PERSONAL HOME PAGES IN ACADEMIA: THE MEDIUM, ITS ADOPTERS, AND THEIR PRACTICES

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PERSONAL HOME PAGES IN ACADEMIA: THE MEDIUM, ITS ADOPTERS, AND THEIR PRACTICES

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To my parents,

Dagmar Wille Rick and Roger Rick,

for their support

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> One of these days,
> I'm gonna sit down and write a long letter
> To all the good friends I've known.
> One of these days, one of these days, one of these days,
> And it won't be long, it won't be long.
> —Neil Young, "One of these Days"

I would like to begin by thanking the participants in this research, without whom there would be no research. To the faculty members who participated, I appreciate your time and wisdom. To the students who adopted AniAniWeb for their personal home pages, I am indebted to your willingness to adopt a new technology to serve a purpose as important as personal home pages are to academia. You have been my fellow researchers in this project and this dissertation is largely a report of your findings and insights.

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I began my studies at Georgia Tech in fall 1993. I end my studies there in spring 2007.

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SUMMARY

Personal home pages are outgrowing their playful beginnings to serve serious purposes. At the forefront of this emergence is academia, where they are becoming a meaningful way for researchers to engage each other. Yet, the medium is still in its infancy: The medium, its adopters, and their practices are unduly constrained by current technology. To better study the meaning and use of personal home pages in academia, I created the AniAniWeb personal-home-page system to loosen these constraints. AniAniWeb applies wiki technology to facilitate easy editing, to enable interaction, and to focus the user on content creation.

Others began adopting AniAniWeb in fall 2003. This dissertation centers on a case study of six graduate students and their experience with AniAniWeb over a period of two years. Their practices are viewed through three analytical lenses. Media theory focuses on the technology. Communities of practice focuses on the social context. Core identity theory focuses on the individual. When combined, these frameworks lead to a rich understanding of personal home pages in academia. Based on observations and interviews, issues of design, technology, meaning, and use are addressed.

CHAPTER I

PERSONAL HOME PAGES IN ACADEMIA

> . . . I stumbled across your paper on Scenic Archetypes, and was amazed that nobody seems to have used this technique very much. In fact I was going to use a similar idea in the coming weeks for a new show I'm going to do. Your paper was inspiring, and has given me a few ideas on how to do this new show.
>
> Are there any other works out there on this kind of thing that you know of?. . .

One of the hobbies I started when I entered college in 1993 was improvisational theatre. In 1995, I began posting my thoughts about improv to my home page. That section of my site has grown over time and is among the oldest and most prominent (i.e., high Google ranking) sites about improv on the World Wide Web. One of the forms I have been working on for some time is scenic archetypes, a long-form improv method based on instantiating predetermined scene structures. To further work on and distribute my ideas, I directed a workshop on that topic for an improv festival. To aid the workshop, I created a written guide that participants could take with them. When I posted my reflections on the festival experience to my home page, I included a version of that document.

About a month after posting the content to my home page, I received an e-mail from Frank asking about further resources on scenic archetypes. Frank came across that document, liked the method, and wanted to know more about it. I informed him that it was a new method I had recently developed and that I unfortunately did not have any further resources. At that time, only three scenic-archetypes shows had been performed (all directed by myself).

What is remarkable about this exchange is that I do not know Frank. Frank is an Australian improviser. Improv is not as ubiquitous in Australia as in the United States; therefore, he finds the Internet particularly useful for finding improv resources. Somehow he stumbled upon my write-up. By posting the document to my home page, I informally published my work in an effective enough manner that someone half-way around the world was able to get something from it. Before the Internet, this kind of exchange could not have happened. I would have had no viable venue to publish my informal write-up; Frank would never have found it. Furthermore, he would have had a much harder time finding any improv resources. Because of personal home pages on the Web, Frank was able to stumble across a useful write-up on an obscure part of an amateur's website.

This example demonstrates the potential of personal home pages to redefine how ideas are communicated. This dissertation is about that potential. It is about understand and realizing the use and meaning of a new medium—personal home pages.

1.1 Understanding a New Medium

New media effect change. They change how we relate to others, to ideas, and to ourselves. Consequently, they are natural learning environments (Bruner, 1966; Rick & Lamberty, 2005). They allow us to visit math land (Papert, 1993), explore decentralized control (Resnick, 1994), and analyze Newtonian mechanics mathematically (diSessa, 2000; Roschelle, 1996). They give us new ways to present our work (Bruckman, 1998) or who we are (Bers, 2001) to others.

The introduction of a new medium causes changes at both the micro-level (for individuals, for a community) and the macro-level (for a society). Unfortunately, understanding that change is difficult. Experimentation is necessary for an individual or a culture to realize the new medium's use (Bolter & Grusin, 1999). Even when that use has been established, the meaning to society is often illusive, commonly realized only in hindsight (McLuhan, 1964; Postman & Weingartner, 1969).

When Gutenberg started printing Bibles, he had no idea that the medium would eventually lead to a loss of power for the Medieval Church (McLuhan, 1962). As Bibles became more accessible, the church no longer had a monopoly over religious information (and thereby salvation). People could read the Bible in their own native language by themselves. The printing press enabled Luther, and the Church was changed forever.

When Edison invented the phonograph, he envisioned a "talking machine" that could be used for correspondence and dictation (Radick, 2003). Edison's original phonograph could both record and play back audio. Market forces, however, wanted something different (Gitelman, 1999). Commercially, the phonograph succeeded only as a playback machine.

The desktop user interface (i.e., overlapping windows, mouse, menus, etc.) was invented at Xerox's Palo Alto Research Center (PARC) in the 1970s. Yet, the personal computer explosion driven by that interface in the 1980s was not driven by Xerox. Why? When Xerox executives were shown the new personal computer, they failed to recognize its commercial potential (Stone, 1998). Some feared that a personal computer spelled doom for paper, Xerox's key business. Xerox failed to capitalize on the opportunity and others introduced the world to the personal computer.

As these examples demonstrate, the passing of time helps us understand a new medium. This historical analysis is particularly useful for well-established media, such as the printed word (McLuhan, 1962) and television (Meyrowitz, 1985), or obsolete media, such as the zograscope (Blake, 2003) or the physiognotrace (Bellion, 2003). For newer media, such as personal computers (Turkle, 1984), the Internet (Turkle, 1995), and hypertext (Bolter, 2001), we do not have the benefit of much hindsight. To complicate matters, the meaning and use of the new medium is not quickly fixed. For some time past its inception, the meaning and use of a medium evolves through a complex interplay of multiple forces: inventors, relevant social groups, other technologies, laws, social conditions, etc. (Bijker, 1995). Thus, methods other than historical analysis will be required to understand any new medium.

Personal home pages are a new medium.[1] A personal home page is a set of pages on the World Wide Web organized around a specific person. While individual pages may be about other topics, these topics relate back to the person that the page is about. A specific page might contain a family recipe, original artwork, pictures from a party, a top ten list, a movie review, a favorite poem, etc. While these artifacts may not necessarily be authored by the person, they are located on that person's home page. As such, they reflect that person.

Through this research, I attempt to understand personal home pages—their use and meaning. Since personal home pages are still emerging, historical analysis is problematic. Instead, the research is conducted from a design-based research perspective: A new personal-home-page system (AniAniWeb) was developed at the same time that it was being studied in an authentic context. For the context, the academic research community was chosen. As a case study, this research may reveal as much about the context (academia) as it does about the new medium (personal home pages).

1.2 Why Study Personal Home Pages in Academia?

Personal home pages are a new medium; their use and meaning are still emerging. Personal home pages have matured enough to be a recognizable genre on the Web (Dillon & Gushrowski, 2000), yet new technologies, such as blogs (Mortensen & Walker, 2002; Nardi, Schiano, & Gumbrecht, 2004), wikis (Leuf & Cunningham, 2001), and social-networking software (boyd, 2004), are greatly expanding the possibilities that home pages afford. With these technologies, additions and changes are easier to make; interaction with others becomes possible. As new affordances are added, new uses will emerge.

Concurrently, the use of personal home pages is starting to outgrow its playful beginnings. During the Internet explosion of the mid-1990s, personal home pages first gained

[1] One of the more annoying aspects of writing about personal home pages is deciding whether personal home pages should be written about in the singular or plural form. As a medium, it is singular. As a set of pages, they are plural. In this document, I will refer to them in the plural form as that usually sounds less awkward; we are not used to having words that end in "es" referred to in the singular form.

To refer to the website of a specific adopter, I use the singular term, personal home page (e.g., his personal home page is two years old). I refer to top-level page of that website as the front page.

prominence. For many, it became cool to include a home-page link in their e-mail signature. Commercial sites, like Geocities, offered to host home pages for free if site owners were willing to display advertisements on their home page. These home pages were typically playfully bright and brash, containing little important information. People often adopted them to "fit in," rather than to convey important content. These early often-frivolous pages should not simply be dismissed, as new media are often most explored and refined when the stakes are low (Jenkins, 2006). Since then, personal home pages have matured.

In academia, they are becoming a meaningful way for a researcher to present who she is to her community of practice. In computer science, it is common for researchers to visit their colleagues' home pages to find research articles and contact information. Additionally, a personal home page acts as an informal *curriculum vitae* or an *über*-business card. Graduate students are advised (Agre, 2005, for example) to maintain a professional page. Many include a link to their home page when applying for a faculty position. Likewise, some faculty members polish their pages before promotion.

Personal home pages are a new form of publication. Since publication is so core to academia, it is only natural that academia is one of the first situations where personal home pages are serving vocational purposes. In academia, we present ourselves to our research community largely through formal publication, such as conference or journal articles (Smith, 1999; Sumner, 2002). Creating personal home pages is very different from the lengthy, sustained argumentation of a scholarly article (Mortensen & Walker, 2002). Publishing something on a personal home page is informal—it requires no peer review and can be done at any time. It is not meant to replace formal publishing, but it may complement it.

What happens when the medium matures? That is the question motivating this work. When changes are easier to make, adopters update their site more frequently and, consequently, make more information available. New uses become practical; for example, users can usefully maintain a "to do" list. When interaction is possible, entirely new uses become possible; for example, researchers can collaborate on early drafts of an article.

These uses elevate personal home pages beyond a research-identity distribution environment. The work described in this dissertation is an attempt to understand the future of this new medium—its use and meaning.

As Alan Kay (1971), personal computer visionary, suggests, "the best way to predict the future is to invent it." In that spirit, this research focuses on designing a better personal-home-page system while studying the use of that system. To that end, I designed the AniAniWeb personal-home-page system to address these issues. Much of the research focuses on AniAniWeb's use by graduate students in computer science. By understanding graduate students' use of AniAniWeb and the meaning that this has for them and their community, this work contributes to a clearer understanding of the ultimate destiny of personal home pages (or like environments[2]) and what meaning they will have to society.

1.3 Three Analytical Lenses for Understanding

The research approach I employ here is known as *design-based research* (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003). The focus of design-based research is both on improving the current best practices through iterative design and informing the research community through theory building (Brown, 1992; Collins, 1992; The Design-Based Research Collective, 2003). To situate the research, the focus is on the computer science research community, where personal home pages are increasingly serving professional purposes.

Studying personal home pages in academia is a complex problem. Personal home pages are a new technology that have implications to both the individual and the community. There are important aspects of the medium in use that are technological, individual, and social in nature. No single analytic framework covers these perspectives adequately. So, it is necessary to use a number of different perspectives. Based on the related literature and informal observation, three analytic frameworks for understanding personal home pages

[2]It is possible that when personal home pages mature, we will no longer conceptualize or term them as personal home pages. For instance, personal home pages created with blog software are often thought of primarily as blogs.

in academia seem to apply here: media theory, communities of practice, and core identity theory. Each of the frameworks acts as a lens to view the research from a different perspective:

- *Media theory* focuses on the technology (Bolter & Grusin, 1999; McLuhan, 1964). How do users adopt the medium? When the medium better serves user needs, what practices emerge? How do the specific features of the system affect those practices? What are the constraints on use?

- *Communities of practice* give us a structure to analyze the social situation in terms of its members, their relation to one another, and their practices (Wenger, 1998). What do personal home pages mean to academia? How does the use of the medium change, depending on the role one plays in the community? How can personal home pages in academia be supported.

- *Core identity theory* focuses on identity. The things that we create or design tell a lot about ourselves to ourselves as well as others (Bers, 2001; Csikszentmihalyi & Rochberg-Halton, 1981). What do personal home pages mean to their adopters? How does a personal home page reflect its owner's identity and how does that reflection affect that owner?

Using different frameworks to examine the same phenomenon is common in case studies (Yin, 2003) and when analyzing media (e.g., McLuhan, 1962). The next three sections give a more thorough introduction to these three lenses.

1.3.1 Media Theory: Understanding New Media

> Societies have always been shaped more by the nature of the media by which men communicate than by the content of the communication. (McLuhan & Fiore, 1967, p. 8)

The crux of media theory is that media are not neutral in conveying content. They also convey an important message that is independent of the content they are carrying. Throughout history, new media, their affordances and limitations more than any particular content, have profoundly changed the cultures that created them (McLuhan, 1964). The introduction of algebra revolutionized physics (diSessa, 2000). The use of the new medium rearranges how society works. This is what McLuhan (1964) means when he famously claims that "the medium is the message;" it is the message to society. I will return to the meaning of McLuhan's statement in Section 7.2.2.

In addition to having meaning to society, media have a meaning to the individuals who use them. When individuals engage media, they engage the affordances and limitations of the media. This changes the message that they take away from their experience. As such, some media make good learning environments as they convey an important message (Rick & Lamberty, 2005). StarLogo, for instance, is designed to engage users in decentralized thinking (Resnick, 1994). It is actually difficult to create a centralized solution to problems in StarLogo. StarLogo is both a good example of how a medium conveys a message and how that message is often contained by the constraints and affordances of that medium.

Media are communication systems by which content is delivered. Any system has effects due to the properties of the system rather than its component parts; unfortunately, people tend to be bad at realizing that these systemic effects even exist (Senge, 1990). Fundamentally, the message conveyed is changed by the medium used to convey it. Nixon wins the debate on radio, while Kennedy wins it on television (Meyrowitz, 1985). Media theory allows us to understand the meaning of media.

Media theory gives us concepts to understand how media relate to us and other media. First, media *extend* different senses of our body (McLuhan & Fiore, 1967; McLuhan, 1964). The ratio of these senses affects the message of the medium. Second, media extend and contain other media. In this research, personal home pages contain hypertext; hypertext contains text; text contains symbols. Third, media *remediate*—they appropriate and

reinvent techniques from other media (Bolter & Grusin, 1999).

Fundamental to remediation are two concepts: transparency and hypermediation. *Transparency* is the need of a medium to make itself invisible, as if the content transmitted was the thing itself rather than the thing conveyed via a medium. Suspension of disbelief in online forums is an example of the need for humans to seek transparency in their media (Turkle, 1995). *Hypermediation* is the opposite. It is an explicit acknowledgment that the medium is mediating the interaction. McLuhan and Fiore's *The Medium is the Massage* is a classic example of hypermediation. That book explicitly acknowledges itself as a book; the authors delight in both a book's affordances and limitations. You need a mirror to easily read the text of one pair of pages. Another pair of pages simply shows two thumbs where your thumbs are when reading the book to indicate a book as a medium. Remediation is the struggle between transparency and hypermediation. It is through these processes that media are adopted and understood (Bolter & Grusin, 1999; Bolter, 2001).

Media theory is particularly important for understanding computer and communication systems, like personal home pages. The computer is the first meta-medium—it can appropriate previous media and extend those media to create new media (Kay & Goldberg, 1977). Computers are "carrier object for ideas" (Turkle, 1995, p. 36). Computers and their interfaces (extensions of our senses) have a message. For Turkle, the Macintosh interface is a carrier object for postmodernism.

Personal home pages are a new medium created using the computer and the Internet. Whenever a new medium is available, it takes time for its affordances and limitations to become obvious (Bijker, 1995; McLuhan, 1964). In my previous work on CoWeb (a wiki), adopters invented uses of the medium that were not foreseen by the designer (Guzdial, Rick, & Kehoe, 2001). So, I approached this research hoping to be surprised by what personal home pages afford. Just like those designing the violin (Boesch, 1997), I am evolving both instrument (a system for creating personal home pages) and music (their potential in academia) simultaneously.

While I went into this research with an open mind, I was not completely clueless when it comes to understanding personal home pages as a medium. Previous research already provides a good foundation for understanding related electronic technologies, such as virtual identity construction environments (Bers, 2001), wikis (Leuf & Cunningham, 2001; Guzdial et al., 2001), and MUDs (Turkle, 1995). There is also work on hypertext (Bolter, 2001), the content of personal home pages, to build on. Hypertext is text that allows linking to other text. A group of hypertext pages come together to create a larger website. On a personal home page, these things all have one thing in common—the identity of the owner. The author writes about the author. The same can be said about an autobiography or a personal memoir. Yet, personal home pages are different from these books. The home page can more easily and more readily be edited. Unlike the text used in books, the hypertext used in home pages is not a linear story, but rather a collection of related things that are linked to each other. That changes its affordances:

> ...hypertextual writing can go further, because it can change for each reader and with each reading. Authors can exploit the dynamic quality of hypertext to alter the nature of an audience's shared experience in reading. (Bolter, 2001, p. 11)

1.3.2 Communities of Practice: Understanding Situated Learning

> A community of practice is a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice. A community of practice is an intrinsic condition for the existence of knowledge, not least because it provides the interpretive support necessary for making sense of its heritage. (Lave & Wenger, 1991, p. 98)

Often, efforts in the learning sciences (Collins, Brown, & Newman, 1989; Bruer, 1993; Schank, Fano, Bell, & Jona, 1994) focus on theories of learning that relate to acquiring and practicing cognitive skills. Most of these efforts have been situated in the classroom—a

safe environment for learning largely separated from the outside world. The hope is that the cognitive skills learned in these *practice fields*[3] will be useful later in life as people engage in practices that require these skills. Ultimately, it is the use of skills in the outside world that is important (Dewey, 1938). Thus, for classroom learning to be effective, the skills need to *transfer* from the classroom setting to the outside world. Yet, there is a great deal of learning that occurs outside of the classroom setting (Lave & Wenger, 1991). In these cases, transfer is no longer a primary concern—the skills and practices learned in one situation will be primarily used in that same situation. Recently, *communities of practice* (CoP) has emerged as a useful framework to go beyond the cognitive view of learning to incorporate these social (or situated) aspects of learning (Wenger, 1998).

> Communities of practice are an integral part of our daily lives. They are so informal and so pervasive that they rarely come into explicit focus, but for the same reasons they are also quite familiar. (Wenger, 1998, p. 7)

Communities of practice are integral to our daily lives. We all belong to them. Families develop practices, routines, histories, etc. Workers organize around their immediate colleagues. Scientists meet at conferences to discuss their findings and make connections with fellow researchers. Students go to school, adapting to both what the learning institution imposes on them and the complex social network of their classmates. Alcoholics rely on a network of fellow alcoholics to avoid temptation (Lave & Wenger, 1991). New employees learn to become claims processors (Wenger, 1998). Each of these are examples of a community of practice in action. They all have a rich history and developed practices. Their practices and meaning are reified in artifacts, tools, symbols, rituals and conventions. New members are able to join and participate. Peripheral members are able to move to more central positions. The practices of the community evolve along with its members. Instead of seeing these situated elements as largely separate from learning, the communities of

[3]They are practice fields in the same sense that a basketball practice field is a place to practice for the game (Senge et al., 2000).

practice framework allows us to see these as central to issues of learning, meaning, and identity (Wenger, 1998).

For this work, *communities of practice*, coined by Lave and Wenger (1991) and refined by Wenger (1998), provides a useful framework to understand the interaction between individuals, their social relations, and the environmental context. While learning can be usefully described and analyzed as an individual practice, there is the important social (or situated) dimension that can get lost with this individual perspective (Putnam, 2000).

The situated perspective argues that learning is social and that, far from being trivially true, this is a "central aspect of learning" (Wenger, 1998, p. 4). So, we need to pay close attention to how the social situation affects the actions and thoughts of the individual (Lave & Wenger, 1991). To do this, the individual can no longer be the sole level of analysis for understanding learning. Instead, the applicable communities of practice—their practices, their members, their artifacts, their meaning—for those individuals must be included in the analysis (Wenger, 1998).

Essential to a situated learning perspective is asking what kinds of social engagements can best support learning to take place (Lave & Wenger, 1991). Lave and Wenger (1991) claim legitimate peripheral participation is the central defining characteristic of situated learning. Learning is recast as a process of moving from the periphery to the core of the community. To negotiate this transition successfully, new members must legitimately participate in the practices of the community. The nature of that participation will transition from the peripheral tasks to core tasks over time. In this new perspective, you cannot separate identity, knowing and social membership, as they all entail each other (Lave & Wenger, 1991).

Because of its situated nature, it is difficult to study a community of practice in laboratory conditions. Communities of practice must be studied in the field or their essential social features are lost (Lave, 1997). It is possible to create a community to support a practice and then study that community (see Bers (2001) or Barab, Barnett, and Squire (2002)

for examples); however, this is not a trivial task, nor is it clear that these communities have the same properties as those with more established histories (Wenger, 1998). So, this research, like most communities of practice research, will situate itself within an already established community of practice. This provides the *minimal ontology* (Barab & Squire, 2004) for examining the important issues of learning in communities of practice; without examining a complex and messy established community of practice, this research could not be conducted (Rick & Guzdial, 2006).

Communities of practice establish meaning through two fundamental complementary processes—*participation* and *reification* (Wenger, 1998). Participation is concerned with how members of a community interact with others and how the participants see themselves in relation to the community of practice. Reification is concerned with how artifacts and tools, rather than people, reflect the practices of the community and are used by that community. Personal home pages are fundamentally tools for reification; they allow their adopters to reify their identities in an external artifact (their home page).

The importance of reification is immediately obvious when considering artists, such as architects, whose work is judged largely by the quality of their designs (reification). A famous architect builds her reputation largely on the buildings she designed and built. Even in more mundane areas such as claims processing, reification plays an important part in how community members think of themselves and others (Wenger, 1998).

Wenger gives the example of a particular worksheet that reified a claims process. Claims adjusters were forced to use the worksheet, but did not understand the process behind it. This caused several problems. First, when they were contacted by clients, it was impossible to explain the reasons behind how claims were processed. This usually left the client angry and the claims adjuster frustrated. Second, the worksheet did not allow for any deviation from its step-by-step procedure. As there are often complications, good claims processing requires flexibility and personal interpretation. This worksheet did not allow for this flexibility. Finally, for many, the introduction of the worksheet was another example

of how the procedures passed down from the head office disregarded the value of their interpretation and competence. Workers were often proud of their work—solving a complex problem in a fast and competent manner. This worksheet stymied this positive perspective.

The introduction of this worksheet had strong effects on learning and identity. It demonstrated that the trajectories for learning and advancement were quite limited and that claims processors were not highly valued by their community of practice. Consequently, workers became frustrated with their community of practice and their position in it. Learning is not always a positive experience, nor are communities of practice devoid of problems when encouraging learning as becoming and belonging.[4]

This example demonstrates the importance of reification to a community of practice; even a simple worksheet may represent important aspects of a community of practice. In this work, I focus on personal home pages, a medium that explicitly reifies identity. Though communities of practice had little to do with the design of AniAniWeb, they provide a useful framework for both motivating the research and giving a framework (language, lens, etc.) to analyze the work.

1.3.3 Core Identity Theory: Understanding the Individual

Independent of the social aspects of identity (Gee, 2000), detailed in the previous section on communities of practice, there is a *core identity*—an identity so core to the person that it is important in all situations (Erikson, 1963a, 1968). In Freudian psychology, this core identity roughly equates to the ego (Erikson, 1963a). Whether it be in outfitting a home (Csikszentmihalyi & Rochberg-Halton, 1981), writing a computer program (Turkle, 1984), participating in a MUD (Bers, 2001; Turkle, 1995), or working on a simple worksheet (Wenger, 1998), people consciously or unconsciously "play with" their core identity. The activity of play is important for recreation and self cure (Erikson, 1963d).

The tools we adopt affect this play (Bers, 2006). Using toys, children learn to master

[4]For another example of how a community of practice can fail to provide support for becoming and belonging, see Lave and Wenger's (1991) description of butchers in training.

things (Erikson, 1963d; Piaget, 1997). When musicians learn to use an instrument, like a violin, they build a relationship with the instrument that changes both the musician and the musician's understanding of the instrument and music (Boesch, 1997). These technologies serve as a mirrors for reflecting the core identity. In adolescents, people turn to these mirrors to establish who they are (Turkle, 1984). Adolescence is a time of change that greatly determines who you are. The same can be said about graduate school. Graduate school is a time to again turn to those mirrors to determine who you are. Personal home pages are natural mirrors; they allow adopters to create their own reflection and see how happy they are with it. Adopters of personal home pages must learn to be at home with their personal home pages just as they must learn to be at home with the house they live in.

> Having listened to many, many accounts of people's feelings about their homes—positive, negative, and ambivalent—there is no doubt in my mind that we all, to some degree, display in the physical environment messages from the unconscious about who we are, who we were, and who we might become. Unable to comprehend all that is encapsulated in the psyche, we need to place it "out there" for us to contemplate, just as we need to view our physical body in a mirror. (Marcus, 1995, p. 17)

Ideally, a personal-home-page system should act as that mirror. With it, graduate students can design an artifact about themselves. The things that we create or design tell a lot about ourselves to ourselves as well as others (Csikszentmihalyi & Rochberg-Halton, 1981). How we use tools affects what we are telling ourselves. Two issues are critical to the understanding of how we appropriate tools: 1) how effectively we engage these issues; 2) what approach we take.

There is both a negative and a positive way in which tools allow us to engage issues of core identity (Turkle, 1984). The negative way is acting out—staging our old conflicts in new settings, reenacting our past in fruitless repetition. For instance, Erikson (1963c)

details the case of a little boy acting out his anxiety by retaining his bowel movements; his actions only complicated the problem. The positive way is working through—thinking about our habitual reactions in a new way. When talking about elementary-school-age children working through problems using computers, Turkle (1984) writes:

> Their style of working with the machine expresses something of who they are, giving them a chance to see themselves in the mirror of the medium. At the same time, they can use the experience as an occasion to experiment with who they are not. (p. 138)

The approach we take to work through our problems is important to the way we understand ourselves (Turkle & Papert, 1991). Some people prefer a hard approach. The hard style is structural and top-down. The large problem is divided into smaller more-manageable problems; solving the smaller problems solves the larger problem. Others prefer a soft approach. The soft style is bottom-up and negotional. It involves a closeness to objects. While hierarchy and abstraction are valued by those favoring a hard style, these bricoleurs prefer negotiation and rearrangement of their materials (Turkle & Papert, 1991). Traditionally, the hard style has been given a higher status, while the soft style has been maligned. Turkle and Papert point out that the soft style too has its advantages; even in Western science, where a distance from the object of study has been systematically encouraged (i.e., the scientific method), there are examples of breakthrough success using a soft approach.

Personal home pages, as self-presentation environments, are often used by adopters to reflect on and construct their identities. Core identity theory allows us a way to understand how a graduate student's appropriation of personal home pages reflects who he is. Graduate students are a particularly interesting audience for issues of identity as they are forging their research identity. The same tensions (industry vs. inferiority, identity vs. role confusion) that apply to childhood development (Erikson, 1963b) are important to the development of graduate students.

