledge base of every computer user to include an understanding of the similarities and differences between all computers, knowledge of how the software works, an ability to troubleshoot basic problems that a computer might have, and a general comfortable familiarity with the machine would go a long way towards enhancing productivity and innovation anywhere computers are used.

The car analogy may be over-used, but it is very apt. Anyone who has been driving a car for several years generally gets extremely comfortable with the car that they drive. They know its quirks and hiccups, they know how far it can go on a tank of gas or how long it's been since they last changed the oil, and it is very comfortable for them to drive. However, they also know a lot about cars in general that they can apply to any car they drive. They know what to expect when they get behind the wheel – they find the ignition, turn the key, familiarize themselves with the lights and wipers, mess with the radio, and drive off. They know what the warning lights mean, they know how fast they are going, and they know when and how to fill the car with gas. I envision a world where everyone is as familiar and comfortable with computers as they are with cars. When a person can sit down at any computer and use it without too much trouble. When people focus on the real issues surrounding the advancement of computer technology rather than the fear-mongering issues. When any person or any business will embrace advancements and upgrades because they understand the benefits that it will bring, and that no one will hold back from advancing the technology out of fear that their employees will be unable to adapt. These are just a few of my hopes for the future of technology and computer literacy, and this project is the first step towards making that happen.

CRITICAL ANALYSIS OF THE PROJECT

I want this project to accomplish many things. First and foremost, I just want it to be a great resource for people who want to find out a little more about how their computer works. Whenever I have described this project to others, they have always commented on an aspect of it that they would find useful – the three-dimensional layout, the information on certain components, or just the ability to decipher the technical jargon about CPUs, video cards, and hard drives the next time they go to upgrade their machine. I want this to be a resource for people who do not have a technical background in computers so that everyone gets the best computer for the tasks they choose to use it for.

On a slightly higher level from that, I want this project to demystify the computer for the many people who see it simply as a "magic box." I want to give people the opportunity to appreciate the computer for what it truly is – an amazingly complex electronic machine that has been able to mask its true complexity under layers and layers of elements designed to make it a universal tool. Part of what makes computers so amazing is the fact that, in just a few decades, they have gone from a highly technical piece of equipment only used by scientists and engineers in big laboratories to a small, affordable household item that anyone can access. However, I do not want the computer's true complexity to get lost in the mainstreaming of the device. I want to find a way to make the technical information about computers accessible to everyone by removing the complex technical jargon and explaining how a computer works in clear, concise terminology. Once people can see, even on a basic level, what lies behind the screen and inside the box, they may still view it as an amazing device, but they will be looking at it from a critical viewpoint rather than a mystical one.

I received my undergraduate degree in Computer Science, so I have a rather clear understanding of exactly how a computer works. I was always frustrated, however, at the large number of my fellow classmates who would look down on me with disgust when I had trouble following their long-winded conversations about a new hardware upgrade or a new programming language. Even among my peers, I

was made to feel stupid because I hated having to remember every acronym and technical term just to follow a simple conversation, so I have great sympathy for people who choose simply to not understand computers in detail because the information presented to them about computers is extremely complex and filled with nothing by numbers and abbreviations. I know that the information does not have to be so difficult to convey, and that is what this project is really all about.

Over the course of working on this project, I found a lot of of value in the idea of simplicity. The end result of my research and my design was to make things simple without dumbing them down, and this core goal informed every aspect of the design. I started out by simplifying descriptions of each of the core components, and through writing those descriptions I was able to pick out elements of each diagram that should be emphasized, which allowed me to simplify my models. Through simplifying the models, I was able to get a clear and complete model of the computer, which then led me to simplify the animation and the detail of the videos that would be played when users wanted to remove a component from the computer. While many of my initial ideas for this project focused on high-detail close-up renderings and a bug's-eye view of the computer, I realized while working through the designs that such a high level of detail was not needed, and indeed would not be very effective at conveying the necessary information. For a user to truly see this project as a representation of their own computer, they have to see it from a person's point of view. Components do not need to by highly detailed in order to be recognized and understood as long as the important elements stand out and are well-explained. And, since each computer and its components is as different in look and detail as it is similar in layout and components, abstracting the differences made the program more universal because the model could be anyone's computer, rather than a very specific one.

My desire to simplify the project for accessibility was also what led me to abandon the idea of opening and closing questionnaires that I had initially believed would assist the user of the walkthrough in deciding what they wanted to view and would help reinforce their knowledge retention after they had learned what they wanted to know. I had planned to collect the results of the surveys that asked people

what they learned from their use of the interactive program for increasing my understanding of the usefulness of interactive programs such as this in imparting educational information. This information would then be useful in future personal projects and in continuing to make this interactive program a useful resource for teaching people about computers. As the project progressed, however, I realized that if I wanted people to use the site frequently and in many different ways in order to get basic computer hardware information, having to fill out or skip over a form every time they visited would discourage them from using the site in the way that I intended, so I abandoned the plan to gather information on the site users' experiences, for now. At some point, if this project appears to be as effective a resource as I hope it will be, I plan to revisit this idea with an optional feedback section as an unobtrusive replacement for the surveys. An optional feedback form will still provide me with user information that can be used to keep information on the site updated and relevant, and it would be helpful in increasing the overall effectiveness of the site, but it would not discourage anyone from using the site as a frequent resource for information the way that a front-and-center survey would.

One of my favorite quotes from Albert Einstein is “Everything should be made a simple as possible and no simpler.” It is engraved on a coffee mug of mine under a step-by-step mathematical derivation of his famous equation $E=MC^2$. That quote, paired with his own work, has always inspired me to work towards simplicity in everything I do. Not because it makes things easier – often times distilling simplicity out of complexity is harder than sticking with complexity – but because complexity can often only be truly understood by the person who came up with the complex idea in the first place, but simplicity can be understood, or at least embraced, by everyone. This entire project is about distilling simplicity out of complexity. The computer is a complex device that has been made usable to everyone by distilling the complexity into simplicity. Every element of my project, from the website design to the program design to the descriptions of the components to my overall project goals started out complex, but were simplified through time and a greater understanding of what this project was all about. Some of my hopes for this project are complex, such as wanting it to change the way that

everyone looks at computers, but my primary goal is simple: to make a program that will be a useful reference tool to the people around me who know it exists. I want to help my friends, family, classmates, and co-workers understand that a computer is both more simple, and more complex, then they may have previously realized. I want them to have help when it comes to embracing new technology, so that they do it with an understanding of each new device, rather than because of marketing or social pressure. This project, in all its complex simplicity, is just a sharing of my knowledge with those who can make use of it. Nothing more, and nothing less.

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