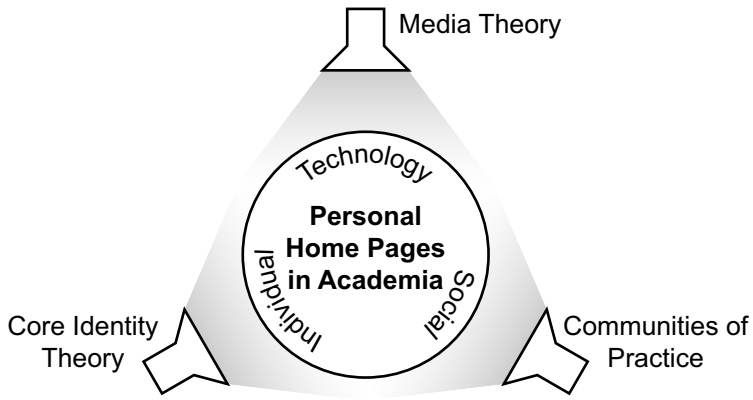


Figure 1: Analysis Frameworks to Illuminate Personal Home Pages in Academia

1.3.4 Combining the Lenses

While each of these lenses provides an interesting perspective and questions to consider, combining these frameworks should illuminate the whole (see Figure 1). Using different frameworks to explain the same phenomenon is a common technique in a case study. The aim of such a case study is not only to better understand the phenomenon, but also to reflect on the analytical frameworks (Yin, 2003). Through this research, I seek to contribute to, confirm, and extend the three analytic frameworks that explain this new medium.

This work is not unique in combining these frameworks to understand a new medium. To various degrees, these theories apply to other new media. Turkle (1995) combines aspects of each of these perspectives to understand MUDs.[5] As a clinical psychologist, her main focus is on the individual—how does the technology affect the individual? Meyrowitz (1985) combines Goffman's (1959) framework on social interaction with a McLuhan (1964) perspective on technology to understand television. His main focus is on understanding the societal changes that television has caused.

Which theories are appropriate to understanding a new medium depends on the features of that medium. Most people relate to television as consumers, not as creators. Television

[5]MUD (multi-user dungeon or multi-user domain) is a role-playing game, played on the Internet. Players interact with rooms, objects and other characters in a virtual world. Most MUDs are text-driven.

is important for its ubiquity. Thus, Meyrowitz largely[6] focuses his historical analysis on the societal level. MUD users are active creators in their medium. In comparison to television, MUDs (at least at the time of Turkle's writing) are obscure. Thus, Turkle focuses her analysis on the individual level.[7] For understanding personal home pages in academia, all three perspectives are essential. The technology is particularly flexible, easily remediating and extending other media. Academia is an established social setting, with a long history, defined rituals, and practices. When someone creates a home page, he is creating something that represents himself; hence, it is a natural medium for a user to play with his identity. How we present ourselves in this medium is strongly affected by the medium, the audience we are addressing, and who we are.

1.4 Stories of this Dissertation

This dissertation is about personal home pages in academia. Three stories overlap to cover that topic. First, *the technology story* is about a new web technology, its development and relation to other technologies. Second, *the research story* seeks to understand a new medium by situating it in an appropriate context. Three frameworks are used to analyze the case study of personal home pages in academia. Third, *the adopters story* tells of the journey of graduate students adopting a new medium. While these stories are naturally intertwined in the dissertation, I tease them apart here to give an introduction of what will follow.

1.4.1 The Technology Story

I first created my own personal home page in 1995, shortly before the major commercial adoption of the World Wide Web. I tried out new HTML features. I followed the debates in web design; I retooled my site to reflect my preferences. My interest in personal home

[6] Meyrowitz does look at the Presidency of the U.S.A. to see how television has affected those individuals, so his analysis does contribute some to our understanding of individuals.

[7] Turkle does make a larger societal claim by arguing that the effects she sees on the individual level for her subject will become more pronounced as Internet technology becomes more prevalent.

pages was one of the reasons that I found myself in the College of Computing pursuing a doctoral degree.

In 1998, I had an internship with Siemens in Germany. I was pursuing a Ph.D. in electrical engineering at the time. After the internship concluded, I had some research money to work with a College of Computing faculty member. When Mark Guzdial demonstrated CoWeb (a wiki), I knew what research I wanted to pursue. I ended up rewriting the CoWeb software and becoming its chief developer. One of the reasons that the technology intrigued me was my affinity for personal home pages. One of the first purposes I had in mind for the new technology was personal home pages. While I felt conventional static home pages were interesting, I was more intrigued with the future of the medium as the technology matured.

Instead of being content to study personal home pages as they are (e.g., Papacharissi, 2002; Vazire & Gosling, 2004), I take a more active (design-based research) approach. I furthered the state of home-page technology by developing AniAniWeb. Conventional static pages[8] lack several features that could potentially better support personal home pages in academia. New web technologies are addressing these shortcomings. Three technologies are particularly applicable: blogs (or weblogs), social networking software, and wikis. Blogs are systems that allow users to easily publish journal-like entries to a website (Hacker, 2003). Social-networking sites connect users to each other through an articulated social network (boyd, 2004). Wikis are collaborative websites that invite visitors to edit and extend the site (Mattison, 2003). Wikis address these major problems of static pages, so I chose to build my system from a wiki (specifically CoWeb). While wikis address many of the shortcomings of static home pages, they have their own problems in supporting personal home pages (e.g., they look too plain). AniAniWeb is an attempt to address these problems in a manner suitable to supporting personal home pages in academia.

[8]By static home pages, I mean home pages that reside on a server that merely serves its contents. To edit these pages, a user has to download the appropriate files from the remote server to their local machine, then edit the files, and upload the files back to the server.

In this dissertation, the design (both product and process) of AniAniWeb is an important theme. Much of the early design was driven by my expertise in building webpages and my expectations of personal home pages. As a designer, I am what Turkle and Papert (1991) term a bricoleur—I prefer a close connection to my design. I use AniAniWeb for my home page. My own use and needs have driven much of AniAniWeb's development. On top of that, I have been influenced by my fellow adopters. I have followed what others have done with AniAniWeb and have tried to adjust the technology to better serve their needs. This document details the more formal part of that process: I link the features of AniAniWeb to the needs of its adopters.

While the practical details of designing AniAniWeb for this specific audience are important, there is also a need to view the technology in relation to other technologies. AniAniWeb extends WikiWikiWeb. AniAniWeb subsumes many blogging features. At times, AniAniWeb and its use are compared to other technologies and their use. This story may be particularly of interest to designers of new web systems, who may be able to draw inspiration from AniAniWeb.

1.4.2 The Research Story

In a case study, it is normal to use multiple frameworks to analyze the same case (Yin, 2003). By doing so, the case can be understood using a language and constructs that others have used before; it connects the research to a larger body of research. In addition, the case study provides a testbed to compare the power and applicability of these frameworks.

Media theory, communities of practice, and core identity theory are the frameworks used to analyze this case study of personal home pages in academia. Going into the case study, I hypothesized that these frameworks would be useful in explaining the use and meaning of personal home pages in academia. The results have confirmed that. All three frameworks contribute to a better understanding of the whole. At times, the frameworks are orthogonal—they explain different things. For some adopters, their experience hardly

reflects their core identity; AniAniWeb is simply a useful tool for them. For others, AniAniWeb does act as a mirror allowing adopters to play with who they are. At other times, the frameworks are complementary—illuminating different aspects of the same phenomenon. So, when trying to understand personal home pages as a medium, it is essential to realize that any given adopter uses his home page to address different communities of practice.

The research approach employed here is *understanding a new medium by actively situating it in an appropriate context*. The new medium is personal home pages and the context is academia. This research approach is not novel. In the research on CoWeb, a similar approach was used to understand the potential of WikiWikiWeb to support collaborative learning (Rick & Guzdial, 2006). In this approach, it is vital that the context is authentic: The medium must serve the real needs of its adopters. Adopters must have the freedom to adapt the technology to serve their needs. Ideally, the medium should be flexible enough to allow adopters to use it in ways unforeseen by its designer. For instance, teachers were able to invent new uses for CoWeb (Guzdial et al., 2001).

This approach changes the nature of this research. It becomes more exploratory. Instead of testing a hypothesis, I harness the energies and creativity of the adopters to understand the new medium. While I went into the research with some expectations, I was expecting to be surprised. Rather than viewing these surprises negatively as breaking the hypotheses, I view them positively as a way to better understand the new medium.

One of the bigger surprises to come out of this work is that several adopters of AniAniWeb primarily used the technology for themselves, something not seen in my survey of static personal home pages (Appendix A); the new medium (AniAniWeb) was used differently than the older medium (static home pages). The need for access control was another surprise. While I went into the project feeling that access control might be important, I was surprised to discover that access control is such a critical part of a personal-home-page system. This finding directly contradicts one of the fundamental design lessons drawn from the WikiWikiWeb, that an open access system is usually preferable (Leuf & Cunningham,

2001). In CoWeb, open access enabled collaborative learning (Guzdial, Rick, & Kerimbaev, 2000). In the initial version of AniAniWeb, open access often limited use.

1.4.3 The Adopters Story

This dissertation reports on the adoption of a new medium by several graduate students. This case study documents the relationships between these adopters and the technology over a period of two years. During that time, each of these adopters invested a significant amount of time using AniAniWeb (and other home-page technologies). As graduate students in computing, they have a good understanding of the technology and how to use it. In essence, the case study seeks to harness their energies, expertise, and experience to better understand personal home pages in academia. Each adopter has individual needs, providing a different perspective and insight.

While their use is often analyzed *en masse*, each adopter is treated as an individual when necessary. Their individual needs and perspectives are explained. Graduate school is a learning experience; students learn to understand their domain, tackle research, present themselves to others, and become academic professionals. This dissertation documents some of that progress, both the struggles and the triumphs.

1.5 Summary of the Document

This introductory chapter provided the motivation and an introduction to the three analytical frameworks for studying personal home pages in academia. Chapter 2 (Studying Personal Home Pages in Academia) introduces the research. The initial design of AniAniWeb, based on other web technologies, is motivated. In particular, the design decisions that separate AniAniWeb from static home pages and WikiWikiWeb are motivated and discussed. The case study is detailed, including its design, the context of study, the collection of the data, and how that data is analyzed and reported.

Chapters 3–6 report the results of that case study. Chapter 3 (In Academia) focuses on the role of personal home pages in academia. Particular attention is given to how that

role changes as a a person becomes more central to the community of practice. Chapter 4 (Adopting the Medium) focuses on how people adopt the new medium to serve their audience and themselves. Where Chapter 3 was primarily concerned with academic use, this chapter takes a broader view of the use and meaning of personal home pages. Chapter 5 (Constructing Self) focuses on the individual. For each of three adopters studied, the respective home page goes beyond being a simple tool; it serves as a mirror for constructing identity. The experiences of these three adopters are detailed. Roughly, Chapters 3, 4, and 5 correspond to the three analytical lenses: communities of practice, media theory, and core identity theory, respectively. Chapter6 (The Design Space) shifts the focus from the adopters to the technology. How can AniAniWeb be improved? How did the design decisions that shaped AniAniWeb get reflected in use? What are some possibilities for future research in the broad design space of personal home pages?

Chapters 7&8 discuss the findings more broadly. Chapter 7 (Understanding New Media) concentrates on this research's broader implications for understanding new media. First, the research method employed to understand personal home pages (a new medium) is reexamined. Then, a theory to understand media in relation to other media is introduced. Finally, that theory is applied to personal home pages; the theory is thereby shown to be supported by the concrete research findings. Chapter 8 (Reflections) concludes this dissertation with a summary of the results. First, the design and study theses are reexamined. Then, the specific contributions of this work are summarized. Finally, some directions for future work are suggested.

CHAPTER II

STUDYING PERSONAL HOME PAGES IN ACADEMIA

The previous chapter introduced and motivated this research. This chapter details the work accomplished and grounds it in related literature. Its three sections concentrate on the research method, the technology, and the case study.

First, the research method is classified as design-based research. Design-based research goes beyond describing learning to improving it, converting this line of inquiry from a passive act of observing to an active act of supporting and improving. As self presentation and distribution environments, personal home pages have the potential to support learning (as becoming and belonging) in academia. To realize and understand that potential, this research includes a focus on improving home-page technology.

Second, the technology is examined. The history of personal home pages is introduced and previous technology to support personal home pages is critiqued. To better support the use of personal home pages by graduate students, I created the AniAniWeb system. AniAniWeb's origins and design are discussed. Particular attention is given to CoWeb, the Wiki implementation that AniAniWeb builds upon.

Third, the study is detailed. The context of graduate students at the College of Computing is justified. The methods of data collection are grounded in the research goals. I explain how the data was analyzed and how the data is reported.

2.1 The Method: Design-Based Research

> Importantly, design-based research goes beyond merely designing and testing particular interventions. Interventions embody specific theoretical claims about teaching and learning, and reflect a commitment to understanding the relationships among *theory*, *designed artifacts*, and *practice*. (The Design-Based

Research Collective, 2003, p. 6)

Design-based research is a popular method of conducting research in the learning sciences, earning special consideration in both *Educational Researcher* (vol. 32, no. 1) and *The Journal of the Learning Sciences* (vol. 13, no. 1). Design-based research is a paradigm for the study of learning in context through systematic design and study of that design in practice (Collins, 1992). The goal is to simultaneously describe and improve learning. Two parts are essential—iterative development and authentic contexts (Cobb et al., 2003). In an iterative development cycle, the design informs the research and the research informs the design. Acknowledging that crucial aspects of learning are missing in a laboratory context, DBR is situated in real-world contexts, such as a classroom, where learning commonly takes place (Barab & Squire, 2004). Design-based research aims to make sense of the complexity inherent to these authentic contexts.

Design-based research has its roots in design experiments (Brown, 1992). Often, the terms design-based research and design experiments are used interchangeably; unfortunately, this undermines much of Brown's contribution (McCandliss, Kalchman, & Bryant, 2003). Brown (1992) narrowly defines design experiments as iterating between the laboratory and the classroom. Work in the classroom informs the researcher on what to study in the laboratory. Work in the laboratory informs the design of the classroom. In that formulation, design experiments can be categorized as design-based research. But, not all design-based research can be categorized as design experiments. Since its inception (Collins, 1992; Brown, 1992), DBR has grown into a broad classification, encompassing a wide variety of research paradigms.

The design-based research approach used in this work is *situating a new medium*. By situating a new medium in authentic context(s), the potential of the new medium can be explored (Rick & Guzdial, 2006). By supporting personal home pages in academia, where home pages are important, the potential of personal home pages can be understood.

2.1.1 Situating a New Medium

New media change how we relate to ideas, to others, and to ourselves. As such, a new medium has the potential to be a powerful and natural learning environment. The computer is a particularly flexible tool to create new media (Kay & Goldberg, 1977). As with other new media, realizing that potential is far from trivial. Significant use is necessary to properly understand the potential of the new medium (Bolter & Grusin, 1999; McLuhan, 1964). With use, new techniques emerge that help shape the new medium (Tenner, 2003). Hence, the early-adopting social groups that develop these techniques are particularly influential in determining the destiny of a new medium (Bijker, 1995). So, a good way to understand a new medium is to actively support its use in these relevant social groups. That way, the users in that context can apply their creativity and energy to adopting the new medium to serve their real needs. Through their experience, the medium can evolve and a better understanding of its destiny can be achieved.

Situating a new medium begins with an initial design—a version of the new medium. Then, the design is applied to meet the needs of a specific context; the design is improved to better serve that context. Design, like all problem solving (Klahr, 2000), is a process of moving back and forth between different search spaces (Goel & Pirolli, 1992; Schön, 1987). In a traditional design method (e.g., Soloway, Guzdial, & Hay, 1994), the problem comes first and the evolution is from problem to solution. In design-based research, the research problem and solution co-evolve, each affecting the other in an iterative manner (Cobb et al., 2003). The new medium is evolved to better meet the needs of its adopters. This method differs in a couple of important ways from more traditional design-based research.

First, the context is not tightly controlled. In traditional design-based research, the context of use is usually tightly controlled and considered an essential element of the design. This research is often done in a classroom where the researcher has significant control over the learning activities. When trying to understand a new medium, this tight control

would be harmful. Adopters need to innovate to understand a new medium (Bolter & Grusin, 1999); having the researchers impose their notion of the medium would only impede that. By supporting adopters to use the medium as they see fit, the research can utilize the adopters' energies and creativity to understand the new medium: How do adopters use personal home pages? What meaning does this use have to them and to others?

Second, the effectiveness of the concrete design is more important than in traditional design-based research. Traditionally, design-based research has been conducted within what Boyer (1990) terms the *scholarship of discovery*. In this mode, success of the research is based on whether new knowledge can be discovered in the context, rather than on whether the design succeeds. In contrast, situating a new medium is a *scholarship of application*: The aim of situating a new medium is to understand an important concrete design—the new medium. Barab and Squire (2004) recall a design experiment that showed significant improvements in learning, but the course it was situated in was canceled because it was too costly. While the design experiment succeeded (in discovery), the course failed (in application). In contrast, in situating a new medium and other design-based research in the application mode (e.g., Kolodner et al., 2003), the success of the design is essential.

2.1.2 From Situating CoWeb to Situating AniAniWeb

There is a strong similarity between previous research on CoWeb and this research on AniAniWeb. As will be detailed in further sections of this chapter, AniAniWeb technologically extends CoWeb. More relevant to this section, both are instances of situating a new medium to understand its potential. The CoWeb research investigated the potential of WikiWikiWeb to support collaborative learning (Rick & Guzdial, 2006). The AniAniWeb research investigates the potential of personal home pages to support self representation and distribution. Both projects are examples of design-based research in the application mode.

The CoWeb work began with the insight that WikiWikiWeb could support collaborative

learning. As iterating on the design is essential to design-based research, a new wiki implementation was developed to better serve the needs of the context; CoWeb was designed to support collaborative learning in Georgia Tech classes (Guzdial et al., 2000). As adoption by others in authentic setting(s) is important, faculty members were recruited and supported for using CoWeb in their classes (Rick & Guzdial, 2006). Over 300 classes, spanning the academic landscape of Georgia Tech, have used CoWebs to complement in-class learning. Through the energies and creativity of these adopters, the researchers were able to better understand WikiWikiWeb's potential to support collaborative learning (Guzdial et al., 2001; Rick & Guzdial, 2006).

The AniAniWeb work began with the insight that home-page technology is improving and that this will change the use and meaning of personal home pages. As iterating on the design is essential to design-based research, a new system was developed to better serve the needs of the context; AniAniWeb was designed to support personal home pages at Georgia Tech. As adoption by others in authentic setting(s) is important, I supported graduate students in computer science in adopting AniAniWeb for their personal home pages. In this academic setting, there is an authentic need for personal home pages. Through the energies and creativity of the AniAniWeb adopters, I am better able to understand the meaning and use of personal home pages in academia.

2.2 The Technology: From WWW to AniAniWeb

The concrete design is a central component of design-based research. The design is a concrete carrier of the technological theses of the research. To properly understand the research, others must understand the concrete design. This is all the more true for design-research in the application mode. In situating a new medium, that translates to understanding the technology used to further the medium. This section is about the technology for creating personal home pages. The design of AniAniWeb is motivated and detailed. The technology is grounded in its historical context and its relations to other web technologies

(wikis and blogs) are examined.

First, the origins of static personal home pages are introduced. Next, I argue that, to realize the potential of personal home pages, home-page technology needs to go beyond static pages. Then, WikiWikiWeb is introduced as a technology that can address the major limitations of static pages. Special attention is paid to CoWeb, the wiki implementation that AniAniWeb builds upon. Finally, the concrete design (process and product) of AniAniWeb is detailed. Together, these sections motivate the technological theses for this research:

Thesis 1 Wiki features (quick authoring, interaction support, and collaboration support) can enhance the authoring of personal home pages over traditional (static) tools by better supporting established uses and by making new uses possible.

Thesis 2 Wiki technologies need to be augmented with more access control, more structure, and more support for customizable looks to better support the authoring of personal home pages.

These hypotheses were made going into the research and are central to the development of AniAniWeb. The following sections motivate them. Chapter 6 returns to these theses, detailing how the research findings reflect and inform them.

2.2.1 Origins of Personal Home Pages

Personal home pages are hypertext pages on the World Wide Web. *Hypertext* is text in which the reader can navigate the text by clicking on hyperlinks embedded within the text. The vision of hypertext goes back to Vannevar Bush's (1945) article on Memex, a device for memory extension. The notion of hypertext was improved upon by Doug Engelbart (the first-realized hypertext system), Theodor Nelson (coining the term "hypertext"), among others (Connolly, 2000). With the arrival of the World Wide Web (initiated by Tim Berners-Lee at CERN), and its commercial explosion in the mid-1990s, the vision of having a hypertext presence that can be shared with others became a reality for many people. HTML

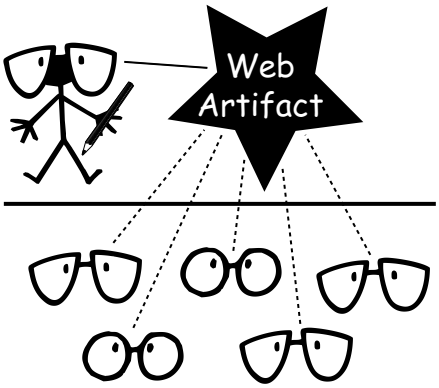
(HyperText Mark-up Language) became the *de facto* standard for distributing information on the WWW.

Personal home pages were one of the first uses of the WWW to reach the point of being a recognizable genre, with expected properties and standards (Dillon & Gushrowski, 2000). In the mid-1990s, commercial sites such as Geocities offered users space to distribute their HTML personal home pages. Users constructed their static personal home page on their home machine and then uploaded it to the server, where it could be accessed by others. While this technology allowed personal home pages to become prominent, these sites only partially fulfilled Berners-Lee's vision of the World Wide Web.

> My vision was a system in which sharing what you knew or thought should be as easy as learning what someone else knew. (Berners-Lee, 1999, p. 33)

When Berners-Lee created the World Wide Web, he envisioned users seamlessly transitioning from viewing a page to editing it; however, he was unable to persuade the creators of Mosaic, the first viable graphical web browser, that seamless editing was essential to the Web. Creating a graphical HTML editor is difficult and the Mosaic team did not feel it was worth the effort. From an adoption perspective, they were right: Even without editing capability, Mosaic and its commercial twin, Netscape, introduced the world to the World Wide Web. Unfortunately, the vision of user editing was largely lost.

Aside from hit counters that show how many visitors had visited a site, there was little interaction between creators and viewers of the web artifact (Figure 2). One person built the artifact and others were able to view it; there was an impassible barrier between the creator and the viewers. This model of interaction was more a function of what the technology easily allowed, rather than the needs of its adopters. AniAniWeb is an attempt to reinvigorate Berners-Lee's vision when it comes to personal home pages. By enabling simple publication and interaction, the potential of personal home pages in academia can be realized.



World Wide Web: Publishing Model
Author and Readers

In a conventional static home page, an author creates a Web artifact on their machine and publishes it to the server. The server then allows visitor to access that artifact. There is an impassible barrier between the author that creates the artifact and the visitors who can only view the artifact.

Figure 2: World Wide Web's Access Model

2.2.2 Beyond Static Personal Home Pages

In academia, personal home pages are already an important medium for communication. Academics post their portfolio and publications to their home pages; they look for that material on others' personal home pages. As such, academia is a well-suited context to study the use and meaning of personal home pages. Unfortunately, the current use of personal home pages is quite limited. Even when personal home pages are acknowledged and used (Agre, 2005; Dillon & Gushrowski, 2000), they are seldom acknowledged and used for more than distributing contact information and making the research portfolio more available.

This limited use is partly a function of the limitations of current technology. The vast majority of academic personal home pages are static (Appendix A); adopters are limited by the affordances (or lack thereof) of the static technology. As the Web matures, new technology will allow personal home pages, their use and meaning, to mature. New uses and techniques will become prominent and the character of personal home pages will change. For instance, personal home pages created using blogging technology tend to be different in character from static pages (Herring, Scheidt, Bonus, & Wright, 2005; Nardi et al., 2004).

AniAniWeb is an attempt to move towards that future—when new technology allows the use and meaning of personal home pages to escape their static constraints. What will

personal home pages look like once their use and meaning is determined by user needs, rather than current technological limitations? What practices do these personal home pages afford? What do the adopters get out of them?

Rather than try to gauge the future by studying the present, I actively seek to "invent" the future with this research. To invent the future, I designed AniAniWeb to address the major limitations of static home pages. Based on previous research and experiences, I hypothesize three limitations of static home pages that need to be overcome for the medium and its use to mature: content creation is not emphasized, publication is awkward, and interaction is not facilitated.

2.2.2.1 Content Creation is not Emphasized

Most conventional website-creation tools, such as Microsoft FrontPage, do not provide structural support for content creation. They are designed to be used for many different applications. An artist can create a gallery to display their work. A company can create their website to match their corporate image. A fan can create an homage to their favorite television show. A graduate student can create a site for potential employers to look at prior to a job talk. All of these users have different needs, but they all share the same website-creation tool. Such a general tool is not particularly well suited for any one of those purposes. Users are left with a large open canvas that can be so overwhelming that they never get beyond creating the looks of their site to focus on generating the useful content (i.e., text) that is important to academia.

As an example, in CoWeb use in English composition classes, the teacher found that the content-focused CoWeb improved the quality of students' work (Rick, Guzdial, Carroll, Holloway-Attaway, & Walker, 2002). For their final project, students were asked to create a website. In previous terms, students had designed their sites using conventional website-creation tools. Although the teacher had emphasized that she was primarily interested in *content*, students tended to focus on *appearance* to the detriment of content. When

students started using CoWeb, this changed. CoWeb, like its ancestor WikiWikiWeb (Leuf & Cunningham, 2001), was designed to facilitate content creation, not creating a great-looking site (Guzdial et al., 2000). If we want users to use websites to present themselves usefully to others, then their tools should support them in that task.

2.2.2.2 Publication is Awkward

For static home pages, the publication cycle is long and awkward. In order for a person to make changes to his home page, he needs to launch special website-creation software or a text editor, such as emacs. Next, he needs to find the file that needs changing. Then, he needs to change and save it. If the user is not on a machine that has direct access to the source files, two extra steps of downloading the original source file and uploading it back to the original server are required. In the community of practice that I wished to study, an additional problem was discovered: Most home pages did not update publicly until the next day.

An awkward publication cycle can be a large barrier to quick changes and keeping a home page up to date. Ease of use and simplicity are good predictors for whether people will use a technology (Venkatesh, Morris, Davis, & Davis, 2003). The longer it takes to access an application, the less likely a user will use it; for instance, PDA users often resort to scrap paper to remember an appointment as the retrieval time for the PDA is high (Starner, Snoeck, Wong, & McGuire, 2004). The more difficult it is to update a personal home page, the more likely a student is to put off updating that home page. Ultimately, less content is made available on the home page for the community to engage with.

2.2.2.3 Interaction is not Facilitated

Static home pages do not facilitate interaction with others. This limits functionality, as collaboration is not even an option. For example, if a graduate student was scheduling a time for his thesis proposal, his home page might be a logical place for the committee to coordinate schedules. The home page can serve as a collaborative artifact that everyone

can visit easily on their own time to view, add to, revise, etc. With conventional home-page software, this functionality is not even an option. Static personal home pages do not allow these types of useful practices to emerge. Since interacting and communicating are fundamental to learning in a community of practice (Wenger, 1998), to learning in general (Vygotsky, 1978), and to the building of identity (Bers, 2001, 2006), a system that seeks to support learning to become part of a community (i.e., identity formation) should allow for this type of interaction.

In using CoWebs to complement classroom learning, we found that teachers and students were able to invent new activities using CoWeb that went well beyond the functionality of a static course website (Guzdial et al., 2001). I expected that a collaborative personal home page will encourage useful activities that cannot be found in conventional (static) sites.

Additionally, static pages limit the feedback that a user gets about his home page. Since awareness of an audience is a critical part of composition (Bereiter & Scardamalia, 1987) and provides a motivation to construct an identity (Bers, 2001; Turkle, 1995), limiting that awareness hampers the composition process.

2.2.2.4 Beyond these Limitations

To investigate these technological limitations in practice, I conducted a survey of first-year graduate students (Appendix A). Regardless of use, students found the current publication cycle to be an impediment to their adoption of personal home pages. This suggests that an easier editing cycle could entice more graduate students to adopt personal home pages. The results were split for interaction. Lower-use adopters did not feel that support for interaction to be important for their home pages. Higher-use adopters, on the other hand, want to interact with others through their home pages. While interaction may not entice students to adopt, it can be a desired feature to realize the potential of personal home pages.

To realize the potential of personal home pages, these technological limitations are

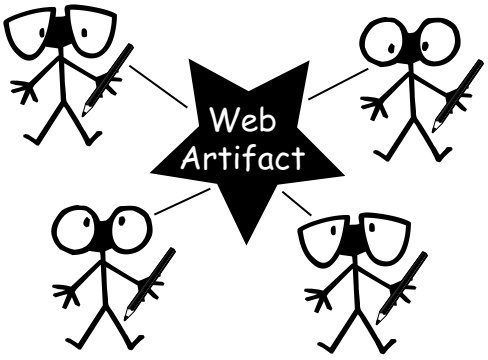
problematic. Because content creation is not emphasized, users have a hard time creating content-centric personal home pages. Because the publication process is awkward, individuals are less likely to adopt personal home pages. Because interaction is not facilitated, no important collaboration will be done. In this research, I seek to go beyond these limitations to create a better personal-home-page system.

Fortunately, these three technological limitations can be addressed through an already established web technology—the WikiWikiWeb. First, wikis focus users on creating text. It is easy to create new pages and link pages together through hyperlinks. Second, the publication cycle of a wiki is quick and effective. To edit a page, a user simply clicks on the "edit" button and the source of the page is available to edit. Third, wikis facilitate interaction, allowing even anonymous users to edit the site. The next section introduces WikiWikiWeb as a platform to build upon to address these technological limitations in order to realize the potential of personal home pages.

2.2.3 WikiWikiWeb

While the standard web browser became popular without an emphasis on client editing, other web applications soon came along to realize collaborative editing. One of the most popular and simplest of these is the WikiWikiWeb,[1] created in 1995 by Ward Cunningham. Wiki takes a radical democratic view of interaction—everyone is a creator (Figure 3). Wiki invites all visitors to edit any page within the website, and add new pages using only a regular web browser. Any person visiting the site can simply click the "edit" button to edit the page. The text is edited in an HTML text area without special applets or plug-ins. While allowing anyone to edit the site may seem quite dangerous, it can also be powerful. For example, by adopting Wiki's open interaction model, Wikipedia has been able to grow and leverage its community of users to create one of the largest and most useful sites on the Internet (Bryant, Forte, & Bruckman, 2005).

[1]The original Wiki is located at *http://c2.com/cgi-bin/wiki*.



WikiWikiWeb: Democratic Model
Everyone is an Author

WikiWikiWeb implements a radically democratic style of access control: All visitors can edit the Web artifact; there are no privileged users. Wiki relies on social conventions, rather than technological constraints, to govern who is to construct and maintain the site.

Figure 3: WikiWikiWeb's Access Model

In 1998, the Collaborative Software Laboratory at Georgia Tech began investigating the potential of wikis to support collaborative learning. To actively realize that potential, we created our own wiki implementation, CoWeb. CoWeb is a wiki, implemented in Squeak, a cross-platform and open-source freeware version of Smalltalk (Guzdial & Rose, 2002). Mark Guzdial first ported the wiki concept to the Squeak platform, naming it Swiki, short for Squeak Wiki (Guzdial, 2001). Shortly after that, I created a more robust and powerful version, which has gone through several major revisions (Guzdial et al., 2000). When writing about Swiki in academic publications, the system is referred to as CoWeb, short for Collaborative Websites. CoWeb use has been successful in supporting collaborative learning at Georgia Tech in a variety of classes (Rick & Guzdial, 2006).

CoWeb looks like a traditional website, except that every page has a set of buttons that allow the user to interact with pages: edit the page, upload attachments (images, PDFs, etc.), or view the history of the page over time. Links between pages are created by referencing pages by their title surrounded by asterisks (e.g., *Page Title*). If a page with the given title does not already exist, a create link shows up next to the title upon save; clicking on this creates the new page (see Figure 4).

CoWeb differs from the original Wiki in a few respects. First, CoWeb was designed to support learning in university-level classes. In this setting, each class is usually given its own CoWeb. This differs from the original Wiki, which addresses a broad variety of

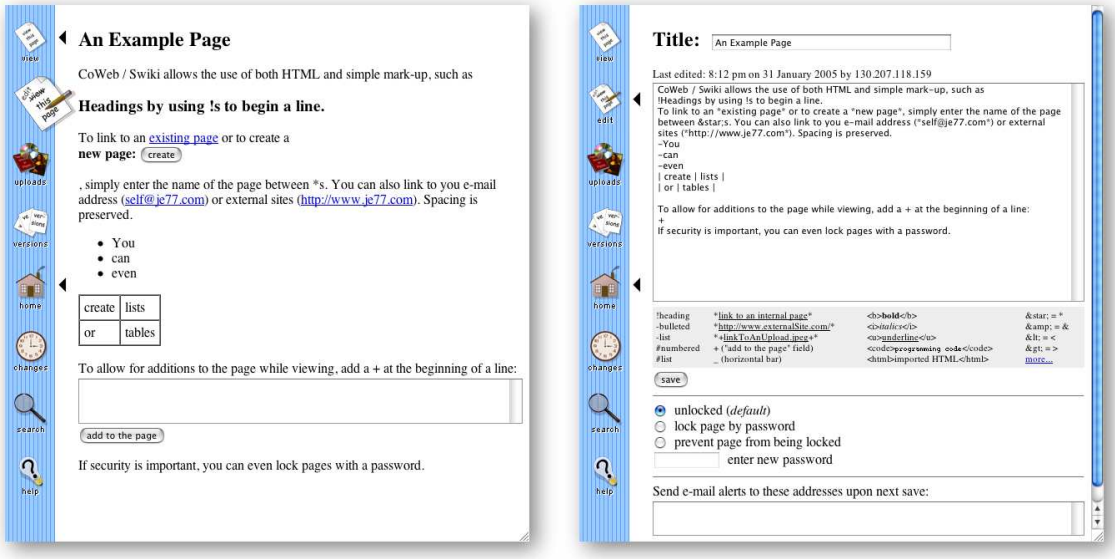


Figure 4: Viewing and Editing a CoWeb Page

topics and contexts. Second, unlike Wiki, CoWeb allows users to add arbitrary HTML. Georgia Tech users are comfortable writing HTML and wanted to use that knowledge. Third, there is more support for multimedia. Users can easily attach images and other files. Finally, CoWeb enables site-specific customizations. This was particularly important as CoWeb was adopted in a variety of academic disciplines (Guzdial et al., 2000). To support engineering and mathematics classes, specialty code was added to facilitate the sharing of Matlab code. To support architecture classes, design gallery spaces were created for students to more easily display their work.

For the most part, like Wiki, CoWeb allows for collaboration without accounts and passwords. As one faculty member commented: "I just like the interaction that it enables. It's basically a white-board that everyone can write on. Protections are always kind of a pain." On top of being an interface problem, unequal capabilities influence which roles users play rather than allowing the roles to develop through the social process; this is particularly important for roles that are ill defined. Roles, such as site organizers, often evolve through social processes; they could not have been envisioned *a priori* (Guzdial et al., 2000). Where CoWebs strays from the principle of every user having the same capability is

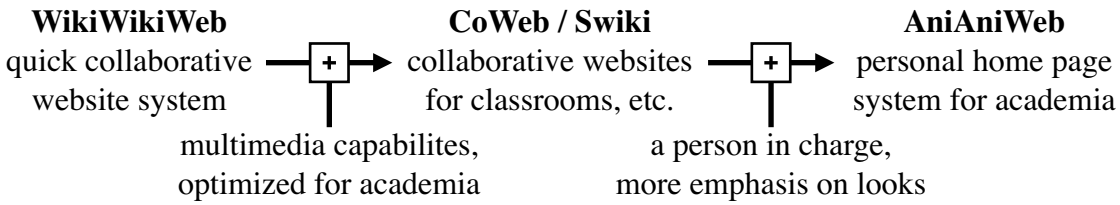


Figure 5: Origins of AniAniWeb

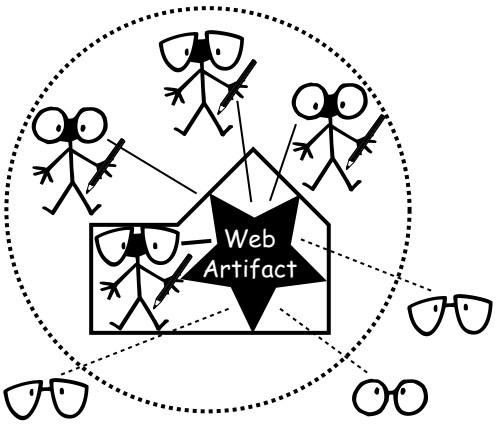
to assist when the natural social process has broken down. For instance, there is an administrator password that allows the password holder to unlock pages; this is most often used when a novice user accidentally locks a page that is clearly communal property.

2.2.4 From WikiWikiWeb to AniAniWeb

Though use of and research on wikis has focused on purposes other than personal home pages, they provide interesting mechanisms for facilitating interaction. Their use has demonstrated that a simple, trusting approach to access control can be effective with few instances of abuse. Wikis demonstrate a best-practice approach to facilitating powerful (going beyond accessing and addition to editing) interaction with a lightweight system. AniAniWeb extends a WikiWikiWeb approach to personal home pages.

Figure 5 diagrams how AniAniWeb evolved technologically out of WikiWikiWeb. AniAniWeb was built on top of the CoWeb platform, inheriting many of its properties. This had several advantages. First, AniAniWeb inherits the wiki properties (content focus, an easy publication cycle, and collaborative editing) that address the limitations of static pages. Second, as the designer of CoWeb, I could easily extend it to create AniAniWeb. Third, as students at Georgia Tech are already familiar with CoWeb, the learning curve is low and it is easy for students to adopt.

While wikis address many of the problems of static pages, they bring up new ones. First, their aesthetics are different than those of personal home pages. A personal-home-page system needs to place more emphasis on looks than a wiki normally provides. Second, wikis are too democratic. A personal home page is about one person; it makes sense to give



AniAniWeb: Home Model
Simple Layered Access

AniAniWeb recognizes three user groups: owner(s) of the site, signed-in users, and anonymous visitors. Any visitor can create an AniAniWeb account to become a signed-in user. In the intial version, an owner could determine two access control settings: 1) whether visitors can see a page and 2) whether users can edit a page.

Figure 6: AniAniWeb's Access Model

that person more power than others have.

In the design of AniAniWeb, I tried to balance the openness of Wiki with the safety of static pages. The model needed to be simple enough so that users could understand and navigate it, yet powerful enough to afford a variety of uses. I chose a home model with simple layered access (Figure 6). This model was inspired by the common analogy of a personal home page being a *home* on the World Wide Web (Döring, 2002; Erickson, 1996; Seabrook, 1995). As with a home, there is an owner with power, but that owner can give meaningful access permissions to others. To encourage *ad hoc* interaction, any visitor could become a contributing member, but she had to identify herself. This barrier was erected to prevent malicious use, such as that caused by *wiki spam*.[2]

When Ward Cunningham was naming WikiWikiWeb, he named it after the Wiki Wiki Buses that shuttled people around the Honolulu airport (Leuf & Cunningham, 2001). "Wiki wiki" means quick in Hawaiian Creole. The quickest way to build a website is to invite anyone who visits the site to also contribute content. To honor its origins in WikiWikiWeb, the software was named AniAniWeb. "Aniani" means mirror in Hawaiian Creole.

[2]Wiki spam is a fairly new problem that negatively impacts the use of wikis. While wiki users, even those randomly visiting a site, tend to be well behaved, this is not true for robots. Recently, disreputable individuals have started to use web crawlers to advertise their sites. These crawlers find a wiki and litter it with links to the advertised sites. Occasionally, this is done as advertising. More commonly, this is used as a ploy to artificially increase the rank of their site for search engines.

> Mirrors, literal and metaphorical, play an important role in human development. In literature, music, visual art, or computer programming, they allow us to see ourselves from the outside, and to objectify aspects of ourselves we had perceived only from within. (Turkle, 1984, p. 155)

If a static personal home page is like a photograph of an individual, AniAniWeb is more like a mirror. It is not as polished, but it is more alive. It is constantly changing and there are things happening in the background. Reflection is key. Through the process of writing hypertext, an AniAniWeb adopter should be able to reflect on his understanding of who he is in the same way that a musician reflects on his feelings through playing his instrument (Boesch, 1997). As designer, my aim is to create an instrument that is good enough so that an adopter can form a relationship with it the same way that a musician forms a relationship with his instrument.

2.2.5 AniAniWeb

Like most wikis, AniAniWeb is an entirely server-based system; all that is required to use AniAniWeb is a regular web browser, like Internet Explorer or Firefox. This makes it extremely accessible. It can be used in the office, at home, at a conference, at a kiosk, etc. All that is required is Internet access and a keyboard.

When first viewing an AniAniWeb, it looks like a regular home page. From a viewer perspective, it is a little bit better than a static site: It shows recent changes, it is searchable, and each page can be rendered for printing. But, from an observer's perspective, it is fundamentally a normal site. The difference is that there is a "sign-in" button. On that page, you can create an account using a valid e-mail address. Once you have an account, you can sign in. When you sign in, the site more closely resembles a wiki or, more precisely, a CoWeb (Figure 7). You can upload documents. You can see the history of each page over time. Most importantly, you can press the "edit" button; from there, an HTML form allows you to edit the page using CoWeb's simple mark-up language (Figure 8).

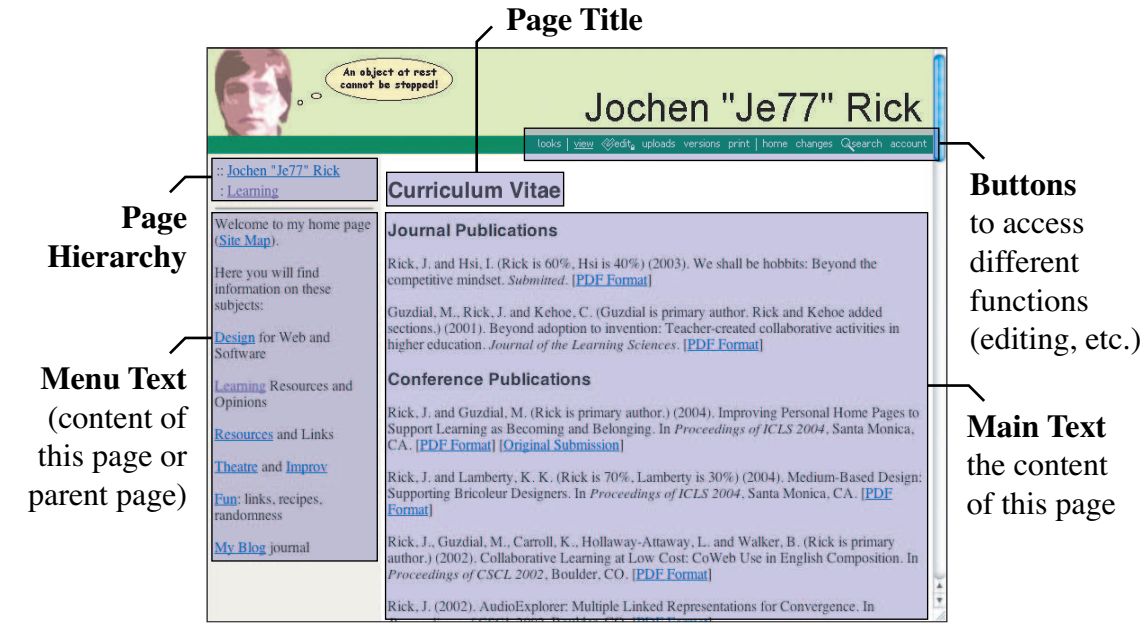


Figure 7: Anatomy of Viewing an AniAniWeb Page

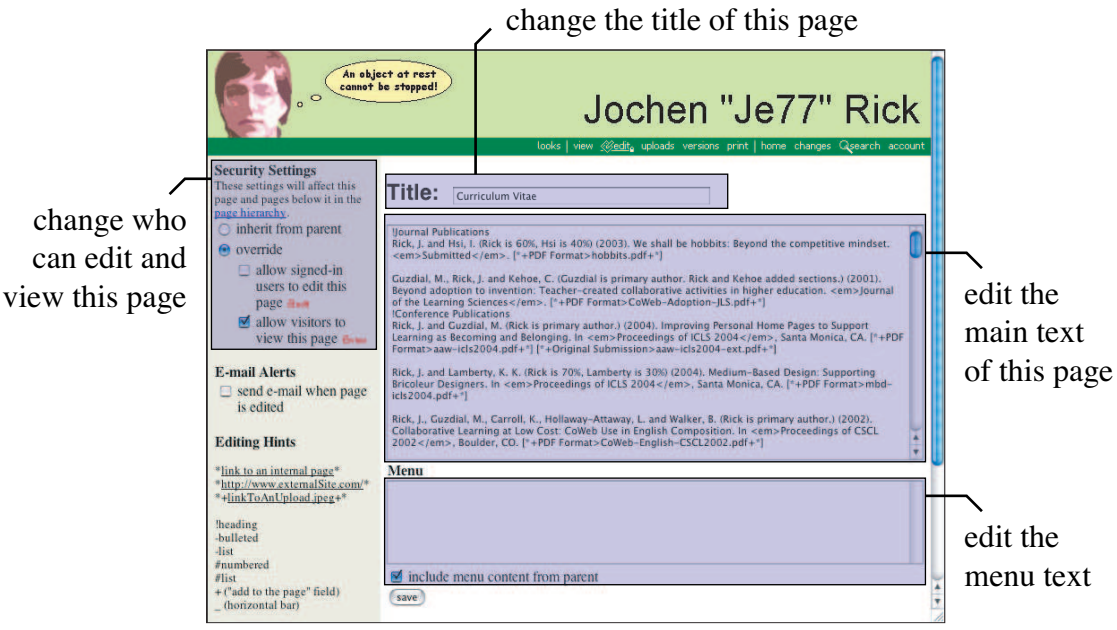


Figure 8: Anatomy of Editing an AniAniWeb Page

There are a few key differences between AniAniWeb and WikiWikiWeb. First and foremost, AniAniWeb grants extra power to the owner of the site. She is the only user who can change the site's appearance. She is the only user who can move or delete uploaded documents. She is the only user who can change the access control (Figure 8). The version of AniAniWeb used at the beginning of this research allowed for fairly simple access control. Everyone accessing the site is classified into one of three categories: 1) an owner of the site, 2) a signed-in user, or 3) an anonymous visitor. Owners control two access properties for a page:

1. Whether anonymous visitors can view the page (anonymous visitors cannot edit a page)

2. Whether signed-in users can edit the page (signed-in users can view any page)

Initially, a more extensive access system, inspired by Unix file permissions, was attempted; however, designing a lightweight interface for that system became an insurmountable obstacle. After failing to realize that design, I decided to start with a simple system. One of the key lessons of Wiki's success is that a simple system can trump a more sophisticated system (Bryant et al., 2005). Through this research, I was ultimately able to develop a more flexible system, largely driven by user needs. While the initial system proved to be less than ideal, it was sufficient to allow AniAniWeb adopters to reflect on their needs. Section 6.3.3 details the new access-control system and grounds it in the research observations.

Second, AniAniWeb features a page hierarchy (Figure 7). When new pages are created, they automatically mark the page they were created from as their parent page. When viewing the new page, the page hierarchy shows a link to the parent page. This feature helps users navigating the website. It also allows pages to inherit appearance and access control from their parent. So, owners can change the appearance or access control of large sections of their home pages with minimal effort.

Third, AniAniWeb supports multiple columns. It has become standard for many professional sites (and many personal home pages) to feature multiple columns. Typically, a smaller left column is used for site navigation and a larger right column shows the main content of a page. AniAniWeb dictates this format (Figure 7). As the navigation column, the "menu text" is set up so that it can be inherited from its parent page.

Finally, AniAniWeb puts more emphasis on appearances. Most wikis will never be mistaken for a professional website; they are too plain. Wikis are designed to place value on collaboration. Collaboration is inherently messy; therefore, a polished-looking wiki is counter to the wiki aesthetic (Leuf & Cunningham, 2001). The appearance of a personal home page is more important. It represents someone's identity; aesthetics can be essential to conveying a good first impression (Kress & Van Leeuwen, 2001). An academic personal home page's aesthetics should positively reflect its owner. To better support aesthetics, AniAniWeb allows users to upload a few key graphics and modify the style sheets to easily change the appearance of all or part of their site (Figure 9).

Designing usable web applications is an art-form that relies heavily on rules of thumb and best practices. There are numerous websites dedicated to web design, including Jakob Nielsen's *useit.com*. Nielsen recommends focusing on content and presenting that content in a usable, standards-compliant manner. Conventional home-page tools are open ended; they allow users to create sites that are neither content focused, nor usable. In contrast, AniAniWeb adopts a Nielsen approach—supporting users in creating content-focused usable home pages.

To support content creation, AniAniWeb focuses users on the creation and organization of content, rather than appearance. For example, to support usability, AniAniWeb creates a standards-compliant usable site. AniAniWeb can be viewed on a small 800-by-600 (SVGA) display. While a vast majority of users have larger displays, there is still a chance someone is viewing the site with an SVGA display. Visitors will also already be familiar with AniAniWeb's two-column organizational scheme, supporting their browsing of the

In AniAniWeb, looks are largely independent of page content. To change the look of all or part of their site, an owner updates a style sheet and uploads key images.

Figure 9: Customizing the Appearance of an AniAniWeb

site.

AniAniWeb was inspired by WikiWikiWeb, but its design is also influenced by blogs (Hacker, 2003). Blogs, also known as weblogs, are journal / diary systems commonly used to create personal sites (Nardi et al., 2004). Conceptually, blogs and AniAniWeb are similar. Both simplify the publication process and enable interaction.[3] Unlike wikis, AniAniWeb and blogs give more power to a specific user—the owner of the site. There are some key differences. Blogs primarily organize content by time. The front page of a blog features the newest posts to the site; thus, blogs focus visitors on new additions, which can be especially important to frequent visitors. In contrast, WikiWikiWeb and AniAniWeb primarily organize content by how pages are linked to each other. So, additions often do not impact the front page.

A system of plug-ins was created to integrate blogging features into AniAniWeb. These allow the user to embed dynamic elements into a page's text. The *changes* tag inlines the recent changes to the site. Embedding a changes tag on the front page can help recurrent visitors catch up on new content. The *calendar* tag embeds a monthly calendar with dates linking to pages. The *blog* tag embeds the page entries from a calendar into a page, allowing for AniAniWeb to act much like a blog.

2.3 The Case Study

In August 2003, graduate students in Georgia Tech's College of Computing began adopting AniAniWeb for their personal home pages. After a year of use, several of these adopters were asked to be participants in this research. In this dissertation, I report on their use, as focused by the three analytical lenses introduced in Section 1.3—media theory, communities of practice, and core identity theory.

This section details the specifics of this study. First, a synopsis of graduate life at the

[3]For research purposes, I view weblogs as a complementary source of research. Few academics use weblog technology for their professional sites. One of the few academics seriously considering weblogs is Jill Walker; her blog can be found at *http://jilltxt.net/*.

College of Computing is given. In design-based research, understanding the setting is vital to contextualizing the research findings (Hoadley, 2002). The College of Computing is shown to be an appropriate setting for studying the future of personal home pages in academia. Then, the data collection procedures are described and grounded in the research goals. Subject selection, instrument design, and the collection timeline are addressed. Finally, the methods of data analysis and reporting are introduced.

2.3.1 College of Computing

Georgia Tech's College of Computing (CoC) is a large (~80 academic faculty members, ~250 Ph.D. students) academic research unit of a technological university. It has a solid research reputation for expanding the scope of computing research. Most of my research participants specialize in areas, such as HCI (Human-Computer Interaction), that are concerned with the relationship between people and computing technology. These human-centric research fields are relatively new, and their faculty members tend to be young. As a result, many of the researchers in these fields have come to prominence in the Internet age. They are web-savvy enough to adopt new technologies. That may be one of the reasons why personal home pages are noticeably more prominent in this community than in related, but older, fields, such as electrical engineering.

The College of Computing is a social environment. The dress is casual. Graduate students and faculty members are on a first-name basis. The community values creativity and encourages a relaxed, collaborative atmosphere. As one example of this, many students take part in a "hanging milestone" tradition. For each significant milestone he completes towards a Ph.D., a student hangs some small themed item above his desk. This is a fun way to show how far a student has progressed. Students choose themes that are fun and personally meaningful, such as smiley faces, rubber ducks, or pictures of dogs.

Interaction between students is essential to graduate studies. Students interact in academic settings. There are seminars, lab meetings, CoC sponsored teas, etc. Doctoral students study together for the mandatory theory class. Students interact in social settings. There's a regular Friday-night happy hour that graduate students and (sometimes) even some younger faculty members attend. There are pot-luck dinners, parties, etc. Incoming students quickly form a community. They befriend their fellow students; this is important, as students often help each other make it through graduate school. Students regularly go to lunch with fellow students and discuss graduate life, research, classes, etc.

All first-year Ph.D. students are required to take an introductory class on graduate studies. In that class, they learn about the different areas of computing at Georgia Tech and how to pursue research in those areas. The main part of the class revolves around several small (~20 hours of work) projects that the students do with potential research advisors. As part of this class, every student is required to create a personal home page. At minimum, the home page will contain write-ups of the three small research projects.

To study the usefulness and meaning of personal home pages, CoC was chosen as the research setting. While there are several practical reasons for this, including ease of access and familiarity with the community, there are also three important intellectual reasons: 1) academia is a strong example of a community of practice, 2) there is an already established authentic need for home pages in this community, and 3) members of the community have the ability to be early adopters of technology.

First, academia, the academic community of practice that includes the College of Computing, is a strong one. It has a long history, established rituals, and an extended, formalized process for joining the community (Sumner, 2002). While even informal communities can be examined using the communities of practice framework, this context exhibits all the important properties that the framework was created to address (Wenger, 1998). In addition, academia, if by its size alone, is an important community of practice. This context provides a strong and important community of practice to study.

Second, in academia, there is a particularly strong need to construct and publish artifacts that present the person's identity to their research community. Identity is largely constructed and published through scholarly publication; academic reputations are made to a large extent by conference articles, journal articles, books, etc. (Sumner, 2002). Publication is so essential to academia that newcomers are often advised to "publish or perish." Publications reflect the identity (understanding of the field, position in the field, etc.) of their authors. The writing and publication of an article cannot be separated from the process of becoming central to the academic community of practice, as success in the former yields the latter. Similarly, the failure to publish can cause someone to be excluded from academia. Since personal home pages are publication tools (Section 3.1), academia is a particularly good setting to study them. The College of Computing, as a respected institution in its field, is an appropriate setting to study academia.

Third, the College of Computing is on the forefront of new technologies. Students are (or, at least, aim to be) experts in computing and are savvy in the adoption and use of new computer technologies. Personal home pages are an interesting, new medium; however, being new, they are still evolving. So, there is a need to study a context where this new technology (personal home pages) is already important and can be investigated. The College of Computing offers such a context. All students have a need to use personal home pages, even if they are only completing the assignments for the introductory class or posting their portfolio to the Internet. All have good access to the Internet and have minimal problems adopting the technology.

The first two reasons justify studying an academic community, but make no claim as to why the College of Computing is the right academic community. The third reason addresses why a community at the forefront of computing is worth studying. When situating a new medium, the aim is to leverage the energies and expertise of the adopters to understand the new medium. Graduate students in computing have the expertise to adopt personal home pages in interesting ways. Together, these three reasons justify studying the College of

Computing to address this topic.

While there are several theoretical and practical advantages to studying the College of Computing, there are also some accompanying hazards. One such hazard arises out of my position in the community. Being a member of this community had an important advantage: I could convince others to adopt AniAniWeb. Adopting a homegrown system for something as important as a personal home page can be risky. Taking part in this research required a significant commitment. Several potential adopters felt there was too great a danger that the software would disappear. For many adopters, their willingness to adopt AniAniWeb was based on their preexisting trust in me. While this enabled the research, it also made conducting the interviews more challenging. Conducting interviews with friends, acquaintances, and colleagues can be perilous (Seidman, 1998). These groups are vulnerable to be influenced by the preexisting relationship. To mitigate this risk, I took several steps: 1) All participants were asked the same set of base questions; 2) A second interviewer was used to address threats to validity; 3) Participants approved their case write-ups before they were published. Because of these steps and the generally benign nature of the research, the threat to validity posed by this problem was judged to be acceptable.

AniAniWeb was introduced to the College of Computing at the beginning of the 2003–04 school year. First-year Ph.D. students were actively recruited to adopt AniAniWeb for several reasons. First, as new students, they had a strong need to present themselves to others. Second, they needed to create personal home pages for the introductory class. Third, they were not already locked into another system. Though they were not heavily recruited, Ph.D. students further along in the program were given the same opportunity.

2.3.2 Data Collection

This research focuses on the use of AniAniWeb by its graduate student adopters. The primary data source I analyzed to achieve this understanding is the qualitative interviews with AniAniWeb adopters, based on their observed usage. To complement these interviews,

other data sources were collected. An early survey was administered to better understand the use of static personal home pages. Faculty members were interviewed to gain a better understanding of the community of practice.

Prior to data collection, the procedures for data collection, handling, and reporting were approved by Georgia Tech's Institutional Review Board (IRB). IRB ensures that the rights and welfare of human subjects are protected. For each data source, potential research participants had to complete consent forms before participating in the research. A consent form informs a potential participant about what is expected of them, possible risks involved in participating in the research, and how their confidentiality will be maintained. If subjects agree with the terms of research participation, they consent by signing the consent form. For the survey, consent was given electronically. For interviews, consent was given with written signatures.

What follows are descriptions of the data sources collected in chronological order. First, the survey was administered at the end of Summer 2003. Next, the primary student interviews were conducted from October 2004 to January 2005. Then, interviews with faculty members were conducted from January to February 2005. Finally, student follow-up interviews were conducted in April 2005.

To establish a baseline of how graduate students use and think about their static personal home pages, an online survey was carried out. This survey was administered before AniAniWeb was available to get a better understanding of the use of conventional homepage technology. Ph.D. students who had just completed their first year of coursework were asked to participate. Because of the introductory class, all had opportunity to use and adopt personal home pages. They were a homogeneous group, allowing me to investigate early issues of use and adoption in a cross-sectional quantitative manner.

Every first-year student was sent an e-mail, asking them to participate in the survey. The e-mail contained a brief explanation of the project and a unique URL to take the survey online. To increase participation, two rounds of follow-up messages were sent to those not

responding. Participants were asked about their background in Internet technologies, how much time they spend on their personal home page, for what activities they use their home page, and how they perceive others' home pages. The questions asked in the survey can be found in Appendix B. The results of the survey are detailed in Appendix A.

After a year of AniAniWeb use, several graduate students who adopted AniAniWeb were asked to participate in the research. Potential participants were purposefully chosen to reflect a variety of users, both in terms of their style of use and their progress towards a degree. Potential participants were sent informal e-mails informing them about the study and asking them to participate. Students were interviewed, based on an outline of questions, detailed in Appendix C.

Students were asked about their current home page, the evolution of their home page, how they view others' home pages, and specifics on their use and evaluation of AniAniWeb. This guide was augmented with questions arising from their home pages. The night before the interview, I closely examined the respective participant's entire web presence. For several students, this went beyond their AniAniWeb to include static pages and blogs. This examination took between one and two hours, based on the size of the website(s). Based on this examination, the guide for the student interviews was customized to address these additional points relevant to that adopter. Through this method, I was frequently able to address uses and activities that many adopters had forgotten about.

The purpose of these interviews was largely *ideographic*—focusing on understanding the individual participants in depth rather than as examples of a user archetype. This depth approach is necessary as many of the important issues of identity construction can only be realized with detailed qualitative data (Turkle, 1995; Erikson, 1963d). The subjects were chosen based on their high use of AniAniWeb. Their usage is not meant to be representative of average use. Instead, it aims to be representative of the potential and variety of personal home pages once further adoption of the medium is a given. The subjects were purposefully sampled to be extreme adopters of personal home pages, as studying extremes is a useful

for understanding the meaning of new media (Turkle, 1995).

The interviews were conducted it an open-ended clinical style (Seidman, 1998), to explore the adopter's relation to personal home pages. To minimize researcher bias, each topic covered was initiated with a broad neutral question, such as "tell me about your home page(s)." Interviewees addressed the topic without interruption by the researcher. If a follow-up question was warranted, the researcher would make a note of it and ask it later. The researcher paused for several seconds after initial answers; this technique often elicited further responses. After the broad questions were addressed, specific follow-up questions were asked. All interviews were videotaped. A computer was made available during the interviews, so that students could examine their home page(s) to better answer questions. The camera was positioned to capture both the face of the interviewee and the computer. The shortest of these interviews took 45 minutes; the longest took nearly two hours.

To supplement the student perspective, faculty members were interviewed. Faculty members are core members of and gatekeepers to the academic community of practice. These interviews sought to understand how faculty members perceive and interact with personal home pages of graduate students. Participants were asked about their home page and how they viewed other personal home pages. Appendix D is a guide to the topics / questions covered in these interviews. Particular emphasis was placed on the role of personal home pages during faculty hiring.

Unlike the student interviews, the emphasis was not on understanding the individual. Faculty members were purposefully sampled to chose members who played key roles during the faculty hiring process at Georgia Tech. Participants were recruited through personal e-mails. Like the student interviews, faculty members participants were videotaped for an open-ended clinical-style interview. The majority of these interviews were conducted in the participant's office. Even when that was not possible, a computer was provided for viewing home pages (and other websites) when necessary. The average faculty members interview lasted 30 minutes.

One of the problems with evaluating AniAniWeb through interviews is that I am both the interviewer and the developer of the system. This can be advantageous as I have the expertise with the system to follow up on comments made about it. It does however have one disadvantage—participants may not want to criticize the system when talking to its designer. This may adversely affect the validity of the findings.

To compensate for this, follow-up interviews were conducted with the two students (MDN and PWM) who used the system in the most innovative ways. Students were interviewed by Allison Tew, who has no affiliation with the design of AniAniWeb. These interviews were structured the same way as the other student interviews. The interviews concentrated on the AniAniWeb system. Appendix E details the topics covered during these interviews. Due to the limited nature of these interviews, they were short; both interviews lasted less than 20 minutes. Practically, these interviews simply supported the findings of the primary interviews.

A few other sources were used to complement this data. In Section 3.2.2, I use server log-file analysis to show how much time a student spent on her home page and how many visitors came to her site. Log-file analysis is further used to support the claims in Chapter 4. In addition to the formal observations, informal bug reports and comments informed the evolution of AniAniWeb. More users adopted AniAniWeb than were asked to be research participants. While they are not research subjects, their comments and my informal observations of their use did inform the design of the system. For instance, by examining all the AniAniWeb sites, it was obvious that the AniAniWeb looks system was not being utilized as expected. As extreme adopters, the research participants used the system; therefore, this observation could not have been made by only considering their use.

As is common to design-based research (Brown, 1992) and case studies (Yin, 2003), this research employs a mixture of different data sources. The purpose of gathering the data is both formative and summative; it informs both the design of the system and the research. While the research focuses on the qualitative interviews, quantitative measures,

such as the survey and log-file analysis, were used to complement that data. In trying to understand the evolution of a student's home page, the research is longitudinal; however, as the time-frame of dissertation research did not allow studying a student for their entire graduate school tenure, the research is also cross-sectional, analyzing students at different points in their schooling.

2.3.3 Data Analysis and Reporting

The primary sources of data for this research are the student and faculty member interviews (~700 minutes of video tape). To aid playback, the videos were transferred to a computer. Using the computer versions of the videos, the interviews were summarized on a point-by-point basis. When a sentence was particularly evocative or well phrased, it was additionally transcribed. These summaries were then analyzed to find broad themes that addressed personal home pages in academia.

By reading repeatedly through the summaries, I selected several potential themes that reoccurred throughout the data: self as important, personal versus professional, stalker things, different audiences yield to different expectations, revisiting the technological theses, access control, other AniAniWeb improvements, in academia, textuality as identity formation, reaction to audience, the role of technology, innovative uses of technology / creativity, self use / organized repository of content, playing with media, collaboration / interaction, use strategies, and limitations. Multiple copies of the interviews were printed. For each potential theme, the lines relevant to that theme were highlighted in one copy of the interviews. At times, themes substantially overlapped and were combined into a broader theme (e.g., matters of collaboration were integrated into a uses theme). Thus, the themes evolved iteratively until several larger themes remained: in academia, properties of media, constructing self, and access control.

These broad themes were then broken into smaller coherent parts that covered the larger theme. The "in academia" theme was broken down into use over time, the expectations of

a professional home page, and the software needs in academia. The "properties of media" theme was broken down into audience, use, and constraints on use. The "constructing self" theme was broken down into the power of text and the integrating self epistemology. The "access control" theme was broken into abuse, prominence of information, access to information, solutions, matching expectations with reality, and what the new version of access control does not do well. In addition to being driven by the concrete data, the selection of themes and their breakdowns into parts was influenced by the three analytical frameworks introduced in Section 1.3.

Social aspects of personal home pages are reported on in Chapter 3 and analyzed through the lens of communities of practice. The "in academia" theme gathered all the data that was specifically influenced by academic practices. That broad theme was further broken down by elements that communities of practice suggests are important to understanding a community of practice. Communities of practice places an emphasis on understanding the role that the artifact plays in the community (Wenger, 1998). So, personal home pages are viewed as a form of publication (Section 3.1), by the expectations that academics have of them (Section 3.3), and by the software needs that academics have for them (Section 3.4). Additionally, communities of practice places emphasis on how the role of a person changes over time (Lave & Wenger, 1991). So, Section 3.2.1 focuses on how the use and meaning of an academic home page changes over time. Two cases, MG and PG, demonstrate how the meaning of a home page changes depending on the community of practice and the adopter's position in that community.

Individual aspects of personal home pages are reported on in Chapter 5 and analyzed through the lens of core-identity theory. Core identity theory holds that it is important for people to actively construct who they are (Erikson, 1963a, 1968). As reflective tools (Bers, 2001; Turkle, 1995), personal home pages can be a natural medium for adopters to actively construct their identity and to get feedback about who they are. Since core-identity theory concentrates on the individual, this chapter is grounded in three individual cases: CM, TI,

and RY. Additionally, two larger themes that influence identity construction are synthesized from these. Section 5.3 focuses on the power of text for constructing identity. TI and RY are different examples of how the textual nature of personal home pages facilitates identity construction. Sections 5.6 and 5.7 analyze the implications of the multiple audience problem for how people think of themselves.

Those aspects of personal home pages in academia not covered by the other two frameworks are reported on in Chapter 4. They are organized through the lens of media theory. As the meaning of a medium is determined by its use (Gitelman, 2006; Tenner, 2003), it is important to characterize that use. As personal home pages are primarily a publication medium, that use can be further broken down into addressing audiences (Section 4.1) and authoring content (Section 4.2). While it is important to look at established use, fringe use can often be important to determining the future development of a medium (Bijker, 1995; Gitelman, 1999). Two cases, MDN and PWM, demonstrate how self use can be an important use for personal home pages. Since media are shaped by their constraints in addition to their affordances (McLuhan, 1964; Meyrowitz, 1985), it is important to focus on the limits of the medium in addition to the use of the medium. Section 4.5 examines the constraints that are on AniAniWeb adopters in academia.

Chapter 6 complements the findings of Chapter 4 by shifting the focus from the use space (how people use the new medium) to the design space (how the system can better support that use). It reflects on the important design decisions that went into AniAniWeb, based on the research findings. Additionally, it suggests possibly-fruitful directions for systems similar to AniAniWeb to incorporate.

2.3.3.1 The Individual Cases

Many of the themes are reported *en masse*. That is, the findings are reported broadly, without identifying the individuals who provided the responses. Even when a story about an individual is used, the individual is not identified, as this story is meant to be an instance

of a broader phenomenon. All of the findings from the faculty members interviews are reported in this manner, as understanding them as individuals is beyond the scope of this research.

While some themes were gleaned from broad trends across students and faculty members, others are associated with specific student adopters. While spotting trends that cut across numerous adopters is important, understanding the individual is vitally important to understanding a new medium (e.g., Turkle, 1995; Gitelman, 2006). To highlight the individual, cases are included that focus on individuals. To ensure anonymity, pseudonyms are used to identify individuals. The pseudonyms are based on the acronyms for the sections in which the individual is introduced; for example, the student introduced in the "Ph.D. Graduate" section is given the pseudonym PG. In addition, any specific material (i.e., screenshots) that could be used to easily decode the pseudonym is disguised. Below, I introduce the pseudonyms to show how they fit into the overall structure of the document.

Chapter 3 focuses on the role of personal home pages in academia. Particular attention is given to how that role changes as a a person becomes more central to the community of practice. Two contrasting experiences with home pages in academia are recounted:

PG (Ph.D. Graduate) is a graduating Ph.D. student. Her story focuses on how her home page evolved over her graduate studies. It serves as a model of how a successful academic home page is created, what it contains, and its use during faculty hiring. PG's home page played an important role in PG's path toward becoming central to her community of practice.

MG (Masters Graduate) is a graduating Masters student. Her story focuses on the role of her home page as she grew closer to graduation. This example contrasts with PG's experience. Whereas the main purpose of PG's page was to facilitate her job pursuits, MG chose to hide her home page from possible employers. The role of the personal home page is changed dramatically by the nature of the communities of practice its

owner belongs to.

While Chapter 3 is narrowly concerned with features of personal home pages in academia specific to academia, Chapter 4 takes a broader view of the use and meaning of personal home pages. It focuses on the audience for the home page and how that home page is used by its adopter. AniAniWeb is a new medium, with its own affordances. This chapter takes a look at some of the unique uses that AniAniWeb enabled:

MDN (My Digital Notebook) is a graduate student who adopted AniAniWeb as an information seeking and organization tool. MDN primarily uses the tool for himself, rather than to present himself to others. This level of self use is something that was not observed on static pages. His story demonstrates how new technology can change the nature of personal home pages.

PWM (Playing With Media)'s case provides an example of the flexibility and variety of home-page technology. Like the computer (Kay & Goldberg, 1977), personal home pages are flexible enough to emulate other media and create entirely new media. PWM is a great remediator—she invents new uses for her personal home pages.

While Chapters 3 and 4 concentrated on the community and the technology respectively, Chapter 5 focuses on the individual. The use of personal home pages says a lot about who one is to oneself, as well as to others. For each of three adopters profiled, the respective home page goes beyond being a simple tool; it serves as a mirror for constructing identity. Their experiences are detailed:

CM (Chocolate Milkshakes Candidate) is a Ph.D. candidate. As with PG, CM's home page was created for faculty hiring; however, CM's experience differs substantially from PG's. Though it may not be obvious to outside observers, CM's relationship with her home page is fundamentally different than PG's. CM chose to have her home page reflect who she is as a whole person, not just as a researcher. This had some unforeseen consequences.

TI (Textuality and Identity)'s story demonstrates the reflective nature of personal home pages. Creating a home page is largely a form of written composition—an inherently reflective process. Writing often helps us build understanding (Bereiter & Scardamalia, 1987). When that writing is about ourselves, writing can help us construct our identity.

RY (Recording Yourself) uses her home page to record who she is. While a home page can act as a mirror, it is more than a mirror. Specifically, it has a memory; therefore, it can be used to document one's history, opinions, priorities, etc. RY's home page is a reification of who she is. While this recording can occasionally take the form of dated journal entries common to blogs, more often it is structural, such as updating the trips she has taken.

These cases detail how individual graduate students relate to their home page(s). I have tried to frame these stories in a manner that is respectful to the adopters of AniAniWeb. When reporting on their use, my goal is to see their wisdom, feel their struggles, and understand their decisions as they adopt a new medium. These students are smart and web-savvy. While not all their decisions are wise or successful, I have tried not to dwell on those. Instead, I emphasize each of their strengths in understanding the new medium. As the pseudonyms used in this research are relatively easy to decode, it would be betraying the research participants' trust to focus on the negative.

2.3.3.2 My Role as Researcher

> We are all drawn to the sort of research and thinking that works best for us, that is most harmonious with the way our minds work. (Bates, 2005, p. 8)

To conclude this section on data analysis and reporting, I will acknowledge my own role as designer and researcher. My understanding and preferences form the foundations of this research, informing the design, research questions, data analysis, and reporting. One of

the main motivations for this work was my own interest in personal home pages, dating back to my first personal home page in 1995. The three analytical frameworks were chosen largely because of my studies in the learning sciences; if my background was in information science (Fisher, Erdelez, & McKechnie, 1995), I would probably have chosen frameworks (e.g., Zipf's principle of least effort) more aligned with that research tradition.

As a designer, I am what Turkle and Papert (1991) term a bricoleur—a tinkerer. I understand things by playing with them. I choose to have a close relationship with my designs. When I designed AniAniWeb, I was initially interested in creating a better personal-home-page system for myself. While I have tried to focus on others' needs when evolving AniAniWeb, my own use is still a major influence. I am the most prolific adopter of AniAniWeb: My home page has over 200 pages. My own use of AniAniWeb is essential to its design. Based on my usage, I have found and eliminated bugs. I have changed interfaces and features to better serve my needs. My method for understanding a new feature is to use that feature for a specific task. For example, to better understand the value of the polling functionality, I created a page on "How to listen to Neil Young."

On that page, visitors can vote for their favorite Neil Young album. I wanted to get a better sense of whether random visitors came across a page and how these visitors would respond to such a poll. In about two years of being available in an obscure section of my home page, over 500 votes have been registered on this poll. Several of these votes came from a single visitor. AniAniWeb polls allow the same visitor to vote multiple times; rather than respect the one-person-one-vote convention, this visitor took the opportunity to cast over 100 votes for *On the Beach*, his (and my) favorite Neil Young album.

One of the lessons learned from wiki research is that people will generally respect the contents of a wiki page and not edit it to violate social conventions. This does not seem to extend to polls; people occasionally vote an extreme number of times, defying social conventions. Perhaps, this is because it is so easy to vote multiple times. One of the more interesting characteristics of this incident was the excessive nature of the abuse. The visitor

was not simply sneaking in a few extra votes; he voted so many times that it was obvious, even comical.

Another instance of this excessive-voting phenomenon occurred when an AniAniWeb adopter was choosing a name for her research project. She created a poll and e-mailed her research group to pick their favorite name. After an initial equitable vote, a few lab-mates took advantage of the multiple votes to promote their preference. Their voting battle escalated, each registering several thousand votes for their choice. The war only ended when one competitor created a script to stuff votes; the script ended up breaking the poll system.

In both cases, the abuse was comical, rather than malicious or deceptive. In either case, it was obvious that the results of the poll no longer represented a cross-sectional survey. This excessive-voting phenomenon has not occurred for more serious polls, such as one I created to investigate future funding for graduate students. Perhaps, the serious nature of that poll better enforced the social convention.

These polling examples demonstrate the nature of my own experiments to understand AniAniWeb. The project-naming example occurred without my influence, so perhaps it the only example that can be considered valid research. Yet, the Neil Young example and the funding example complement that example. All three enable me to better understand polling on personal home pages.

In addition to influencing the design, my own understanding informs the research observations. I keep a close watch on AniAniWeb. I frequently check what adopters are doing with their sites. These informal observations largely determined the selection of participants for this research. They also informed the questions asked of students during interviews. Thus, their answers are influenced by my understanding of what is interesting about their usage. While I tried to be objective during the interviews, qualitative interviews are naturally biased by the interests and expertise of the interviewer (Seidman, 1998). Some topics may be promoted, while others are neglected. Similarly, my preferences came into

reporting on those interviews in this document. To lessen my bias, I have tried to frame my analysis through the analytical frameworks.

This document tries to accurately depict the experiences of AniAniWeb adopters, yet the sections are written by me. It is not possible for researchers to fully understand their subjects (Rosaldo, 1993). To ensure that I have not read too much into their responses, I have had participants comment on drafts of their case write-ups. I have then integrated these comments into the respective sections.

CHAPTER III

IN ACADEMIA

Academia is one of the first professional communities to adopt personal home pages; therefore, it is a particularly appropriate setting to study the use and meaning of personal home pages. Academics use personal home pages for many reasons. Some browse others' home pages to find inspiration for their own. Some use them to keep up with old friends. Some use them to distribute pictures to family. While these are interesting uses, they are largely orthogonal to the needs of academia. This chapter focuses on the practices of academia and how they affect the use and meaning of personal home pages.[1] Consequently, this analysis reflects both this community of practice and personal home pages. How and why are personal home pages used in academia? What features of home pages support academic practices?

This chapter consists of four sections. First, personal home pages are analyzed as a useful form of publication. In academia, publication is a core practice. So, personal home pages in academia are often construed as distribution channels, complementing and supplementing traditional publication. Second, the use is examined chronologically. The role of the personal home page changes as an adopter transitions from being an undergraduate, through graduate studies, to becoming a member of the faculty. Third, the expectations of an academic home page are detailed. While early academic home pages contained little more than contact information and a picture (Erickson, 1996), modern visitors expect (and usually find) more useful content (Agre, 2005). Fourth, the software needs of academic home-page adopters are analyzed. Those needs are framed in terms of the features that a software system should provide to better support personal home pages in academia.

[1] For a broader perspective on the use of personal home pages, see Chapter 4.

3.1 Informal Publication in Academia

In academia, we present ourselves to our research community largely through formal publication, such as conference or journal articles (Smith, 1999; Sumner, 2002). We build our academic reputations on these articles. We all heed the warning: "Publish or perish." The published articles act as proxies for our academic reputation; the reader engages us through our constructed artifacts.

Often, when I review or read an article, I find it useful to know more about the context of the article. Who is this author? What was her previous research? Which academic communities does she belong to? For established researchers, I tend to know the previous work and can thus better understand the current work. For relatively unknown researchers, such as graduate students, this requires a bit of work. My strategy is to perform a web search on the author. This usually leads me to their personal home page. If that home page is useful (and, in computing disciplines, it usually is at least somewhat useful), I can efficiently answer these questions to better understand the article.

Like the published article, the personal home page acts as a proxy. I could have answered these questions by engaging the author directly (for instance, through an e-mail exchange); instead, I engage the constructed artifact—the personal home page. Unlike direct engagement, the author is not aware that I have engaged their home page. Yet, it could have a real effect on my impression of the author as researcher. If I am acting as reviewer, it might even have a measurable effect on the author's academic reputation. Thus, though academics may not be aware of it, their personal home pages are important. In particular, they are important to graduate students who are still trying to construct their research identities. As Agre (2005) advises graduate students, "your home page is a projection of your professional persona—a way for people to know who you are as a member of the profession."

Creating personal home pages is very different from the lengthy, sustained argumentation of a scholarly article (Mortensen & Walker, 2002); compared to scholarly articles,

there is a larger focus on connections and small ideas. Publishing something on a personal home page is informal—it requires no peer review and can be done at any time. The provenance associated with formal publication is thus undermined (Gitelman, 2006). Yet, even informal documents can be important. For instance, when applying for an academic position, it is standard for candidates to include a curriculum vitae, a research statement, and a teaching statement; none of those documents goes through peer review.

While personal home pages may not replace formal publishing, they may compensate for some of its deficiencies. For instance, the barriers to formal publishing are often quite high, with the review process often censoring *controversial* or *immature* ideas (Smith, 1999). Scientific progress is often marked by revolutionary paradigm shifts (Kuhn, 1970). Because of their revolutionary nature, ideas from the new paradigm are initially regarded as controversial. Formal publication tends to censor these controversial ideas (Smith, 1999). As journals (and some conference publications) serve as the definitive source for knowledge in a community, immature ideas are rightly censored. Yet, writing helps people build their understanding (Bereiter & Scardamalia, 1987). Publishing that writing to an audience opens it up to critique that can further help to refine the ideas. Thus, even immature ideas deserve to be written and published (Smith, 1999); the personal home page can be a useful venue for this purpose.

Also, personal home pages offer a unique and interesting medium for publishing information. Compared to formal publication (peer-reviewed conference publications and journals), the barriers to publication are low, the time gap between construction and publication is virtually nonexistent, and there are few limits on content (Gitelman, 2006). Adopters can publish and link a variety of media (text, images, video, software, etc.) (Bolter, 2001; Groth, 1998). In addition, hypertext allows users to easily link to external content (Walker, 2002). In comparison, a conference paper is technologically antiquated. Personal home pages can provide their adopters a forum to reflect on their thoughts through composition and a way to distribute those thoughts in a meaningful manner.

Another advantage of personal home pages is their accessibility. Their content is available to anyone with a web browser. They are indexed by search engines. Pages are often interlinked in a coherent manner, allowing people to browse or skim the content to find what they are looking for with a minimum amount of effort. This browsing behavior is characteristic of web visitors, who tend to continue browsing a site as long as the value of the current page exceeds some threshold (Huberman, Pirolli, Pitkow, & Lukose, 1998). Hence, personal home pages may achieve their stature in academia by the *principle of least effort*: People invest little in seeking information, preferring easy-to-use, accessible sources to sources of known high quality that are less easy to use and/or less accessible (Zipf, 1949). Home pages are useful, because they allow busy academics to form an impression with a minimum amount of effort.

As a significant kind of (albeit informal) publication in academia, personal home pages are only starting to be acknowledged, utilized, and understood. For instance, formats for conference and journal articles in computing fields generally include the e-mail address but not the home-page URL of the author. The latter seems more useful than the former, because, at minimum, the home page contains the e-mail address. In addition, the home page contains other useful information.

3.2 The Role of Personal Home Pages Over Time

In this research, I examine the use of personal home pages in academia. While all members of academia are members of the community, they play different roles: undergraduate student, graduate student, faculty member, etc. One useful method for classifying and understanding these roles is through the framework of learning in a community of practice (Wenger, 1998). Each community of practice has its core practitioners; a successful learning trajectory for someone joining the community is to move from the periphery to the core (Lave & Wenger, 1991). In academia, this process is institutionalized through graduate school. Ph.D. students start as undergraduate students, at the far periphery, and may end

as faculty members, core practitioners in the field. While not all students move along this route, it is the model path. This section is about the role of the personal home page along that learning trajectory.

This subject is addressed in four subsections. First, the typical use of personal home pages along the ideal learning trajectory is chronicled and analyzed. That section is synthesized from the reoccurring themes in the student and faculty member interviews. Next, the adoption of personal home pages by a successful Ph.D. student is detailed; this case illustrates the standard use of personal home pages in academia. Then, the adoption of a masters student is detailed; because the masters student is on a different learning trajectory, her experience is strikingly different. Finally, the differences in the two experiences are reconciled by acknowledging that different communities view the same home page differently (sometimes radically so).

3.2.1 Use Over Time

As an undergraduate student, a person first joins the world of academia. For the most part, that membership is far removed from the academic research that is so core to academia. Because their practices and values are inherently different, the realms of academic research and undergraduate education are often entirely separated. The vast majority of undergraduates will not pursue academic research professionally. Yet, there are opportunities for some students to legitimately participate in academic research. At Georgia Tech, the faculty members who teach undergraduate classes are often active researchers; the interactions with them allow students to get a better sense of academic research. In Georgia Tech's College of Computing, the UROC (Undergraduate Research Opportunities in Computing) program supports undergraduates in conducting computing research.

While most undergraduates do not actively participate in academic research, they do often have home pages. Personal home pages and blogs are quite popular among undergraduate students, even if their use is not professional. At Georgia Tech, it is common for

an undergraduate student to create a personal home page for a class assignment. These pages tend to be simple, containing little more than contact information, a picture, or a class paper. A few even put their resume on their home page. One study participant was contacted (as an undergraduate) about a job opportunity, based on posting her resume to her home page. Another was contacted about a class paper she had posted to her site for a class assignment.

Because of such undergraduate experiences, a new graduate student may already have a personal home page. While the purpose and content of that home page is different than the academic professional home page, this beginning can affect how graduate students adopt personal home pages. A few graduate students build their professional site on this foundation. As content on personal home pages tends to stay around over time, these roots can continue to be important to that personal home page.

Professional home pages become important as a student transitions from being an undergraduate to being a graduate student. When applying to graduate school, students browse the home pages of faculty members to find out about their research interests. For doctoral students, the home pages of faculty members can be a good place to start finding a research adviser. At a minimum, home pages can act as a filter, allowing for some possibilities to seem more appealing than others. Home pages are particularly useful to incoming students as they can provide useful information before they arrive on campus. Once on campus, face-to-face interaction is a more attractive option. For instance, these home pages can inform students of what classes to take their first term.

For most students, graduate school is the first time to start thinking about having a professional web presence. As part of the "Introduction to Graduate Studies" class, College of Computing Ph.D. students create personal home pages, containing contact information and a picture. For the class, students complete three small (about 20 hours of work per project) projects with different faculty members. Here again, students may view the home pages of faculty members to find people to work with. When a student completes a project,

she posts the results of it to her home page. These home pages are also used by the other students to get to know their fellow classmates. As graduate school is a social process, forming connections with peers is essential. When AniAniWeb was introduced to a class of incoming Ph.D. students, several used its interactive features to connect with their fellow students. The College of Computing maintains a directory of graduate students on its home page. That page links to these personal home pages. Thus, these bare-bones home pages become the starting point for professional home pages in the future.

At this point, it is difficult for an adopter to know what to put on his professional home page. He realizes that senior doctoral students and faculty members have research projects, publications, and a CV on their professional home pages; however, as a new student, he does not have this content. In search of things to put on their sites, some graduate students list the courses they take. For a while after the introductory class, the home page stagnates.

The home page becomes important again after qualifying exams.[2] At that point, graduate students have proved themselves worthy of conducting research to the internal research community (the College of Computing). The focus then shifts to the external research community; it becomes essential for graduate students, as junior researchers, to connect with others in their research area (Agre, 2005). Students attend conferences, often presenting their work. It is common to give out and collect business cards at these conferences. Since a business card only contains basic contact information, it has become commonplace for researchers to include the URL to their home page. The receiver of the business card can then use the personal home page to find out more about the person. Because of this, graduate students often update their home pages before attending conferences. At this point, the professional aspects of the personal home page begin to become standard. Maintaining a professional home page becomes a standard thing to do. One informant mentioned giving out her home-page URL to students in classes she was teaching (as teaching assistant or

[2] At the College of Computing, the depth-based qualifying exam comes before the thesis proposal. Most students take the exam at the end of their second year or the beginning of their third year.

instructor). Some graduate students update their home page before applying for summer internships.

At faculty hiring time, the use of personal home pages has become standard. Students are advised to have their professional home page prepared when applying for an academic position. Some students reported being advised to do so at a doctoral consortium.[3] Commonly, online faculty applications prompt the applicant for a home-page link. Before sending in applications, a candidate posts his research portfolio (curriculum vitae, research statement, teaching statement, publications, etc.) to his home page. Faculty candidates also visit the personal home pages of faculty members at the institutions they apply to. While it is common to do this even before applying, this use is critical when preparing for an interview. Candidates research the history of the interviewers and other faculty members they will meet on their visit.

When a student transitions to being a faculty member, maintaining a professional home page continues to be important. It can be a good place for a new faculty member to present who he is to his new community (undergraduate students, graduate students, faculty members, etc.) and research area. New content emerges. Faculty members frequently list their doctoral students and the classes they are teaching on their home pages. A home page can also be used to distribute informal words of wisdom (teaching philosophy, contents of a dissertation, etc.). One Georgia Tech faculty member was contacted about possible funding, based on a project home page. While faculty hiring might be the most visible form of academic hiring, promotions, such as tenure review, also give incentive for adopters to update their home pages. Anytime it is up to others to evaluate your research, there is an incentive to polish one's professional home page.

The use of others' home pages also changes as one's position in the community changes.

[3] A doctoral consortium is an event, at a larger conference, for doctoral students reaching the end of their graduate studies. Student present their work to each other and senior researchers in that area. The doctoral consortium helps students forge connections to fellow researchers in that area and receive advice on the road ahead.

Since others post course content to their home page, it can be useful to borrow class material from these sources. To find out about students or faculty members, a home page can be valuable. One faculty member received an invitation to be a guest editor for a journal; he did not know the person who sent him the invite, so he used their website to find out more about them. Another faculty member was tasked with assembling a panel for a National Science Foundation program. He began with the author list from the proceedings of the appropriate conference. Then, he filtered these candidates by appropriate qualifications and research interests, based on looking at their respective home pages. In particular, he used the home pages to research people he did not already know.

One trend found in this chronological progression is a shift towards being more conservative (more reserved about personal content, separating personal and professional concerns, avoiding sensitive subjects, etc.). As the status of a person changes in the community, there is a natural incentive for more informal or personal (possibly embarrassing) content to be removed and a new emphasis on professionalism to become standard (see Section 5.2). The goofy pictures of friends that are acceptable (even popular) for undergraduates are out of place for senior faculty members. The often quirky and innovative visual designs of young researchers give way to content-centric faculty-member pages.[4]

Another trend is that content on personal home pages accumulates over time. Even when a home page is not being used, its content stays around. When the adopter has a reason to update the site, he or she will simply add content to the existing page. When the goals of the site change, the user will simply repurpose the old home page to meet his new goals. Most of the time, the content from the old home page stays around, even after it outlives its welcome. So, a new faculty member may have pictures on their site that are unprofessional by the standards of their new career position. Because of this, long-time home-page adopters often struggle with preserving their past while adapting to their new

[4]This trend may also be a function of previous experience. Younger researchers tend to be more web-savvy than their senior counterparts. Perhaps, as these researchers mature, they will keep their more stylized designs.

responsibilities.

This chronicle has been largely written from the perspective of what a home-page adopter does with their home page. In many of these scenarios, there is a corresponding audience use. A student puts a home-page URL on their business card, so that someone will visit. A faculty candidate creates a professional home page, so that the hiring committee can view it; faculty members on the hiring committee look for competence, research interest, and how engaging the candidate is. In both of these examples, the home-page creator anticipates the visitors and their corresponding needs. In other cases, visitors and their needs may not be anticipated. Because home pages do not give their owners much information about who visits their site, the adopter may not be aware of this mismatch. Section 3.3 returns to this topic, concentrating on the expectations that users have when viewing others' home pages.

This section synthesized the recurrent themes from interviews with College of Computing graduate students and faculty members to summarize how personal home pages are used over time in academia. To better serve the narrative, it is framed nomothetically—the account stitches together multiple experiences into a coherent whole. While that whole represents the state of personal home pages in academia today, it does not reflect anyone's particular experience. Because the meaning and use of personal home pages is rapidly evolving, this synthesized narrative cannot be accurate for any current individual on a long-term scale. Current senior faculty members did not have personal home pages as undergraduates, because the technology did not exist at that time.

To balance this nomothetic perspective, the next two sections detail individual cases. Where this section tries to abstract typical use across multiple experiences, these sections provide concrete examples of how a home page matures with the position of its adopter in the community of practice. The first case follows a Ph.D. student along the model path—from undergraduate student, through graduate school, to becoming an academic faculty member. The second case counterpoints this ideal by focusing on a masters student, who

is on a different learning trajectory.

3.2.2 Case: The Ph.D. Graduate

> "I think every student and faculty member should at least have this level of page." —PG

The road towards a Ph.D. and becoming core to academia is a formidable one. Many who travel it never make it to the end. Others face significant obstacles and setbacks. This is not their story. This is the story of someone who competently traversed the road and the role of her home page along that journey. This case demonstrates how an effective academic home page evolves, what it contains, and its role during academic hiring.

PG is a well organized and competent academic. She succeeded as a Ph.D. student. She published regularly. She has built social connections to other researchers in the field. She completed her dissertation work in a competent and timely manner. She mentored undergraduates and newer graduate students. She was well prepared for being a faculty member, the goal of her graduate studies.

As she was getting close to graduating, she realized that she needed a professional home page. While she had a static page, it needed a major overhaul. Conveniently, AniAniWeb became available at that time. As the technology could serve her needs, PG chose to be one of the first to adopt AniAniWeb. She wanted a home page that was easy to edit and had a professional look; AniAniWeb met those criteria. As she was familiar with CoWeb and its formatting syntax, making the transition to AniAniWeb was trivial.

Figure 10 displays the time PG spent on her home page over time.[5] At its inception, in August 2003, PG spent significant time copying information over from her static site, updating that information, organizing the site, and creating a serviceable look. Next, she

[5]The time was calculated through log-file analysis. The log file records hits to the site—who accessed the site when. To estimate how much time PG spent on the site, a simple formula was followed: When PG accessed the site twice within 5 minutes, it was assumed that she spent the time between the hits working on the site. While this is not a precise measurement, it gives a good indication about how the use changed over time. Upon inspecting the data, PG affirmed the accuracy of the results of this technique.

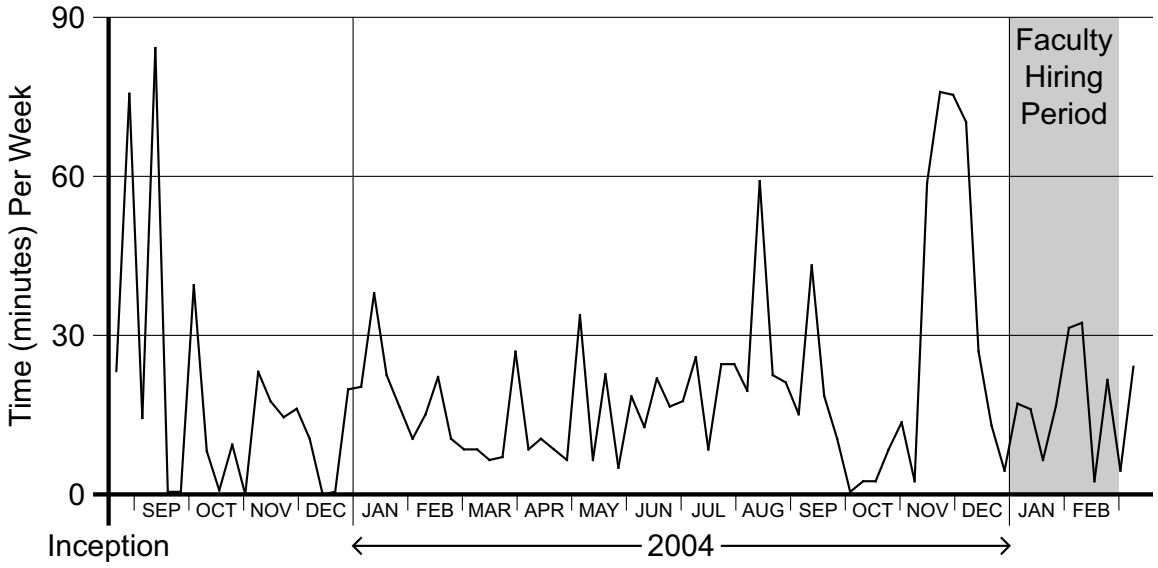


Figure 10: Owner's Time Spent over Time

replaced the contents of her static site to automatically forward visitors to her AniAniWeb.

After its initial design, the site evolved based on everyday needs. For example, she needed to update a page describing a research project. The page was a static page. Because it would be easier to edit the page on AniAniWeb, she moved the page to her AniAniWeb, integrating it into the structure of her home page. Then, to balance the site, she created pages to describe her other research projects. To organize these, she created a research overview page; this page would become the foundation for her research statement.

In summer 2004, she spent a considerable amount of time updating the looks of her site to match the new AniAniWeb look (see Section 6.3.2). In late fall 2004, PG updated her site to prepare for faculty hiring. She updated her curriculum vitae. She added links to publications. When she finished her research and teaching statements, she posted them. She also finished the summaries of her research projects, adding screen-shots to the textual descriptions. PG anticipated that possible employers would visit her home page; therefore, she designed her home page to present herself as a competent and interesting researcher. The content of her site reflected her understanding of the best way to do that; accordingly, she recommends that every academic should at least have her "level of page." During

the hiring period, she did not access the site much, except to communicate with her letter writers about where to send reference letters.

Unlike other research participants, PG made the conscious choice that hers would be a strictly professional home page. The intended audience was her fellow researchers. Outside of her professional activities, her home page contained little information. While she had considered adding a page about her hobbies or trips she had taken, she never did. When a member of her research group added a script that showed how many days and hours remained until PG's birthday to her front page, she promptly removed it; the countdown was not professional enough to belong on her home page. In person, PG often integrates her personal and professional life. She has an outgoing personality, reflected in her large social circle of fellow graduate students. She deliberately befriends her lab-mates. When one of them added the birthday countdown, it was perhaps with this integrated PG that he was communicating. That the site only presented one aspect of PG, an otherwise integrated individual, caused the *faux pas*.

While PG chose to present herself as professional, she found a way to do that without being dry. First, she designed the look of the site to showcase her cheerful side. While it was appropriate for an academic home page, the look was more playful than most. Second, she prominently featured a small research project on digital picture frames. PG created a web interface to a digital picture frame that visitors could access through her home page. Visitors could upload digital pictures through the web interface that would then appear in the picture frame sitting on PG's desk.

The picture frame served two purposes. First, as it was featured on her home page, people were likely to run across it, thereby facilitating the research on image sharing. PG frequently visited the page to check what others had contributed. Second, it quickly and creatively demonstrated PG's research interests in human interfaces for new technologies. While the content of the picture frame was often added by friends, the primary reason for it to be on the site was as an indication of research interest. In that way, PG was able to show

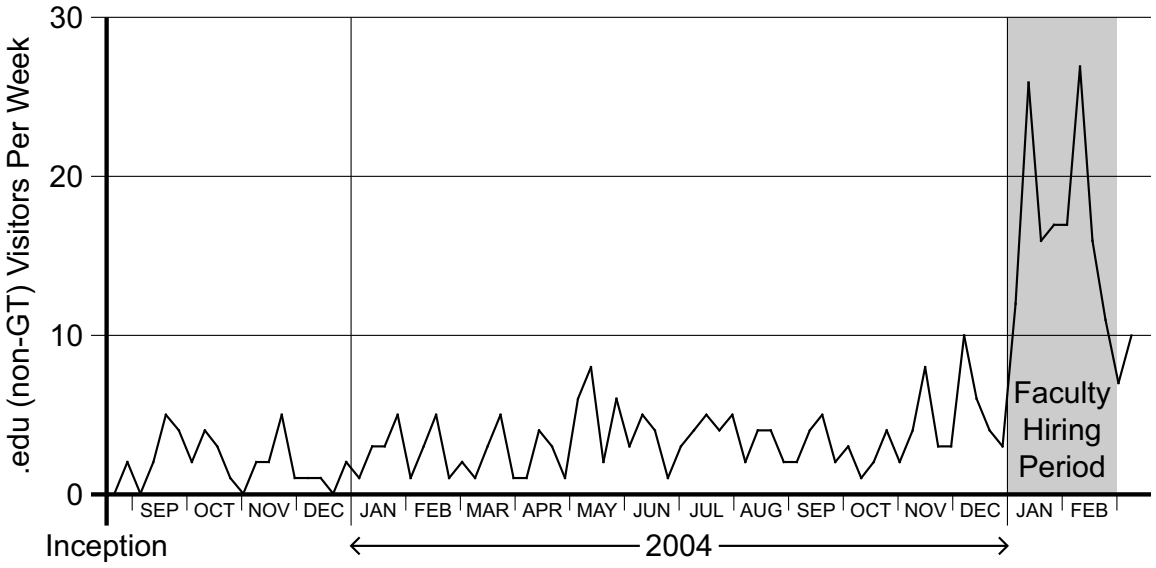


Figure 11: Academic Visitors over Time

off her personal side in a professional manner.

Unlike face-to-face interaction, it is difficult to know with whom you are communicating through your home page. Besides cryptic entries in server log-files, web users seldom leave evidence of their visit. Even if a home-page owner has access to the log-files, deciphering their meaning can be difficult. So, most people only have a fuzzy notion of who visits their website. The same is true for PG. Once in a while, people mention that they have visited her page or follow up through e-mail. Since PG's site is interactive, an occasional user will edit a page or add a picture to the picture gallery. Yet, these visible indicators only account for a small percentage of the hits to PG's home page.

Figures 11 and 12 display how many people visited PG's home page. Figure 11 shows how many distinct I.P. addresses, coming from educational[6] domains, visited PG's site every week. As seen in the figure, the number of academic visitors spiked from January to February, 2005. That period of time roughly corresponds with the academic hiring cycle

[6]Visitors were considered academic if their I.P. address resolved to a top-level domain of "edu." This indicates that these visitors were using a machine at an academic institution. As this analysis focuses on faculty hiring, internal visits from Georgia Tech were excluded.

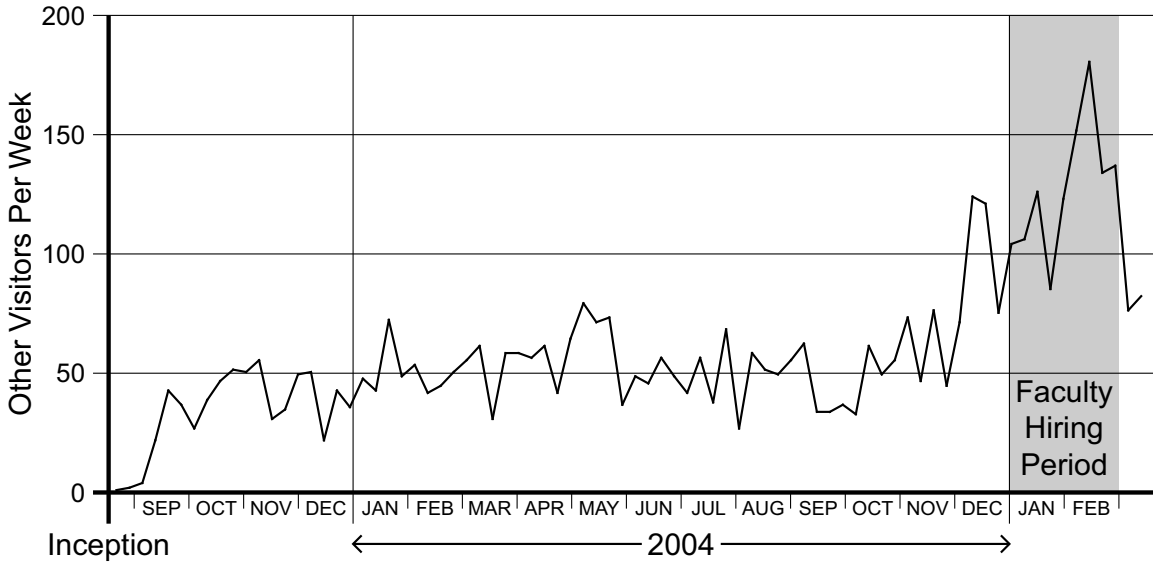


Figure 12: Non-Academic Visitors over Time

(i.e., when academic institutions assess faculty applications and invite candidates to interview). As PG had expected, potential employers checked out her home page. As she later reflected, "it was very clear that others read it during hiring." While Figure 11 demonstrates that the site received more hits by academic visitors during the faculty hiring period, the absolute numbers are perhaps a bit misleading.

Several of the faculty members interviewed for this research remarked that they viewed home pages for faculty hiring from their home machine. As hiring committees are assessing several hundred applications, accessing the portfolio through candidates' home pages is convenient: The committee member is not forced to carry around the bulky paper portfolios. For that reason, it is likely that many of the hits not from educational domains were still related to hiring. In addition, PG applied to several research laboratories; those visits would not be marked as educational even if the potential employer was accessing the home page from his work machine. Figure 12 graphs the visitors to PG's home page that did not come from an educational domain. Again, there is a marked increase in visitors after PG submitted her job applications in early December, 2004.

Before the job applications were submitted, her home page received approximately 50

non-academic visitors per week. After the applications were submitted, the number of non-academic visitors nearly doubled for a period of almost three months. That suggests that about 50 visitors per week visited PG's home page for faculty hiring. When PG first created her AniAniWeb, she did so with the anticipation that a good professional home page would be beneficial to her academic career. Considering the number of visitors to her site during the faculty hiring period, there's good reason to believe that she was correct.

PG succeeded in her job search. She interviewed for several positions, received multiple job offers, and accepted a faculty position at a research university. When she left Georgia Tech, she took AniAniWeb with her. She set up an AniAniWeb server to host her new home page. The new home page continues her preference of separating her professional and personal life. If anything, it is more professional than the Georgia Tech version. The primary audience for her new home page is her undergraduate students. As a young faculty member, she feels it is important to appear professional. She wants to be perceived by her students as a faculty member, not as a fellow young person. Consequently, she does not want students to know about her personal life.

3.2.3 Case: The Masters Graduate

> "Should I really have a professional site?" —MG

As PG's case illustrated, a Ph.D. student in computing benefits from having a professional web presence. The professional home page is particularly useful when applying for academic positions; potential employers visit the personal home page to find out about the candidate. Does the same apply to masters students? In several ways, masters and doctoral students are similar. The term graduate student refers to both masters and doctoral students. They take the same classes. At the College of Computing, both masters and doctoral students are (by convention) on a first-name basis with the faculty members; in contrast, undergraduates traditionally refer to faculty members by their title (e.g., Dr. Smith). Both are in the academic community of practice. But, as is illustrated by this case, the meaning

of personal home pages to masters students is quite different.

MG is a masters student in human-computer interaction (HCI), a specialization of computer science. She has been creating web content since the beginning of college and has a large personal home page. She has familiarized herself with HTML and CSS. Because of her interest and skill, she designed her church's home page. After graduation, she wants to become a professional website designer, applying HCI principles to increase the usability of a site. Often, websites are primarily designed to be visually engaging. There is a strong tradition in HCI, best espoused by Jacob Nielsen's *useit.com* website, that usability is vitally important to the design of websites. MG is particularly interested in making sites accessible to blind users, whose needs are often neglected by visually-focused designers.

As MG approached graduation, she began contemplating her home page from a professional perspective. Like PG, she felt that her home page could play a significant role during her job search. Unlike PG, MG is not looking for an academic or research position. Consequently, her home-page approach is significantly different. As a career fair approached, she began working on a professional site. She failed to finish the website in time for the career fair and then lost the motivation to complete it.

First, she realized that it was unnecessary; employers at the career fair were not explicitly expecting one. This contrasts directly with PG's experience with academic employers, who often prompted for a home-page link. Second, MG began to have reservations about publishing her portfolio. While she would have enjoyed demonstrating her web design skills, the content proved problematic. Her previous work was largely proprietary. While she felt authorized to summarize the work on a resume, publishing that resume so publicly might be inappropriate. At minimum, she could not expand upon the details of the work. Unlike a doctoral student, she had no publications or major projects as content. At best, the site would simply be a rehash of her resume. As MG values content over form, such a redundant site would not accurately reflect her design sensibilities. This lack of supplemental content may partly explain why employers generally do not expect a home page from

an undergraduate or masters graduate: The home page does not add much to the standard resume.

While MG is capable of creating a professional home page, she never did. Furthermore, she went to some effort to hide her personal home page from potential employers. After failing to create a professional home page, she reconsidered her fairly extensive AniAniWeb: "Unfortunately... I've been thinking about 'do I really want to be found?'... The answer is yes and no."

From a personal perspective, she is content to have friends, family, and colleagues stumble onto her home page: "I don't mind others looking at it, but it's not meaningful to them... No one cares what my homework is for this week, besides me." MG's AniAniWeb is designed for herself and not for these audiences; however, MG is happy to be found by a member of this audience. When an old friend contacted her through the site, she felt good about it.

From a professional perspective, she does not want potential employers to access her AniAniWeb. While there is nothing controversial or deeply personal on there, she would still rather not have employers evaluate her professionally on that basis. Because some employer run web searches on potential employees, she began taking steps to hide her home page. When she did a Google search on her full name, her AniAniWeb was ranked highest. Because of their built-in cross-linking, AniAniWebs, like Blogs (Walker, 2002), quickly gain a high Google ranking. While this is greatly appreciated by doctoral students who want their professional home page to be prominently associated with their name, it could be problematic for MG.

To hide her page, she first changed the name of the front page[7] from "FirstName LastName's AniAniWeb" to "FirstName's AniAniWeb." This proved ineffective—her site was still ranked prominently. Because the site URL was based on her last name and the title

[7]In AniAniWeb, the name of the front page is also the name of the site.

based on her first name, Google still associated her full name with her AniAniWeb. Deducing this, she removed her first name from the front page. This worked, moving her AniAniWeb satisfactorily down the search results. Eventually, MG created a separate site that contained her contact information and a movie she made for a class project. She designed this minimal site to be acceptable for employers to stumble across. While she made no point in promoting this site, she explicitly considered the most important audience for that site.

PG and MG were in similar situations. Both were graduate students in Computer Science, nearing graduation, and looking for employment. Both felt that their website could play a significant role during hiring. Both were motivated to change their sites to be more professional. Both are web-savvy and made well-reasoned decisions about their respective sites. Yet, the decisions they made were almost diametrically opposed. PG did Google searches to make sure that her home page was prominent; MG did the opposite. PG created an extensive site to supplement and complement her application materials; MG created a minimal site that would not be harmful if stumbled upon by employers.

While web technologies are just as important (if not more so) for her future employment, MG did not end up with as strong a professional home page as PG. The reasons for this had less to do with their respective expertise, but rather the respective communities of practice that they were looking to join. For those remaining in academia (or the closely related research laboratories), the professional home page is valued. For those seeking more conventional jobs, the professional home page is still not an established construct. While this could change over time, MG's case points out that the impetus to change is fairly low. For many masters students, a professional home page adds little added value to their portfolio.

3.2.4 The Meaning of Personal Home Pages

Bijker (1995) points out that a technology, particularly in its infancy, often has different

meanings to different social groups. It takes time for the meaning of a technology to reach *closure*—when only a few well-established meanings persist. The meaning of personal home pages, particularly in their use in professional settings, is still being defined; consequently, different communities view them differently. For academic hiring, the *professional home page* has become an accepted standard. For industry hiring, this meaning is less accepted. Because undergraduate and masters students do not generally have content on their home page that would usefully supplement a resume, there is little incentive for businesses to adopt the professional-home-page model. When there is no established meaning for a technology, other meanings are more likely to be considered (Bijker, 1995).

One model that deserves some attention is that of the *indiscreet home page*. For many businesses, the discretion of their employees is important (Nippert-Eng, 1996). By protocol, employees should refrain from making their work public. Breaking that protocol could have serious consequences. A breach could violate a confidentiality agreement or cause an internal problem to become externally visible. Recently, some prominent bloggers have lost their jobs for posting inappropriate content to their public blogs (Bahney, 2006). So, a company may be wise to make sure an applicant's home page matches their expectations of professionalism, even if that information may not have been posted for their consumption.[8]

For academic institutions, the chance of a home page being regarded as indiscreet is far less likely. Not only is it acceptable for academic researchers to post their work publicly, it is encouraged. It is also more acceptable for academic employees to integrate personal and professional aspects of their life (Nippert-Eng, 1996). So, unlike companies, academics are more likely to view a home page from the professional-home-page perspective, rather than the indiscreet-home-page perspective.

One setting where these two models of personal home pages are clashing is in company

[8]A personal home page may also volunteer information (marital status, race, religion, national origin, sexual orientation, age, disability, veteran status) about an applicant that employers may not be allowed to consider or ask about by law or company policy. A person making that information available on their home page may find that they have inadvertently lost the protections of these policies. Conversely, a company may feel less inclined to visit a personal home page for fear of discovering this information.

research laboratories. The company may value confidentiality and discretion; however, these researchers often engage in the practices of academia, openly publishing their work to academic conferences. At IBM Research, the researchers had to negotiate an exception to company policy, allowing them to publish their personal home pages without prior approval (Erickson, 1996). So, at IBM, the professional home page has made some inroads into a business setting. To date, this policy is still in effect; although, it has been more restricted. The IBM server only hosts strictly professional content (i.e., publications, contact information, research summary). A more-personal home page must be located on an external server; however, the internal home page can link to the external home page.

The boundaries of a community of practice are often fluid, allowing its practices and values to migrate to adjacent communities of practice (Wenger, 1998). In academia, the professional home page has become an accepted standard. From there, it may expand to related communities of practice. Research laboratory employees may adopt this conception to more closely match their academic counterparts. Masters students may emulate the personal-home-page style of the doctoral students that share their classes. In this manner, this model may extend beyond the academia archetype. As Bijker (1995) notes, an early-adopting social group can be instrumental in determining the meaning of a technology. Because of this, the meaning of personal home pages in academia may contribute to the ultimate destiny of personal home pages elsewhere.

Until closure is reached, multiple models for personal home pages can coexist. The tension between these models can have important implications for adopters and the various communities of practice that access the site. Because of this, PG and MG rationally took such different approaches to their respective home pages. Their respective potential employers have different conceptions of personal home pages. For PG, it was important that she could be found; her site is meant to be a portal to her research identity. In contrast, for MG, the home page is much more perilous; industrial employers may not be as accepting of a personal home page, believing that it may be indiscreet. While both PG and MG are

using the same technology and have similar expertise, their use is dramatically changed by their respective communities of practice.

If MG had continued with her education and pursued a doctoral degree, her AniAniWeb page could have evolved into a professional home page. She has research links and project work on her site. At the time, she posted that information for herself. Because she did not consider her work to be research, she never saw it as important to an external audience. Yet, as she commented, if she were a Ph.D. student, then more people would be interested in that work. MG's AniAniWeb could have easily evolved into the professional home page, which has become a meaningful construct for academic employment.

The difference between PG and MG's experience exemplifies a *time-based tension*. A home page's usefulness and primary audience may change dramatically over time. Since content may have been created at an earlier time, it may not fit the current purpose of a site or its current audience. If MG were to continue with her graduate studies, she might be well served to undo all the actions that hid her home page from others.

The situation that the IBM researchers are in exemplifies a *community-based tension*. Because these researchers belong to two communities of practice (industry and academia), their practices are at the mercy of both of these influences. These category of tensions are particularly felt by members who are at the periphery of the academic community of practice—masters students, industrial researchers, and doctoral graduates now working in industry. At the College of Computing, a doctoral student is allowed to keep his personal home page at Georgia Tech after graduation; thus, he can maintain a professional home page, even if his employer does not accommodate that medium.[9]

Over time, a person's role in a community of practice changes as she moves from the periphery to the core (Wenger, 1998). New connections are made. New practices

[9]Hosting personal home pages for students who are no longer associated or employed by Georgia Tech is a particularly tricky policy for a state school that is accountable for the use of its resources. That the College of Computing is able to accommodate this extraordinary policy is further evidence of the importance of the professional home page in academia.

are adopted. In graduate school, these changes come quickly and can be quite dramatic. PG, the student, became PG, the faculty member. In addition to these intra-community transitions, people often move in and out of connected communities of practice. MG took an industrial job, moving largely out of academia. As these changes happen, the role of the personal home page changes. In this manner, social interactions drive home-page evolution. How a personal-home-page adopter negotiates the demands of various social groups reflects who she is, both to others and to herself. As they transitioned from school to a professional life, both MG and PG began to more clearly separate personal and professional concerns. I will return to this theme in Chapter 5 as I focus on CM's struggle with satisfying conflicting demands.

3.3 Expectations of Professional Home Pages

> "I look up other people all the time as part of doing research searches. Most people nowadays—any researcher I'm actually looking up—has a webpage."
> —PG

It has become an accepted practice for computing researchers to maintain a professional home page. Other researchers often use these home pages as an information resource. Academic home pages normally contain contact information, affiliations, a list of publications (often with links to download the actual publications), summaries of current and past research projects, and an academic picture.[10] For candidates nearing graduation, a research portfolio (curriculum vitae, research statement, teaching statement, select publications, etc.) is typically featured prominently.

Researchers who visit others' websites expect to find this standard content. They also expect it to be up to date and well organized. When a home page does not meet these expectations, it reflects badly on that researcher. As a faculty member stated, "the way you

[10] A typical academic picture is a head-and-shoulder shot in good lighting; others use it to match the face with the person. I, for instance, find these pictures invaluable when meeting someone I have not met face to face at the airport.

present yourself on the Web reflects how organized you are as a researcher." One student was so embarrassed that her adviser's home page failed to meet these expectations that she helped the faculty member work on it; as an older, established researcher, the adviser did not place the appropriate priority on adopting the new medium.

Academic visitors expect the personal home page to be primarily professional. As a faculty member remarked, "the primary role of the web space ought to be in pursuit of your academic role in the [research] community and the Institute." While it is acceptable to have some personal (i.e., non-professional) content, the overall impression should be professional. Based on experience, one faculty member advises his graduate students to avoid appearing "goofy." Once, a possible employer for one of his students contacted him. The student's e-mail address was a bit goofy (something like *firetruck@cc.gatech.edu*) and the employer was concerned that the applicant might not be professional enough. While weird addresses are commonplace for undergraduate students, they are suspect for academic professionals.

The same applies to professional home pages. The picture should be conventional. One student initially featured a picture of her husband and herself. After one e-mail sender perceived the owner of the site to be her husband, she changed the picture to one of just herself. Personal content should be largely separated from professional content. Several academic visitors prefer to only engage the site for its professional content. The design should be usable, rather than hip. One student changed the background color of her home page from black to white, because a faculty member made a negative comment about the "kind of people" who use a black background on their home page.

While it is advisable to separate non-professional content, several interviewees commented that they enjoyed knowing a bit more about the person. Does he have a family? What are his hobbies? Is he an interesting person? Academia tends to be an open work environment; it is fairly common for academics to integrate personal and professional life

(Nippert-Eng, 1996). Several people reported that they actively try to befriend fellow researchers as they find it makes for better collaboration. It is even institutionally encouraged for graduate students to befriend their classmates. So, a personal section can be a useful addition to the professional home page.

It is worth reiterating that this research focuses on a specific community. The College of Computing and particularly those taking part in this research are currently at the forefront of the adoption of personal home pages in academia. Most of them conduct research in human-centric areas of computing. Because these fields are fairly new, the researchers tend to be young. Many of them are web-savvy and are thus open to adopting personal home pages as a professional communication medium. Other research communities are only beginning to adopt personal home pages. In older areas of computer science, home pages tend to contain noticeably less information. In the School of Electrical and Computer Engineering (even further removed from the studied community), the home pages of faculty members are spartan—comparable in content to what was standard ten years ago at the College of Computing.

For two reasons, it is likely that the practices of the studied community will be adopted by these other research communities over time. First, useful practices are spread from one community to another. Because research communities overlap, those researchers who are part of both a new area and an older area may introduce the new practices to the older community. Second, communities of practice need to refresh themselves with new members (Lave & Wenger, 1991). As younger faculty members are integrated into the community, web competence will cease to be a major barrier to adoption.

3.4 Software Needs

The previous section focused on the expectations that academic visitors have of a professional home page. This section shifts the focus from the visitor to the adopter. Academics use their home pages for many purposes; this section is about what home-page software

should do to support those uses. Unlike Chapter 4 which is concerned with general uses for a home page, this section is specifically about academic uses. I observed four general activities that academics used their home pages for:

Publish Content As detailed in Section 3.1, personal home pages in academia are an informal form of publication. Unlike traditional means of publication, the style can range from the formal to the informal. On the formal end, it is fairly common for academics to include publications to download. Other documents may not be publishable in traditional media, but are still formal: hiring portfolio, project descriptions, technical reports, proposal and dissertation documents, etc. Other documents are comparably informal: words of advice, answers to qualifier questions, reflections on a conference, etc.

For computing professionals, one important advantage of personal home pages is that they support dynamic content. Graphics researchers often include a reel of their work with their portfolio. The personal home page allows them to distribute this video to others easily. Before personal home pages became accepted, graphics researchers would commonly include a CD or DVD with their faculty application. Computing researchers often create useful software as part of their work. The home page can be a useful venue for distributing this software. Here again, this content can range from the formal (the software built for dissertation research) to the informal (CVS scripts that others find useful). Several graduate students also included interactive software, such as PG's electronic picture frame, that actively demonstrated their research interests.

Connect to the Research Community It is fairly common to find lists of upcoming conferences and links to interesting articles or sites on a home page. Why? First, the links have a practical benefit to the adopter: The resources become easier to access. Second, the links have a learning purpose: They signify which research communities

that person belongs to. Joining a community of practice requires both becoming that professional and belonging to that community (Wenger, 1998). These links show to a visitor that this person *belongs* to these research communities. In addition to its value to visitors, choosing the links can allow the site owner to reflect on where he belongs. Determining what resources to associate with yourself can be a useful act of identity construction (Bers, 2001). The home-page adopter is constructing his research identity by connecting himself to the research community.

Connect to the Local Community While it will eventually be vital for new graduate students to join their research communities, initially it is more important for them to join the College of Computing community. Since graduate school is a social process, new graduate students are encouraged both formally and informally to get to know their fellow graduate students and faculty members. Connecting yourself to that community of practice can be an important function of a home page. Several new graduate students used the interactive features to connect to their classmates in the "Introduction to Graduate Studies" class. A few even used the interactive capabilities to plan social activities, such as a potluck dinner or movie night. When much of the College of Computing moved to a different part of campus, one student posted reviews of nearby restaurant so that others would have a better idea of where to go for lunch. Connecting to the local community is equally important for new faculty members who are trying to recruit students and make themselves known.

Collaborate with Others The practices of academic research, and graduate school in particular, are often collaborative. So, the unidirectional (from author to reader) communication model of publication can at times be inadequate. The home page can be a convenient medium to collaborate with others. Some students used the AniAniWeb to collaborate on a research paper or to develop software with others. The site provided a convenient space to share information and collaboratively author content.

Often, this collaboration is uneven—the site owner plays a larger part (Section 4.2.4). For instance, PG set up a page to communicate with her letter writers about where to send references. Another adopter used his home page to gather comments on a research paper. Because these collaborations can often contain sensitive or private content, a collaborative home-page system needs to support a flexible access-control system (Section 6.3.3).

The uses (and thereby wants) that academics have for their home-page system change over time. For incoming graduate students, connecting to the local community may be primary. While some students used AniAniWeb for this purpose, the system was not optimized for this purpose. Social networking sites and blogs have features that better enable this kind of activity; these technologies often allow a user to easily find out which of his friends have recently updated their sites.

For a graduate student first using her home page for professional purposes, it can be important that she can create a professional looking page in a short amount of time. Thus, she can complete it in time for the conference. AniAniWeb separates style from content, allowing students to concentrate on content and then change the style of the entire site. To better serve this need, a newer version of AniAniWeb includes a color scheme (GT) that requires no tweaking to look professional (Section 6.3.2); an adopter can put off dealing with creating her own style until she has the time and initiative. While a coherent color scheme for an entire site is a good idea, it is also useful for people to change individual pages. For instance, a project page, while it may reside on someone's personal site, may have a life of its own; a unique look can be a good way to communicate this sentiment. So, a home-page system should allow for parts of the site to have a distinctive look.

For graduate students repurposing their site for faculty hiring, it should be easy to re-arrange content, so that the hiring portfolio is displayed prominently. At that time, it may also become appropriate to hide or deemphasize content. Basically, the site owner should be able to readjust what he is professional and what he is personal about.

Another way to understand the relationship that others have with a personal home page is by the strengths of the ties that these visitors have to the site owner. The impacts of media are often determined by the ties that they affect (Haythornthwaite, 2002). There are three types of social ties. You are strongly tied to the people you know well, communicate with frequently, and collaborate with. You are weakly tied to the people you casually know and occasionally communicate with. Latent ties are the connections that are made possible through the medium but have not been realized. A good home-page system allows the adopter to engage all three of these ties.

Through a latent tie, previously non-existent bonds can be formed. When a stranger stumbles onto a home page, he is realizing that latent tie. A good home page will be easy to find and enable visitors to forge a weak tie. For weak-tie visitors, an informative home page can strengthen their tie. Strengthening ties is essential when connecting to the research or local community. Faculty candidates are explicitly trying to forge stronger ties with the people who will be evaluating their portfolio. When new graduate students write on each others' AniAniWebs, they are trying to connect with their classmates. With time and effort, weak ties can evolve into strong ties; however, it seems unlikely that these strong ties will be forged primarily through the home page. Strong ties are better established through other means of communication, such as face-to-face interaction (Haythornthwaite, 2002). While home pages may not build strong ties, they should support strong-tie interaction. For instance, two people collaborating on an article are most likely strongly connected. Enabling that collaboration can further strengthen the strong tie. While the function of transforming latent ties to weak ties can be adequately accomplished by a conventional static home page, strengthening weak and strong ties requires a more sophisticated system, such as AniAniWeb, that allows for collaboration and flexible access control.

CHAPTER IV

ADOPTING THE MEDIUM

> A medium is that which remediates. It is that which appropriates the techniques, forms, and social significance of other media and attempts to rival or refashion them in the name of the real. A medium in our culture can never operate in isolation, because it must enter into relationships of respect and rivalry with other media. (Bolter & Grusin, 1999, p. 65)

A medium is a tool for communicating and constructing meaning; however, it is not a simple tool (e.g., a hammer). It is separated from a simple tool by its malleability and social relevance. A variety of different techniques and forms emerge from the same medium. Techniques and forms from different media can be remediated into a new medium. People can adopt a medium differently. Personal home pages are a medium. Hypertext and multimedia support allow personal home pages to incorporate, extend, and remediate other media.

This chapter is about the common and unusual relationships that people have with personal home pages. The previous chapter concentrated on the meaning that personal home pages have in one setting—academia. This chapter is more broad: It focuses on how people adopt and relate to personal home pages in general. While the research participants are still academics, this chapter concentrates on their more general uses, which apply in other settings.

Technology and people construct a medium together. The medium evolves through the interplay of inventors, external conditions, companies, laws, patents, and relevant social groups (Bijker, 1995). The affordances and limitations of the technology define a flexible

space that adopters can utilize differently. This chapter is about that space and the approaches that adopters take to make a place for themselves it that space. The tools we use change who we are (Tenner, 2003); they shift our sensibilities and make us adopt new practices. While people cannot always predict how the medium changes them, they have the freedom to adopt the medium in different ways. Both the viewing preferences of visitors and the authoring strategies of authors vary widely.

This chapter is split into six sections. The first examines the role of audience. Others visit personal home pages; through their observations, they construct meaning that is important to the owners of those sites. As with other written composition (Bereiter & Scardamalia, 1987), good authors take the audience into consideration when creating content. The second section examines how people author content—how they use their home pages. I synthesize across the experience of multiple research participants to get a better understanding of how adopters negotiate problems of audience, interaction, and use. In their pursuit, failure can be frustrating; success can be empowering. For example, one adopter faced the problem of having a long narrow list of links on a page. She used HTML to create multiple columns on the same page. This solved the problem and made her feel good about her competence in negotiating the medium. That section is about the strategies that people adopt to succeed in their use.

To understand an evolving medium, it is particularly important to consider emergent uses, as these uses may foreshadow the future of the medium (Bijker, 1995; Gitelman, 2006; Tenner, 2003). One significant category of use to emerge from this research is *self use*, the use of the site primarily for oneself. Sections three and four detail how two graduate students adopt the tool in unconventional ways to serve themselves. MDN adopts AniAniWeb to be his digital notebook. PWM adopts multiple personal-home-page technologies to better understand them. The fifth section delimits the authoring space by examining the practical limits of personal home pages. To characterize a medium, it is important to consider the limits of that medium, in addition to its uses (Bolter & Grusin, 1999; McLuhan,

1964). The sixth and final section ties these sections together to better define a personal home page.

4.1 Addressing Audiences

> The combination of many different audiences is a rare occurrence in face-to-face interaction, and even when it occurs (at a wedding, for example) people can usually expect the speedy resumption of private isolated interactions. Electronic media, however, have rearranged many social forums so that most people now find themselves in contact with others in new ways. (Meyrowitz, 1985, p. 5)

It is notable that Meyrowitz's observation came significantly before the widespread adoption of the Internet. Today, his sentiments seem even more appropriate. Over one billion people have accessed the Internet.[1] In just twenty years, electronic media have wildly rearranged how we communicate and with whom we communicate (Jenkins, 2006). Since most personal home pages are open to any visitor, they are widely accessible. People from all over the world can access the site. The relationship(s) of these visitors to the site owner vary. Visitors can be complete strangers, friends, family, fellow first-year graduate students, lab-mates, committee members, letter writers, potential employer, etc. Each of these audiences comes to the same home page with different expectations and needs. To complicate matters, some visitors fall into multiple audience categories. In face-to-face conversation, we can (and do) change how we present ourselves based on our audience (Goffman, 1959). With personal home pages, we do not have that luxury. For a normal static home page, all visitors basically have access to the same content. Authoring a personal home page that serves these different audiences to the author's satisfaction is the *multiple audience problem*.

[1] *http://www.internetworldstats.com/stats.htm* (12 September 2006)

Personal home pages are an asynchronous medium: The owner posts content to the site at one time; the viewers access that content at a later time. The expectations of and opportunities for interaction are fewer in these asynchronous forums than for comparable synchronous media, such as text chat and face-to-face dialogue (Guzdial & Carroll, 2002). It would be socially absurd to view someone's desk while he is present and avoid interacting with him. In contrast, visitors to a home page feel comfortable remaining hidden. The vast majority of the time, a visitor leaves little evidence of the visit. Traditional website technologies confine visitors to being viewers; these technologies do not even allow visitors to interact. Even when it is possible for visitors to leave a comment, few do (Nardi et al., 2004). Typically, the only evidence of the visit is a line in a log-file. These log-files are often not accessible to the home-page owner and are sufficiently cryptic to render them nearly useless even when the owner has access. Understandably, this lack of presence makes it difficult for publishers in these digital realms to know who is listening (boyd & Heer, 2006). Authors in asynchronous media only have a hazy awareness of who their audience is; often they even fail to realize that they have one (Forte & Bruckman, 2006). Authoring a personal home page without useful feedback on how others will view the page is the *audience awareness problem*.

Home-page adopters hoping to best address their audience(s) must contend with the multiple audience problem and the audience awareness problem. This section seeks to understand what it means to publish a home page for others. First, I detail the viewing habits of home-page visitors. Next, I explore the dangers of having a widely-accessible home page. Finally, I inspect the inherently thin line between the average home-page viewer and the gaze of a stalker.

4.1.1 Viewing Habits of Others

> When viewing a website, observers form clear, coherent impressions of the author, and they tend to agree about what the author is like. Furthermore, their

impressions are by and large correct. (Vazire & Gosling, 2004, p. 130)

Studying how others view a specific personal home page is inherently difficult. Visitors leave few clues about who they are, so it is not possible to contact most visitors for follow-up questions. Log-file entries are also woefully crude. Since communication to the server only happens when loading a new page, a log-file makes no distinction between a visitor carefully reading a page or, as is common (Huberman et al., 1998; Nielsen, 2006), quickly browsing and leaving it. Because of these problems, I chose not to investigate how viewers browsed and reacted to a specific home page. Instead, I have tried to get a better understanding of how people view academic home pages in general. To do this, I asked my research participants, both graduate students and faculty members, how they view personal home pages. What follows is a synthesis of their viewing habits.

This sample is clearly limited. All of these research participants are academics in the College of Computing. Their viewing habits and judgments may not reflect how others, such as non-computing friends and parents, view a home page. Yet, they still represent numerous important audience categories. Students viewed the home pages of their fellow students, colleagues, friends, and faculty members. Faculty members viewed the home pages of their fellow faculty members, students, potential hires, etc. While being a limited sample, the viewing habits of these academics still vary widely.

The purposes for viewing personal home pages vary. First, viewing a home page can be used to form an impression of its owner (Vazire & Gosling, 2004). In academia, that impression can be both professional and personal. The impression gained can help a student get to know a fellow student, a faculty member to better understand the potential of a new faculty prospect, etc. Second, a home page can be used to keep up with friends or colleagues separated by space. It is common for students to switch schools between undergraduate and graduate studies; home pages can be useful for keeping up with friends from college. Academic research communities also extend across multiple institutions; personal home pages can help to bridge that space. Third, a home page can be useful for finding a

specific piece of information, such as an electronic copy of a publication. Fourth, another's home page may serve as a model for one's own home page. Authoring a personal home page is a formidable task. There is no clear best practice, so the home page of another can serve as inspiration for how to negotiate the problems of home-page creation. For students creating a personal home page for academic hiring, adopting the standards of others is a safe way to author an effective home page.

Styles of viewing personal home pages also vary. Some visit home pages with a specific purpose in mind. Others enjoy just browsing a home page and seeing what is there. Some enjoy seeing creativity in both content and design. Others prefer a utilitarian approach that allows them to easily find useful (i.e., professional) content. One faculty member reported that several people commented on how useful his "words of wisdom" had been to them. By distributing these informal writings, he both helped others in the community and helped build his reputation.

Viewing habits also vary based on the relationship a viewer has with the home-page owner. The same person may approach the home page of a friend and the home page of a colleague completely differently. PG rarely looks at the personal section of home pages of people she has only a professional relationship with; however, she checks the personal section of home pages of people she knows better. Others prefer to view both the personal and professional sections of a professional contact, believing the personal section to add value. Naturally, viewing habits are affected by how a viewer and owner communicate through other media. If one sees a person frequently face to face, there is little reason to use the home page to form an impression.

4.1.2 The Potential to Misuse / Abuse

While a personal home page can serve its owner in many ways, it can also be misused. There is no guarantee that a visitor to the site will use the information as the owner intends them to or for the owner's benefit. As the content is so openly accessible, even people who

might not have the best interests of the owner in mind can use the site. Since there is little to no trace that a visitor has accessed the content, the home-page owner does not even know that the site is being used in this way. Without that knowledge, it is difficult for home-page adopters to prevent and correct misuse. There are two general categories of misuse: 1) that content will be accessed by an audience for which it was not intended; 2) that the content will be inappropriately used.

The former is mainly an effect of the multiple audience problem. A home page may practically serve multiple audiences. Unfortunately, material written to be consumed by one audience may not be appropriate for another audience. Yet, people may stumble upon or even search for content not intended for them. For instance, potential employers may look at the home page of a candidate. If such a visitor stumbles onto a personal section, he may not like what he finds. The author may have created this content without an eye for how it reflects on them professionally. CM, whose case is discussed in Chapter 5, used her AniAniWeb to collaborate on a research paper. Later, she realized that those drafts could be accessed by others, such as potential employers. She felt uneasy about others judging her based on these early drafts.

People use various strategies to address these unintended communications. First, owners can avoid posting sensitive information. MG does not post anything highly personal on her home page, because she realizes that others can get to it. PG maintains a purely professional site, avoiding personal content altogether. TI, introduced in Chapter 5, makes sure to keep highly sensitive documents only on a laptop that he owns and controls. Second, owners can try to hide content so that visitors will not stumble upon it. MG removed her name from her page, so that potential employers could not find it by just doing a simple web search. Several students use pseudonyms to post in other forums or to maintain other sites. Since only their friends recognize the pseudonym, they are assured a level of privacy. Third, owners can take a more *laissez faire* stance and accept that they cannot tightly control who has access to material. These owners accept that others could misinterpret the

content, but they judge this threat to be negligible.

Inappropriately using the content is another danger of personal home pages. Text, pictures, and other information can be easily taken off the home page and reappropriated for some other purpose. One faculty member discovered that somebody used the picture he had posted to his home page for an entirely unintended purpose (Chapter 5). Of greater concern to academics is the idea of *scooping*—that a visitor will co-opt the ideas on a site as his own. There is little stopping a visitor from taking a research idea from a home page and pursuing that research themselves. If the idea has not been formally published by the home-page owner, that visitor may be the first to publish the idea, making it difficult to prove any theft. Scooping is one instance of how misuse can become abuse; another potential for abuse comes from stalkers.

4.1.3 The Stalker's Gaze

> "I don't think people are stalking me or spying on me, so it [having personal content accessible to visitors] is not a big deal." —PWM

A stalker is generally considered to be a person who clandestinely tracks another person, sometimes obsessively so and with unlawful intentions (Tavani & Grodzinsky, 2002). Because of its tendency towards anonymity and lack of effective regulations, the Internet has opened up new avenues for stalking, termed cyberstalking (Adam, 2002). The stalker enjoys having so much access to his quarry, while remaining hidden. A stalker is inherently dangerous, because he can use his advantage to the harm of his subject.

On most personal home pages, the owner of the site has little to no information that someone has visited her site; hence, the home-page visitor is a *voyeur*—someone who sees without being seen. That one-sided gaze adds a sense of power and domination for the viewer (Adam, 2002). While voyeurism in a physical setting is often considered improper, it is the norm for viewing personal home pages. Since voyeurism is an essential element

of stalking, personal home pages are a nearly ideal medium for supporting stalking behavior. Even an unskilled visitor can discover much about the site owner without the owner noticing.

Given the home page's affordances for stalking, it is not too surprising that the term was mentioned by several research participants during my interviews. In none of these cases was I, as interviewer, the first to mention the word. While none of my research participants felt stalked or used personal home pages to stalk others, several associated stalking with personal home pages enough to mention the term.

Stalking is typically a masculine activity: The male stalker pursues his female subject (Mullen, Pathé, Purcell, & Stuart, 1999). There are certainly exceptions to this rule; however, as men tend to be physically stronger than women, the potential for abuse is strongest in the typical male-stalking-female case. So, it is not surprising that the three women who mentioned the subject did so from the perspective of being potential prey. They realized that the danger lay in an external person stalking them. One student's mother warned her about posting sensitive information to her home page; to allay her mother's concerns, she deleted her physical address from the site. Thus, a possible Internet stalker would have a harder time locating her physically. Another student listed babysitting as one of her hobbies. Based on that content, she received two separate e-mails from complete strangers about babysitting for their children. While these inquiries were probably legitimate, there are no assurances of that. It is not uncommon to hear of predators abusing the Internet (Tavani & Grodzinsky, 2002). Thus, she felt uncomfortable and declined the offers. While these women acknowledged stalking as a possibility, their concerns were mild, as characterized by the above quote. None of them lingered on the topic for long.

Curiously, the one male to mention stalking did so from the perspective of the predator. He commented that he engaged in "stalker-like" activities on his acquaintances' home pages; he carefully examines the home page of someone to get to know them better. When I followed up on his use of this loaded term, he explained his reasoning. He considers it

stalking because he is looking at potentially personal information about that person without their knowledge. At minimum, it is voyeuristic. It is not quite stalking, because the person made the content publicly available; however, accessing that much content about a person without their knowledge is discomfiting. It feels like stalking. Unlike a "predatory stalker" (Mullen et al., 1999), he did not have any ignoble intentions. Yet, his experience of carefully inspecting a personal home page felt like stalking.

I can sympathize. Before I interviewed a research participant, I would prepare extensively. I spent a considerable amount of time investigating all parts of their web presence. I searched for them on search engines. I examined their various sites. Since AniAniWeb also maintains a history of each page, I closely examined how some key pages changed over time. As a thorough researcher, I scrutinized the smallest detail to find meaning. In other words, I stalked my research subjects. I was ready to pounce with my acquired knowledge during the interviews. I discovered sites that people thought were effectively hidden. I unearthed details of sites that the owner had forgotten about. While I did not have nefarious intentions, I too felt my actions to be uncomfortably close to stalking.

4.2 Authoring the Home Page

The last section focused on how people engage others' personal home pages. This section focuses on the other side of the coin—how people engage their own home page. First, I introduce the elements that people should consider when authoring a personal home page. Second, I elaborate on the prevailing strategy of separating personal and professional content. While those first two subsections apply to authoring personal home pages with any tool, my research participants primarily used one tool, AniAniWeb. The affordances and constraints of that tool affected the participants' authoring. The last three subsections detail how AniAniWeb affected authoring. First, I examine content creation. Second, I examine the role of interaction and collaboration. Third, I introduce one of the emerging uses of personal home pages in this research—self use.

4.2.1 Authoring Considerations

The authoring space for personal home pages is substantial. Personal home pages vary widely in technology, style, and content. A home-page adopter makes a home for themselves in this vast design space. To investigate how adopters approach this authoring, student research participants were asked, "What strategies did you use [for authoring your home page] and how did you feel about those strategies? What would you advise others about creating personal home pages?" (Appendix C). The following is a summary of the considerations that these participants felt were vital when authoring a personal home page. These strategies constrain the composition process in a useful way.

First, adopters must select the appropriate technology. Home-page adopters should consider the reason for creating the home page when choosing the authoring tool. If the primary purpose of the site is to communicate with friends, a LiveJournal blog might serve the purpose. AniAniWeb would be appropriate for a professional academic home page. Another technological strategy is employing multiple technologies. For instance, there are specialty applications and services (e.g., Flickr) that are optimized for distributing pictures.

Second, adopters must author and manage content. Since a home page evolves over time, the initial design needs to be flexible enough to grow. Often, a novice home-page designer will create a design that is not flexible enough; consequently, he finds that he must completely redesign the site to add more content. To combat this, several adopters use placeholders. It is their intention that these placeholders will be replaced by content once they have the resources and motivation to do it. This requires the author to predict what content he will add in the future. Unfortunately, these predictions are often faulty. The adopter may lose interest and leave the placeholder there in near perpetuity. It is common to find "under construction" or "coming soon" signs on home pages that have been there for multiple years. Alternatively, adopters find that the new content that they want to create does not fit their predetermined placeholders. One effective strategy that many experts adopt is to *keep the design simple and expandable*; AniAniWeb was designed with this

strategy in mind. This allows the home-page owner to add to it incrementally. Over time, this strategy can lead to a substantial home page. It would not be possible to envision or create such a large site all at once.

Third, adopters must consider the audience. For most adopters, the home page is primarily a publication medium. Consequently, creating and presenting content in an appropriate way for its consumers is vitally important. As discussed in the previous section, one personal home page is often viewed by multiple audiences. A common strategy for serving multiple audiences is to split content into different sections or entirely different sites, based on the appropriate audience for that content. In academia, a common solution to the multiple audience problem is to split content along the lines of personal and professional.

4.2.2 Personal and Professional

> But the line between what is public and what is private is increasingly fuzzy for young people comfortable with broadcasting nearly every aspect of their lives on the Web, posting pictures of their grandmother at graduation next to one of them eating whipped cream off a woman's belly. (Bahney, 2006)

Personal home pages tend to blur the lines between what is public and what is private. Blogs are often treated as both a personal diary and as a forum that anyone in the world can access (Nardi et al., 2004). One academic home page might simultaneously address friends, family, and colleagues. Personal home pages, like other electronic media (McLuhan, 1964; Meyrowitz, 1985), tend to integrate previously separated spheres. While new media tend to integrate, integration only goes so far. There are still traditional separations that are valued. One such separation is the separation between home and work. Even in more integrating fields, there is still an expected separation of home and work concerns (Nippert-Eng, 1996). While it may be acceptable to have a "whipped cream" picture on a purely personal site, the same image might be considered uncouth on a site that serves a professional purpose. Grandmother's picture, though not professional, would be acceptable in either setting.

In academia, the professional home page is a must; however, the home page can be useful for other purposes. An adopters must decide how professional or non-professional he wants to be on his site. What kind of non-professional content is acceptable? Should professional visitors have the choice to avoid non-professional content? While the first question was answered in multiple ways by research participants, all research participants that used their home page to publish professional content kept that content separate from non-professional content. Thus, a professional visitor could simply view the professional part of the site. On home pages that included professional and non-professional content, a prominent link leads visitors to the professional section or the non-professional (commonly labeled "personal") section.

As far as integrating non-professional content into a largely professional page, people vary in both their preferences and integration strategies. Non-professional content ranges from the safe content that no professional would find objectionable to indiscreet content that could be viewed as dangerous. Some, like PG, prefer to keep non-professional content to a minimum, and always safe when present. Others prefer to be more adventurous. While all adopters felt that the content that they made available to others was sufficiently safe, the determination of what content was deemed safe varied. One person's acceptable content could easily be another's unacceptable content. Some restricted their professional site to fairly safe content. TI, for example, maintains hidden sites for less safe content. RY, on the other hand, maintains fairly controversial content on her home page.

Just as the determinations of what is acceptable content vary among home-page authors, they vary among home-page viewers. Because of the audience awareness problem, a home-page author has little actual feedback about how others react to a home page. So, his choices are based on intuitions, rather than evidence. To minimize risk, home-page authors are more conservative about what they will author than what they themselves would find acceptable. Consequentially, the personal content of academic home pages is uniformly polite; see Section 5.7 for details and implications of this trend.

4.2.3 Creating Content with AniAniWeb

> "I've probably updated my AniAniWeb webpage more than I ever updated all my other pages combined... maybe not... it just feels like it." —CM

AniAniWeb differs from traditional tools, such as Microsoft FrontPage, for authoring personal home pages. These differences change how users author personal home pages. One major difference is found in how people create account. As the above quote attests, the research participants authored more content with AniAniWeb than with other technologies they had used.[2] Furthermore, compared to the static-home-page users surveyed in Appendix A, AniAniWeb adopters created more content.

To usefully compare these groups, I examined their respective home pages. I had downloaded the home pages of survey participants, shortly after they completed the survey. At that time, they had been at the College of Computing for one year. As a comparison, I reconstructed the home pages of AniAniWeb research participants one year after their AniAniWebs were created. Because AniAniWeb research participants were recruited based on their high usage, I only considered the static sites of the nine survey respondents who reported spending more than one hour per month on their home pages. Comparing these two groups, the static home pages averaged under 12 HTML pages, while the AniAniWebs averaged almost 39 pages—more than three times as many pages.[3]

This direct comparison has several problems. First, the populations are slightly different. All the static-home-page users were first-year doctoral students, while many of the AniAniWeb adopters were not. Since the need for and usage of personal home pages is influenced by the position in the community (Section 3.2.1), this might bias the numbers towards AniAniWeb, as senior students have a greater need for a professional home page. On the other hand, all first-year students had to author several pages for the "Introduction

[2] While this characteristic was true for all research participants, it is not too surprising, as the research participants were recruited based on their high use of AniAniWeb.

[3] While the sample sizes were small, the comparison still achieved significance of $p < 0.05$ on a single-headed t-test.

to Graduate Studies" class, thereby biasing the results towards static technology. Second, a hand-authored HTML page and an AniAniWeb page are not exactly the same. An AniAniWeb page can serve purposes (such as interaction, covered in the next section) that static-home-page users would have to use other technology (e.g., *evite.com*) for. Third, only the AniAniWeb portion of the web presence for research participants was counted, since I could not reconstruct the static sites for the appropriate times. Even given these defects, the large difference in the quantity of pages suggests that home-page adopters created far more content with AniAniWeb than with traditional HTML tools. Why?

In terms of creating content, the primary advantage of AniAniWeb over static tools is the quick editing cycle, enabled by wiki technology. To better understand the role of wiki editing, I examined the number of contributions adopters made to their sites during active use of AniAniWeb. I calculated the time of active use for a site as the period from the inception of that site to the last time the site was used; the ending limit was needed as many research participants stopped using their Georgia Tech AniAniWebs after leaving Georgia Tech. Examining those figures, two distinct groups emerged: 1) those that used their sites primarily as a professional web presence; 2) those that used their sites primarily for self use. The latter group edited much more, averaging about 37 edits a month and about 25 edit cycles per page; the former group edited less, averaging about 10 edits a month and about 9 edit cycles per page. Self use, such as maintaining a "to do" list, inspired large amounts of edits. The greater number of edit cycles per page for the self-use group was a consequence of these self uses; a "to do" page naturally lends itself to more edit cycles than a project description page.

Another significant advantage of AniAniWeb over static tools for creating content is that AniAniWeb largely separates content creation from designing the look. This allows AniAniWeb adopters to concentrate on creating content. By examining the static home pages of survey participants, it was obvious that several concentrated on visual aesthetics, rather than content; for the time that they claimed to invest in their sites, the amount

of content was minimal. In addition, it was easier to maintain and update the look of an AniAniWeb. Like on a wiki, adopters can add a new page without having to replicate the structure and visual feel of the site; instead, the look is inherited from the parent page. When an AniAniWeb adopter does want to change the look of the site, he can change a few central files and have the changes automatically apply to the other pages. Several participants reported that updating the look of multiple HTML pages was much more tedious.

4.2.4 Interaction and Collaboration

Another large difference between AniAniWeb and static tools is that AniAniWeb allows for interaction and collaboration. Through various features, the owner can open their site to contributions from visitors. This section reports on the successes and failures of AniAniWeb adopters to foster interaction. While AniAniWeb builds on a wiki platform, the amount of interaction was far less than on a typical wiki, with most adopters only achieving a small amount of interaction. This section examines the important technological and social barriers to interaction. It also shows how interaction and collaboration can be usefully facilitated. Lightweight tools can help adopters set up a successful interactive space. Private areas can enable deeper collaboration. Even if the amount of interaction was small compared to a typical wiki, it was still an important element for most research participants.

Normally, the communication between the owner of a home page and its visitors is unidirectional: The owner authors content that the visitors consume. This principle even applies to home pages created with newer technologies, such as blogs and AniAniWeb, that allow visitors to contribute content. The average personal blog has far fewer comments than posts (Nardi et al., 2004). AniAniWeb users too found that visitors only occasionally contributed to their home page. While wikis normally have many different authors posting significant content (Craig et al., 2000; Rick et al., 2002), the same does not hold true for AniAniWeb, a similar technology.

While it is possible for a visitor to an AniAniWeb to contribute content, most do not feel

compelled to do so. The vast majority of the content is authored by the owner of the home page. Research participants knew that others regularly visited their site, but visitors only occasionally posted content when visiting. For most participants, it was more common for a website to be mentioned through other channels (e-mail, conversation, etc.) than the site itself.

For most research participants, visitor content contributions were minimal. MDN intentionally locked down his site, preventing any interaction. While the other participants left their sites open to external contributions, they did not receive many. Excluding RY, only 6% of content contributions came from people other than the home page owner.[4] Furthermore, most of those contributions were fairly minimal: fixing a spelling mistake, adding a short greeting message, adding a movie night preference, etc.

RY's site presented a noticeable exception to this trend. Using the same metric, about 44% of the content contributions to her extensive site came from others. RY succeeded in getting others to contribute to her site, where others generally failed. To succeed, RY did a good job of navigating both the technological and social barriers to interaction.

One explanation for the small amount of interaction is technological: AniAniWeb has a higher barrier to editing than WikiWikiWeb. In order to edit an AniAniWeb page, a visitor needs an AniAniWeb account. While anyone with a valid e-mail address can create an account, this requires some effort. To create an account, a visitor goes to the sign-in page. There, he enters his preferred user name and his e-mail address in the appropriate HTML form. An e-mail is sent to that address with a preliminary password. Using that password, he can sign in. This prerequisite adds a degree of accountability to content contribution. At minimum, the owner of the site has an e-mail address to associate with any abuse to their site. This technological barrier also prevented spam-bots from trashing sites, as has

[4]To calculate this percentage, the relevant HTTP requests to the site where categorized by whether they came from the owner of that site or from someone else (including anonymous IP addresses). Both edit and "add to the page" request where counted, as both could be used to contribute content to the site. The individual ratios of visitor contributions to total contributions were calculated. 6% is the average of these ratios, which ranged from 2% to 8%.

become an increasing problem on wikis. While this level of protection was desirable for preventing abuse, it made it more difficult for legitimate visitors to interact.

Another explanation for the small amount of interaction is social: There are no established practices for editing someone else's home page. In a wiki, collaborative practices are well established. In addition, there are often guidelines on a wiki that usefully guide use. For instance, Wikipedia has guidelines about writing in a neutral voice and citing claims that usefully guide the authoring (Bryant et al., 2005). In contrast, a visitor does not have a model of how to appropriately edit the home page of another. For example, TI added a statement on his home page, inviting anyone to edit the page; however, the amount of editing by others has been minimal. One reason that visitors may hesitate to edit TI's site is that it is not clear how they should contribute; TI does not have a specific page for external contributions. So, when a stranger, who was willing to create an account to add content, added content, TI simply erased it, judging the content to not fit his professional home page.

Overall, incidental or unplanned interactions were rare on AniAniWeb. Several adopters reported that an old friend who stumbled onto the site might leave a comment. On PG's site, a friend fixed a spelling mistake. While some incidental interactions occurred, these were infrequent. Practically, to overcome these barriers, owners must explicitly set up the interaction, providing both a setting and a purpose for the interaction. When given explicit directions, visitors did contribute.

One technological feature that facilitated interaction was the "add to the page" box. By beginning a new line of page's text with a plus sign, an HTML text box is created at that spot when viewing the page. By entering text into that box, a visitor can contribute content (without creating an account). The new content is inserted before the plus sign. This feature was first created for CoWeb, to support external reviewers who were not familiar with wiki technology (Guzdial et al., 2000). Since external reviewers did not have enough invested to learn about wikis, this provided them a simple interface to add comments. The same simple

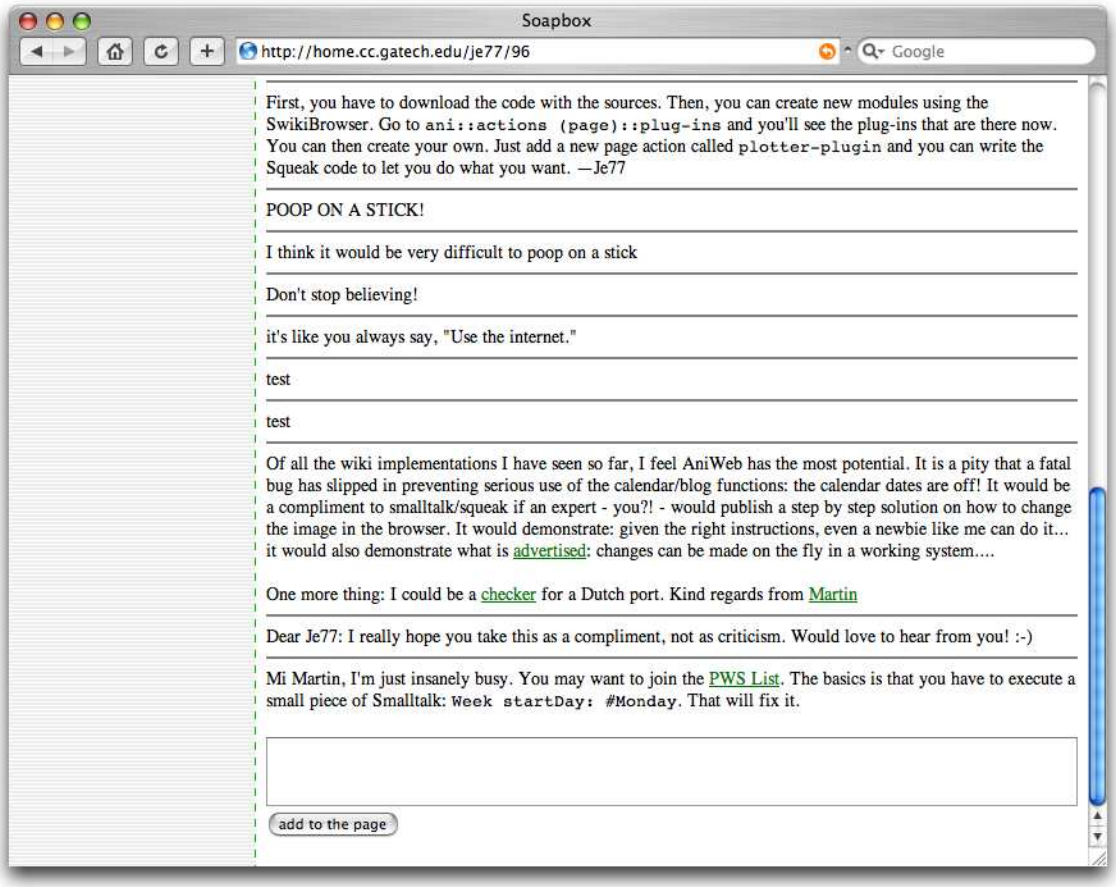


Figure 13: My Comments Page

interface proved useful in allowing anonymous visitors to add content to AniAniWebs.

On my site, I use this feature to implement a "Soapbox" page (Figure 13). The page invites visitors to add a message to the bottom of the page, using the "add to the page" box located there. Every few months, I receive a message on this page; considering that this page is an Easter egg for my site, that is fairly successful. This page succeeds, because it addresses both the social and technological barriers. I make it explicit that people are welcome to add (almost any) content and provide them a lightweight tool for doing so.

RY uses a similar page successfully on her site. She too receives a comment in this manner every few months. These comments are small and friendly. An old acquaintance might announce that she stumbled across the site. A fellow researcher might note that he finds her research interesting. A friend might leave a remark that only makes sense to RY.

These comments pages demonstrate that the appropriate technology and the appropriate setting can encourage interaction. These pages are similar to the popular "walls" feature in Facebook in both the process of the interaction (add content directly to a prominent part of a person's home page) and the nature of the typical content added (short, friendly, informal, etc.). One difference between the two technologies is that AniAniWeb contributions are anonymous unless the person has an account, whereas all Facebook posts are associated with an identifiable Facebook user.[5] So, it is easier for Facebook users to reply to the message. To compensate for this, anonymous contributors often leave an e-mail address for replies. Like me (e.g., Figure 13), RY will occasionally reply to new posts by posting a message to her own interactive forum.

PWM used the same "add to the page" boxes as a convenient method for adding content to her page. Occasionally, she would receive similar notes from anonymous visitors, although she had not intended for these boxes to be used in this way. This suggests that visitors are willing to add content to a home page as long as the process for doing so is simple.

Another lightweight interaction opportunity arose through polls. Polls could be set up through editing a page and then be used by anyone simply viewing the page. All it takes is a button press to vote. Several adopters used polls. Polls helped several adopter chose movies for movie nights. For RY, the poll helped her name her research project. CM created a poll to better understand how people felt about some computer science topics. While polls take a while for home-page owners to set up, they only require visitors to press a button. As a consequence, visitors are willing to participate on polls. Polls proved to be a useful form of light interaction.

While it is useful to support the occasional visitor who wants to leave a small comment, there is also a need to support more sophisticated interaction (i.e., collaboration). PWM's

[5] At the time of this writing, Facebook pages can only be viewed by Facebook members. Facebook has a large user-base, so this is not a huge barrier. AniAniWeb's user-base is much smaller; therefore, requiring that visitors create an account to edit a page is a much larger barrier to interaction.

initial reason for adopting AniAniWeb was for collaborating on a class project. CM was able to use one page to collaborate on a software project and another to collaborate on a research publication. PG created a page for reference letter writers to communicate. RY had several close friends and colleagues who would regularly contribute to her home page. Even in cases where the interaction never became highly bi-directional, the possibility of collaboration helped make the technology appropriate for the task. TI created a repository for a class project; while he was the only one to edit this page, this was a result of his role in the project, rather than the disinclination of his fellow group members to contribute.

One technology that could better facilitate collaboration is support for private areas, which are open only to the collaborators. PWM did not use AniAniWeb for her class project as the early version of AniAniWeb did not support private areas. CM felt vulnerable that the drafts of an article were available on her site. AniAniWeb's new access-control system enables such private areas (Section 6.3.3).

While entering a password or creating an account can be significant barriers, serious collaborators are more willing to overcome these barriers than casual visitors. Collaborators typically have strong ties to each other (Haythornthwaite, 2002). Even for RY, who had hundreds of contributions from others to her site, those contributions all came from eight people that RY knows well. Thus, different technologies are necessary for supporting interaction and for supporting collaboration. Lightweight tools, such as "add to the page" boxes and polls support interaction, since the visitor does not need to invest much effort to use them. In contrast, serious collaborators are willing to overcome hurdles, such as creating an account, and are willing to learn more complicated skills, such as properly using the wiki syntax. To support these collaborators, access control can be important as the collaborative efforts of people with strong ties often are not open to the general public.

While interaction and collaboration did not occur as often or as pervasively as on a typical wiki, it was still important to adopters. Most felt positive about others contributing to their site and were disappointed that it did not occur more often. Only one studied user

locked his AniAniWeb to prevent contributions from visitors. The other adopters left their sites open for the most part. They trusted visitors to use their abilities appropriately. PG specifically commented that she would leave her site open until she gets abuse; then, she might reconsider it. Many adopters were familiar with CoWebs. CoWeb has few access restrictions, yet the sites are seldom abused (Guzdial et al., 2000). AniAniWeb users may have adopted a similarly open attitude, believing social protocols can keep their site from being abused. Besides the occasional attack of spam-bots (see Section 6.4.1 for more about spam-bots), reports of abuse were non-existent throughout this study (from either research participants or other AniAniWeb adopters).

4.2.5 Self Use

Although AniAniWeb enabled interaction, the majority of the content of any given AniAniWeb was authored by the owner of that site. Overall, interaction and collaboration, while important, were much less prevalent on an AniAniWeb than on a typical wiki. One use that did grow substantially with the introduction of AniAniWeb, over the static personal home pages analyzed in Appendix A, was *self use*—use of the home page to serve purposes that are primarily of interest to the owner. Traditionally, the personal home page is a publication medium: Owners publish content for visitors. With self use, that model of the home page is largely abandoned: Owners publish content for themselves. As expected from the analysis of static personal home pages (Appendix A), the amount of self use increased as adopters used the technology more. As it was so much easier to author and maintain content on an AniAniWeb, adopters used their sites for purposes not traditionally associated with personal home pages. The easier to compose and revise, the more self use emerges. AniAniWeb enabled self use for several reasons.

AniAniWeb makes it easy for adopters to link to other websites. Considering the vast amount of information and services available on the Web, keeping links organized and in a central location can be essential to successfully navigating the Web. For several research

participants, AniAniWeb took over the role of bookmarking, generally relegated to the web browser. One bookmarking advantage of AniAniWeb is that users can organize the content as they see fit. For example, a user can put descriptions or keywords next to a link.

Another bookmarking advantage of AniAniWeb is that it is easily accessible. Since people do not always use the same computer or browser, browser bookmarks, which are associated with a specific browser on a specific machine, can be inconveniently inaccessible. In contrast, a personal home page is available from any computer connected to the Internet. To overcome the limited availability of the browser bookmarks, one faculty member created a script to upload his browser's bookmarks to his website nightly. This allowed him to view his bookmarks away from his office; however, it did not allow him to add new bookmarks from other locations. In contrast, adopters of AniAniWeb can edit their bookmarks from any machine connected to the Internet.

AniAniWeb also allows users to easily revise content. With just a click on the edit button, a page's text can be altered. This led to such observed uses as a "to do" list, a "homework" list, and a scratch page.

Self use means an author is creating content without others in mind. Yet, that content is not inherently meaningless to others. The bookmarks that one person makes can be useful to another. Often adopters leave their bookmarks visible to others. Although they did not generate the bookmarks to serve others, they did not mind visitors browsing them. On the other hand, items like a "to do" list proved to be more sensitive. When greater access control was added to AniAniWeb, adopters switched their "to do" lists so that these pages could only be viewed by themselves. While it is important to support interaction through an access-control system, it may be just as important to support self use through that access-control system.

Not every adopter used AniAniWeb for self uses. For instance, PG almost exclusively used it for publication purposes. Yet, several members primarily conceived of their AniAniWeb as serving themselves. RY, whose case is detailed in Section 5.5, describes her home

page as an "organized repository" to keep track of herself. The following two cases, MDN and PWM, highlight two adopters who primarily used their sites for themselves. Their cases demonstrate how the medium of personal home pages can usefully and differently support self use.

4.3 Case: My Digital Notebook

> "You need a digital notebook." —MDN

MDN entered Georgia Tech with work experience and a masters degree. As a result, he had a clear vision of the research he wanted to do for his doctorate. Unlike typical incoming graduate students, he worked fairly independently, without much guidance from the faculty. For a variety of reasons, AniAniWeb was a natural fit for his research needs.

He began using AniAniWeb when it was advertised for incoming students. Unlike his classmates, he did not adopt it to be social. One of his first actions was to lock down the site so nobody else could edit. Instead, he started using his AniAniWeb as a digital notebook. While it was public, it primarily served himself. The vast majority of the content was written with him in mind (i.e., self use); all of the content was written by him. The site became a central place to keep his information—an augmented memory.

MDN primarily uses his site to organize his research interests and work. Most of the research he is interested in can be found on the Web. Articles are available to download and project websites detail relevant work. When he finds research of interest, he links to it on his AniAniWeb. He annotates the links with short hypertext notes about why the link is relevant. He also organizes the links like a web directory so that similar ideas are grouped together. While this content is meaningful to him, to outside visitors it just looks like several pages filled with lists of links (and brief annotations) only roughly organized by headings.

The links serve two purposes. First, they remind him what he has read already and how it fits into his research agenda. Second, the links can serve as a reading list. He does not

always have the time to read an article when he finds it. By linking to it at that time, he can more easily retrieve it later. In addition to external resources, he also posts documents about his own research work; these range from polished articles to be read by others to works-in-progress that are only fit for himself.

While the primary purpose of the site is research, he also maintains other self-use information: a schedule, links to Georgia Tech sites of interest, class resources, banking information, notes on apartments to consider, etc. In his words, the site is a digital representation of everything (public and private, professional and personal) he wants to remember. While his home page is largely driven by self use, MDN also uses the site as his professional home page. A web search on his name will lead visitors to his AniAniWeb. So, he provides some standard professional content, such as contact information, an academic picture, and his resume.

4.3.1 Why AniAniWeb?

MDN feels it is important for a researcher to have a digital notebook to organize his thoughts and augment his memory. There is so much information that relates to research and other aspects of life that it is impossible to keep it all organized in memory. While his desire for a digital notebook is well reasoned, there is little to suggest that AniAniWeb could serve that purpose. AniAniWeb was designed to create personal home pages, a medium generally associated with broadcasting to others. MDN instead uses his site primarily for himself. Furthermore, AniAniWeb was designed to enable interaction with others, yet MDN shut down that possibility immediately. While he acknowledges that he could use the site to collaborate with others, he does not feel that such an opportunity has ever arrived. He neither uses the technology as it was envisioned by its designer, nor does he use some of its core features. Yet, he is relatively happy with it as a digital notebook. Why?

First, AniAniWeb is accessible from anywhere. MDN is highly principled in his approach to organizing information. One of his rules of thumb is that “everything should be

in one place." If everything is one location, it can be easily accessed and linked. Since he uses different computers at work and at home, simply storing the information on one of these machines would violate this principle. The personal home page solves this problem by being easily accessed from either machine.

Second, AniAniWeb integrates well with the rest of the Web. He often links to other websites. It is easy to do this quickly with AniAniWeb. As it is just a server application, he does not have to switch out of the browser to add these links. He also likes hypertext to organize his information; he likes both HTML and the more concise AniAniWeb mark-up language. He can add a working link to his AniAniWeb by simply surrounding the URL by asterisks; straight HTML is much more verbose.

Third, AniAniWeb facilitates publication. While producing content for others is not MDN's main focus, it is something he occasionally does. With AniAniWeb, he can easily publish a page by inviting someone to visit that URL. Before he sends out such an invitation, he might polish the page to make sure that it is ready for an audience. He expects to only get visitors when he invites them; consequently, he is not concerned with casual visitors viewing a rough page.

These three features made AniAniWeb suitable to be a digital notebook. MDN could consider other technologies; however, many of these have serious drawbacks. A static home page might be easily accessible and facilitate publication, but it does not integrate with the Web as seamlessly. Editing a static page typically requires the user to open a separate application and another program to transfer content from the client to the server. MDN felt this process was too tedious; therefore, he never created one. His first real home page was his AniAniWeb website. Before that, he had hijacked a few pages on a wiki to serve this purpose. While he found the editing abilities useful, he felt he was abusing that wiki by posting content that was primarily of interest to him, rather than the community. As a more suitable alternative, MDN expressed interest in moving some of his AniAniWeb functionality to a word processor. It would allow him to do some things more easily:

WYSIWYG editing, spell checking, and printing. In particular, he would implement this strategy if he had a notebook computer. As he would carry the notebook with him, the accessibility problem associated with using multiple machines would be solved.

4.3.2 A Better Digital Notebook

While AniAniWeb functioned adequately as a digital notebook, MDN had several suggestions for improvement. He explicitly made these suggestions for improving AniAniWeb as a digital notebook, rather than as a typical personal home page. While the average homepage adopter may not desire these features, heavy adopters may find that the same system that serves to informally publish content to others can be useful to themselves. If self use increases, the needs of users will change accordingly.

Some of his suggestions were simple and obvious. MDN would like to have a WYSIWYG (what you see is what you get) editor that integrates the view and edit mode. This is certainly not a novel suggestion for improving wikis. Most wikis still utilize a plain HTML text-box to edit content, because older browser technology made it impossible to do anything more sophisticated without a plug-in. Plug-ins are problematic, because downloading a plug-in can be a huge barrier to entry. Browsers have traditionally neglected the value of authoring (Berners-Lee, 1999). Only now are new web standards making it possible to realize this vision. Google builds on this technology for Writely,[6] a WYSIWYG word processor with a browser interface that allows users to easily share and coauthor content.

Another obvious need that MDN discussed is the need for more-powerful access control. In particular, he wants to restrict pages so that only he can view and edit them. "The fact that it's public holds me back a little bit." For instance, he maintains a page of account information. Many web services ask that the user create an account, with a user-name and password. Keeping track of all of this account information can be a difficult problem. MDN solves it by recording all his account information on one AniAniWeb page. Because

[6] *http://www.writely.com/*

he could not initially prevent registered users from viewing the page, he disguised the passwords. With completely private pages, he could use the actual passwords. Newer versions of AniAniWeb implement these private pages.

A more novel and ambitious improvement that MDN envisions for his digital notebook is integrating e-mail. This is a natural extension of his "everything should be in one place" principle, since much of the information that he would like to recall is encapsulated in e-mail messages. For many people, e-mail is a vitally important part of personal information management (Belotti & Smith, 2000). E-mail is a medium of time-tagged messages commonly used for one-to-one correspondence. Personal home pages are a medium of revisable pages that are broadcast to an open audience. Based on these core uses, these media seem incompatible; however, in the context of a digital notebook, they become complementary. Both the personal home page and the personal e-mail archive can augment memory. To better access this memory, MDN would like to link content, organize messages, and search through them. From his perspective, whether the content is in his e-mail inbox or on his home page is largely irrelevant. Integrating the technologies would help to integrate the content. Combining these media is difficult for many reasons (the format of messages is different, the notions of public and private are vastly different, etc.), but MDN's usage of AniAniWeb suggests that it might be useful for some people.

A good digital notebook enables its user to easily create, organize, and retrieve content. To better illustrate what that means, consider how MDN approached his research section. At first, he simply organized it chronologically; when he found new content, he would append it to the end of the page. This worked initially for retrieval as the page was short enough to scan visually. When it became unmanageably long, he split the page into several pages, organized by topic. This solved the unwieldy page problem; however, it introduced new problems. While the reorganization scheme might work initially, new content may prove the original split to be flawed as some pages grow out of control while others remain small. Eventually, another reorganization may be necessary. Organizing content can be a

tedious task, so MDN does not want to do it frequently. In the nearly two years of having the site, he has only taken the time to reorganize it twice. In addition, splitting content into topics can be difficult when topics overlap or when one resource addresses multiple topics. MDN's experience is that it is possible to split content well along broad topics, but it is more difficult for subtopics.

AniAniWeb is limiting as there is only one way to browse its content: viewing a page. Given the complex interrelated nature of MDN's digital notebook, this static structure is limiting. For instance, MDN might want to browse all resources he has on machine language, but those might be located on separate topic pages. He believes a more structured database interface would better serve this purpose. This structured-data preference predates AniAniWeb. One of his first research interests was building a more structured World Wide Web. Shortly before I interviewed him, he had been searching for an apartment. While he found sites online for various apartment complexes in Atlanta, he was unable to trim the list according to whether they had a pool. The website interface only allowed him to sort results on a few conventional criteria (price, location, number of bedrooms, etc.). A database interface would have allowed him to make more flexible queries to better suit his preferences.

MDN wishes to apply his structured-data preference to his digital notebook—to structure his posts by keyword or by how they relate to other posts. With this feature, he could more easily browse and reorganize his digital notebook. While end-user programming, such as querying a database, can be useful, it is also a skill that takes time to learn (Nardi, 1993); a novice user might be turned away by this hurdle. Also, an *ad hoc* system can be more appropriate for content that cannot be easily structured. MDN realizes that there are trade-offs between the two approaches. Ideally, a digital notebook should implement both approaches; thus, its owner can experiment with what approach better suits the problem.

4.4 Case: Playing with Media

As MDN's case demonstrates, people can adopt media in unconventional ways. Instead of using his personal home page to publish content for others, MDN used it as a digital notebook to organize his life. Like MDN, PWM uses AniAniWeb primarily for self use; however, she approaches both personal home pages specifically and new media in general quite differently.

MDN seeks a system to fulfill his vision. For him, AniAniWeb is nearly the closest approximation available for the digital notebook he desires. Since AniAniWeb was not designed to be a digital notebook, it often fails to meet his needs and expectations. Rather than adapt to the affordances of the system and explore their benefit, he would like the system to adapt to his vision. First, he failed to take advantage of the collaborative features of AniAniWeb. Second, he declined to learn AniAniWeb's color scheme system. While he wanted to change the look of his site, he did not want to learn the CSS system; instead, he felt that the system should build on the HTML that he already knows. Third, he did not like the look of the column that contained the page hierarchy and menu text (Figure 7 on page 41); while these features are core to AniAniWeb, he did not use them and wanted to remove them. While his frustrations suggest how AniAniWeb could be made more flexible, they also demonstrate MDN's unwillingness to adapt to the system.

In contrast, PWM tries to adapt to the affordances of the medium. She actively experiments with the medium to see whether it affords certain uses. If the experiment succeeds, then she can use a similar approach in the future. If the experiment fails, then she knows that this task does not fit the medium. Either way, she discovers the properties (affordances and limitations) of the medium. Where MDN is frustrated by failure to easily accomplish a task, PWM views this failure as a positive learning opportunity. While she is disappointed that she did not accomplish her goal, she at least gets something positive out of the experience. It helps that she has an intrinsic interest in personal home pages; that interest sustains her when the results of her use disappoint.

Personal home pages are flexible and expressive: Adopters can approach them in vastly different ways. Where MDN tries to impose his world-view on the medium, PWM seeks to integrate the medium into her world-view. Her approach to creating a personal home page is that of a bricoleur. A bricoleur seeks to have a close relationship with the environment, building her understanding by trying things out (Turkle & Papert, 1991). MDN, in contrast is a planner. He starts with an abstract principle (e.g., everything should be in one place) and seeks to make the environment behave according to that principle.

Playing with media is a method for understanding media (Rick & Lamberty, 2005). It takes serious experimentation to discover the affordances of a new medium. One manner of experimentation is remediation, applying the established practices of one medium to another. PWM is interested in understanding new communications media, such as personal home pages. She is curious about personal home pages from both a professional and personal perspective. Her use of those media informs her about the tools that shape her world. Mastery of tools can be essential to establishing identity (Tenner, 2003). This tool-based notion of identity construction differs from the identity construction detailed by Turkle (1995) in her studies on MUDs and detailed in Chapter 5 for personal home pages. For Turkle, people construct their identity by *playing with their problems* in the medium; PWM instead constructs her identity by *playing with the medium* in the medium. Her success is not measured by progress on addressing a problem, but rather by progress on understanding the medium.

This case details PWM's experiences of playing with media. First, a brief history shows how she became interested in personal home pages. Then, her experiments with various personal-home-page technologies is detailed. PWM does not restrict herself to one technology. As she wants to understand personal home pages in general, each technology just offers a different complimentary perspective. By synthesizing across similar concrete experiences, a person can better understand a phenomenon (Kolodner, 1997). While she uses AniAniWeb extensively, she does not consider her AniAniWeb a personal home page. She

discovered that she actually prefers using that technology for uses not generally associated with personal home pages (i.e., self use). Finally, the results of her experiments with personal home pages are examined.

4.4.1 Her Interest in the Medium

PWM first created a personal home page to fit in. Like other participants in this research, she grew up in an era when having a personal home page had cultural value. Many people would include a link to their home page in their e-mail signature. Her brother had a home page. So, she created one as well. Like many home-page adopters at that time, she started with a free Geocities home page. Since she did not know HTML, she used their authoring tool. Eventually, she learned HTML by looking at the source code of a page. At that point in the Web's development, even professional pages were created with simple HTML. A novice could view the HTML source of a page inside the browser. Then, the novice could apply the same methods to achieve a similar result on their page.[7]

Her interest evolved as she gained competence in the technology. She learned that authoring web content was a valuable vocational skill. She entered the College of Computing's Masters of Human-Computer Interaction program explicitly to learn skills that could make her a valuable website creator. Even before taking classes, she realized that she was neither good at nor interested in creating aesthetically innovative sites; instead, she wanted to apply usability principles and user-centered design to website design.[8] She became particularly interested in issues of accessibility. Many websites are not accessible to blind users; however, new laws increasingly require some sites (e.g., government sites) to be handicapped accessible. So, she feels that there is a market for someone familiar with practices that make a site more accessible. Her interest in website technology has driven

[7]This method of learning HTML was quite common ten years ago. Unfortunately, it is no longer as viable. Newer technologies (e.g., DHTML, CSS) have made it much more difficult for a novice to trace what appears on the page to specific code. As a medium evolves, so do the common practices associated with that medium.

[8]See Jacob Nielsen's *useit.com* for articles promoting the importance of usability and user-centered design to website design.

much of her exploration of different website technologies. She tries these technologies out by applying them to serve her needs.

4.4.2 Adopting Multiple Technologies

Her oldest home page is her static page, which she started in 1997. After some time, PWM realized that she enjoyed both having a personal home page and working on it. So, she moved the site from the free Geocities server to a commercial server. This gave her more flexibility and control of the site. For instance, she was able to purchase a domain name to make the URL more memorable. Bucking the convention of simply using her full name, she acquired a domain name that combined two terms from her main interests: computing and music. This choice both reflected her personality and could be easily remembered by others.

This static site has been her primary web presence for others. The intended audience is her friends and family. Since the site is meant for public consumption, she does not post anything too personal. The site primarily contains a few informal writings and pictures. The writings showcase her quirky and observant personality. The pictures document trips that she has taken and events she attended.

Initially, this site served as a place for her to play with HTML. She practiced manually writing HTML by changing the looks and organization of the site. She discovered that changing all the pages to match a new design was tedious in plain HTML; she had to manually update all pages on the site. So, she learned PHP, a server-side programming language offered by her web-host. Using PHP, she could insert the same HTML code into all the pages on the site. While PHP solved the update problem, it introduced a new problem—an elongated editing cycle. Because PHP is a server-side technology, she could no longer render the site on her local machine. To test her work, she had to upload the documents back to the server. That made finding and fixing errors more difficult.

Over time, she quit updating the site. Increasingly, the effort was not worth the anticipated reward. When she uploaded pictures, she no longer added captions. Since the pictures were posted for friends and family, captions were not strictly necessary and too time-consuming to add. For a while, she regularly posted blog-like posts to the home page. She abandoned this practice after only a short time, realizing that the benefit was not worth the cost. At one time, she intended to redesign the site to be more accessible, thereby practicing her professional skills; however, she never did. The site has continued to stagnate, becoming increasingly out of date. Her interest in the site waned as its novelty has faded; the site no longer engages her intellectually. Since she had already achieved sufficient competence in HTML and PHP, play in this medium became banal.

At about the same time that she lost interest in her static page, she began using AniAniWeb. She heard about AniAniWeb through a friend who thought it might be a suitable private space to collaborate on a project. Upon further investigation, they discovered that the existing access-control system failed to meet their expectation of a password-protected private space. While they did not use AniAniWeb to collaborate on the project, she did start using it for herself.

Like MDN, PWM adopted AniAniWeb as a tool to organize her life, rather than as a professional home page: "I don't think of it as a personal home page." The quick editing cycle made it a convenient space to put anything going on in her life. In comparison to her static site, AniAniWeb makes logging in and authoring content much easier. She also likes using the mark-up language, rather than verbose HTML. In particular, authoring simple lists and adding links is simpler with AniAniWeb's mark-up language.

The ease of authoring drove her to use the technology for many different purposes: "Because it's so easy to use, I practically put anything and everything on there; although, I try to keep it somewhat organized." Like MDN, she keeps any content that could be useful in the future, thereby using the site to augment her memory. Whenever she needs to write something down, she adds it to the site. Since AniAniWeb is accessible from anywhere,

it is a convenient forum for storing and recalling information. She prefers keeping this information digitally, rather than on paper; it is much easier to lose paper.

Like MDN, she maintains bookmarks of relevant links with short annotations. Initially, she just had one hodgepodge page containing all the links she was interested in. She would add to this page using the "add to the page" feature; this allowed her to add content even if she was not logged in. Over time, the page became unmanageably large. She then split the content among new pages based on themes that had emerged. While she just linked to content most of the time, she created one page that contained a full screen-shot of an external site plus a link to that site. She was worried that the site might disappear. By archiving a screen-shot on her site, she would not lose the content, even if the site no longer existed.

PWM adopted AniAniWeb much like MDN did; however, there are some notable differences. First, PWM placed more emphasis on planning the future. She managed different "to do" lists for projects, purchases, and homework. Unlike the links pages, which tend to simply grow, these pages varied in size as she completed old tasks and added new ones. Second, as a masters student, more of her focus was on classwork, rather than research. For instance, she set up a page to evaluate possible classes to take; her AniAniWeb served as a repository for links to relevant information, such as course recommendations. She also used the technology to support her in the classes she was taking. For instance, she collected links that would help her when programming for class: "When I find something that seems important—that I think I might want to go back to when I'm coding—I'll just add a link on here. But, I'm not sure how much I've actually gone back and looked at those URLs again. But, it just makes me feel better to know that if I need to... that I have an easy way to get back to it." Third, PWM was more open to collaboration. She leaves the site open to others; occasionally, someone will leave a message. Furthermore, she used her site to collaborate on a class project. While she does not mind others viewing and contributing to her site, she does not feel that the site serves an external audience. The majority of the

content is not meaningful to an outside audience. “No one cares what my homework is for this week, besides me.” Her AniAniWeb is for herself.

Shortly before my first interview with her, PWM adopted a blog. Her aim was to use it to inform her family, primarily her parents, what she was studying and what was going on in her life. She felt that other media, such as e-mail and telephone, were not doing the job. For instance, it was difficult to explain her professional interests over the telephone; on the blog, she could include useful links and carefully craft her words. She realized that she was trying something new and that it might fail. She had already had the experience of losing interest in the blog-like posts on her static site. So, she only let her parents know about the site. “I wanted to see if I kept it up, before I sent it out to people.” If it succeeded, she would let friends know about it.

In a follow-up interview, she was asked about how the blog experiment was proceeding. She reported mixed results. On the one hand, she was posting to it about twice a month on a regular basis; it was much more convenient than editing her static site. On the other hand, she had little faith or evidence that others were actually reading it. She could get others to read a post by e-mailing out the link; however, that largely defeated the purpose of having a blog, since she could have just e-mailed the information. She expanded her audience a bit by including friends that were separated by distance. Her local friends did not need the site, since they met her in person on a regular basis. Unfortunately, the audiences of parents and friends were not quite as compatible as she initially imagined. She had to hold back from posting some content, because it was not appropriate for both audiences.

4.4.3 Reflections of a Bricoleur

PWM is a bricoleur. She seeks to understand a medium by adopting it for a variety of tasks. Through this play, she constructs her understanding. Compared to MDN, she reflects more on the nature of personal home pages and websites in general. This is certainly a consequence of her professional interests in designing commercial websites, but it also is

a function of her bricoleur preferences. When she first created her static home page, she did not start from an abstract plan, but instead did "what was easiest and would get the job done." As she redesigned the site over time, she wanted to create a site that showed her competence: "I want it to look like it's thought out."

Instead of concentrating on visual aesthetics, she wanted the site to reflect her competence in web usability. Part of user-centered design is anticipating the needs of intended users (Norman, 1988). She added width and height fields to image references to allow the page text to render quickly even if the user accesses the site through a slow connection. She made sure the site could still be be viewed on a low-resolution SVGA display, such as her parents had. By imagining herself as a visitor to her site, she realized that new and recurrent visitors would have different needs. She tried to design a site that could please both groups. She also realized that with a diverse group of visitors, she would have to limit the content of the site—not everything should be available to everybody.

While she constructs her understanding largely through active play, she also integrates her knowledge from observation and outside sources. She learned HTML by looking at the source code of good sites. When she designed the home page of her church, she added a link to it from her personal home page. While others might do this to associate themselves with the institution or the religion, she had a more practical motive. When she did a search for her church's name, the site she had designed did not appear in the first twenty hits. She knew that search engines base the importance, and thereby relevance, of a site on the other sites that link to it (Walker, 2002). By linking to the church's site, she helped raise its page ranking. She was able to apply her knowledge of search technology to serve a practical purpose.

She sought out opportunities to apply her understanding to the problems of others. In addition to helping out her church, she tried to help out her mother. Her mother is a school teacher; she faced the common problem of not being able to access her bookmarks on her home machine from school and vice versa. PWM set up a solution. She created a page on

her AniAniWeb that her mother could use for bookmarking; since AniAniWeb solved her bookmarking problem, she felt it could do the same for her mother.

PWM differed from MDN dramatically in how many different uses she had for her home pages. She would frequently invent new uses for her sites. On her static site, she created a PHP application to send invites for an event. One day, she had to complete a presentation for class. Normally, she would have authored the presentation in PowerPoint; however, the computer she was working on did not have PowerPoint installed. So, she started using her AniAniWeb to create the presentation. By increasing the size of the fonts and using links for navigation, she could create a functional presentation. While it lacked the polished look of a PowerPoint presentation, it worked. After she received an extension on the assignment, she transferred the content to PowerPoint; however, her experiment succeeded: She was able to remediate a presentation tool into AniAniWeb.

Unfortunately, the experiments did not always succeed. In particular, she found it difficult to motivate others to interact. When she first adopted AniAniWeb, she tried to interact with other users by leaving comments on their AniAniWebs. Nobody responded. By then, many initial adopters had given up on their sites. Nobody ever used the event invitation tool she had programmed with PHP. Nobody made comments on her blog. Her mother never used the page she had set up. The one time she was able to get others to interact was by using an AniAniWeb poll; however, even that failed as one person flooded the poll with multiple votes, thereby invalidating the results. Fostering collaboration and interaction in a new medium is inherently difficult. It requires understanding both the medium and people, both difficult entities to predict. Although many of her experiments failed, PWM has gained a thorough understanding of personal home pages by playing with media.

4.5 Constraints on Use

> WASHINGTON, DC—In the interest of national security, President Bush has been asked to stop posting entries on his three-month-old personal weblog,

acting CIA director John E. McLaughlin said Monday... (The Onion, 2004)

"CIA Asks Bush to Discontinue Blog" is the title of this article in *The Onion*, a popular satirical newspaper. While many people usefully maintain a blog (or other personal home page), it would be absurd for President Bush to do so. Even if he had the time and inclination to maintain such a site, the constraints of his position would keep him from doing so. As President, his posts would be far more scrutinized than those of the average blog adopter. He could do serious damage to his reputation and to his office by writing the kind of blog posts that are common for others. His actual public communications are carefully scrutinized, crafted, and polished before they ever reach the public. The informal nature of a blog post would not befit his position.

While it is immediately obvious that President Bush is constrained in his use of personal home pages, every adopter's use of personal home pages is practically constrained by at least three factors: the affordances of the technology, the conventions of the relevant social groups, and the relevant governing policies. While it is possible for an adopter to violate the latter two, it would be practically unwise, potentially having serious negative results.

First, the adopter is limited by what the technology allows. MDN is unable to structure his links like a database on his AniAniWeb. While AniAniWeb was designed to be more flexible than conventional static home pages, it still has many limitations; Chapter 6 will further address important limitations and what might be done to overcome them. As one connects to AniAniWeb through HTTP, it inherits the limitations of that transfer protocol. In particular, HTTP messages are not encrypted; any machine between the server and the client thus has access to the full data being transmitted. Hackers have exploited the insecurity of HTTP in the past. It has become standard to use a different protocol, HTTPS, to transmit sensitive data, like credit card information.

Second, the adopter is limited by the conventions of the relevant social groups. To belong to a community of practice, a member should adopt the social conventions of that community (Wenger, 1998). In the President Bush example, there are too many relevant

social groups to allow a blog. As the article quips, the CIA would frown on him leaking sensitive information. While the conventions of presidential politics are unique, each community of practice has conventions of appropriate behavior. For academics, it is conventional to keep the content polite (Section 3.3); I will return to implications of this convention on home-page adopters in Section 5.7. Interviewed faculty members further felt that a personal home page should avoid sensitive topics irrelevant to the academic position of its owner. For instance, it would be inappropriate for a computing faculty member to post articles on politics; however, it would be acceptable for a computing faculty member to post articles (even controversial ones) on computing, as that relates directly to their position. In contrast, for a faculty member in political science, posting articles on politics would be appropriate as it relates to their professional position.

Third, the adopter is limited by the policies that govern the medium. For personal home pages, those policies can be divided into two categories: laws and provider policy. An adopter is subject to the laws of the appropriate governing bodies. The relevant governing bodies vary based on the location of the person and the location of the server. A personal home page is served from some server on the Internet. Whoever provides that service has certain hosting policies that they can enforce. Of course, a person can change providers if the hosting policy becomes a problem. For most people, conforming to these laws and provider policies is trivial; they would conform to them even if the policies did not exist. While these policies did not notably impact the research participants, it is worth exploring the actual limits to demonstrate the constraints of the personal-home-page medium.

AniAniWeb adopters in the College of Computing are subjects to the laws of the United States and the State of Georgia. Since the home page is served from a College of Computing server, it is subject to the policies of the following institutions: College of Computing, Georgia Tech, and the Georgia Board of Regents. Violations of those policies could cause the adopter to lose the resource or, in the extreme case, his job.

While the United States prides itself on the right of people to exercise free speech, there

are limits. For instance, speech that is "likely to incite imminent lawless action" has been declared to fall outside of free speech. Speech that libelously damages another's reputation is also not protected. Furthermore, the distribution of obscene content is regulated. So, a person cannot distribute pornographic content without blocking minors from accessing the material. Other content, such as child pornography, is not legal to distribute in any manner. The limits of free speech have always been vague and often have to be negotiated.[9] Business transactions are also regulated by law. For instance, online gambling is illegal in the United States.

Some content is copyrighted and cannot be widely distributed. It is not legal to share copyrighted music; the RIAA (Recording Industry Association of America) is particularly vigilant about enforcing their copyrights. Copyright infringement is a legitimate concern for academics. Research work is often confidential and cannot be published in such an open forum as a personal home page. For instance, MG felt that publishing her portfolio would be inappropriate as it contained confidential information. Furthermore, posting published papers to a home page can be dangerous. When an academic article is published, the authors transfer the copyright for that article to the publisher. Publishing that article to the personal home page violates that copyright. Yet, this is a fairly common practice. The publisher has the right to prosecute the home-page owner. As academic publishers wish to maintain good relations with their authors, this is unlikely to happen. But, it could.

On top of limiting what content is acceptable, these policies can change who has access to that information. Laws and warrants can grant others the ability to access your otherwise private content. In Georgia, the Open Records Act further opens the doors as people have a formal process to request documents of any public office. For instance, the salaries earned

[9]One such negotiated boundary is necessitated by child pornography. Child pornography—its creation, possession, and distribution—is illegal. Unfortunately, defining child pornography is difficult. Child pornographers are willing to abuse loopholes in the legal definition. For instance, several "modeling" sites recently began offering pictures of clothed children posed suggestively to avoid prosecution (Eichenwald, 2006). To combat this, laws tend to be written with a wide definition of what constitutes child pornography. Free speech advocates worry that loose laws can be used to censor legitimate content, such as paintings with nude children or nude baby pictures.

by Georgia Tech employees are open to the public. Furthermore, Georgia Tech retains the right to inspect the content of any of its resources. So, even private pages on an AniAniWeb are not entirely secure. As one faculty member commented, "your expectations of privacy are exactly that—your expectations." Your expectations can be flawed.

Service providers, such as academic institutions, are concerned about the content on their servers, since they can be held legally liable. Yet, the large amount of content makes it untenable for these institutions to police all content. As a consequence, most institutions use a reactive strategy: They do not monitor content, but will act quickly if informed about violations by a third party. Georgia Tech takes a similar approach. It publishes a set of guidelines to which web content should conform; however, it will not review information published on personal sites. When approached by a third party, such as when the RIAA reports someone using a server to illegally distribute copyrighted music, Georgia Tech will then immediately take action.

What is perhaps most notable about Georgia Tech's web policy is that it is much more lenient than the general computer usage policy. The general policy states, "appropriate use of computing and networking resources includes instruction; independent study; authorized research; independent research; communications; and official work of GT units, recognized student and campus organizations, and agencies of the Institute." Under that policy, a personal home page with personal content would fall outside the appropriate use of computing and networking resources.

The general resource policy is written for employees to separate professional and non-professional concerns. As a state institution, Georgia Tech uses public funds. By law, these public funds cannot be used for private purposes. The policy is explicit about conflicting business agendas: "Computing facilities, services, and networks may not be used in connection with compensated outside work nor for the benefit of organizations not related to Georgia Tech, except in accordance with the Institute Consulting Policy or the policy Access by External Entities to Institute Information Technology Resources. State law restricts

the use of state facilities for personal gain or benefit." Furthermore, the Board of Regents mandates that institutional funds cannot be used to support a political campaign.

The official policies ask that employees only use Institute resources for purposes that are directly related to Georgia Tech; however, abiding by this policy is often practically difficult. So, for instance, when Georgia Tech issues a wireless telephone to an employee, they accept that incidental personal use will occur. As long as this use does not cost the state money, it is acceptable. On land lines, personal long distance calls are prohibited. Theoretically, an employee should reimburse the Institute for any personal calls made. Practically, such usage does occur and people do not report it, because the use is limited. As one faculty member remarked, using resources, such as a personal home page, for avocational uses raises ethical concerns about how much an employee can use the Institute's resources for personal reasons. So far, there is only an *ad-hoc* consensus of what is acceptable.

While the general usage policy is strict, the specific web policy is more flexible. A person can maintain a personal home page with content as long as it meets certain broad criteria. First, the home page should not be excessively accessed by others; in other words, a site cannot become so popular that it causes problems for Georgia Tech. This is a fairly common policy for service providers; many constrain a user to a certain bandwidth. Second, users should avoid content that appeals to "prurient interest," such as pornography. Third, if the content could be associated with the Institute, it should contain a disclaimer that this work is not official.[10] Fourth, owners of the site should clearly make contact information available, so that others who have problems with the site can contact the site owner directly.

Georgia Tech's willingness to create a more lenient web policy than its general use policy is interesting. In this case, the policy changed to accommodate the use of the new medium, rather than the other way around. This is a good example of how new media

[10]The newest version of AniAniWeb includes a color scheme that is patterned after the Georgia Tech home page design. This design allows new users to quickly create a site that associates them with Georgia Tech. To abide by the web policy, a disclaimer that this site is not official is integrated into the color scheme.

effect change. Early adopters of a new medium create uses that do not work within existing policies and laws; therefore, the problematic policies and laws have to be renegotiated (Gitelman, 2006; Jenkins, 2006). In this way, new media change the limits of their constraints.

4.6 Defining the Personal Home Page

This chapter examined how people adopt personal home pages within their constrains. Personal home pages have been shown to vary enormously both in how people use them and in how they conceptualize them. AniAniWeb was used for diverse uses: publishing information, interacting with others, personal information management, etc. Research participants also conceptualized home pages as radically different things: as a place to address others, as a stalking vehicle, as a digital notebook, as another web technology to explore, etc.

As such, a personal home page cannot be confined to a compact set of practices and values. While it can be defined as pages on the Web that represent a specific person, that still encapsulates many different uses. Newer technologies—AniAniWeb, blogs, and social networking tools (Section 6.4.2)—are redefining what a personal home page can be. Each of these technologies afford different practices and values. Along with technology, the social environments they are used in change how they are used.

As personal home pages mature, prominent genres have established themselves. Each of these genres may fit a standard definition of a personal home page, but have their own important properties and associated uses. As this dissertation documents, professional academic home pages have established properties that reflect the values of their community (Chapter 3). As another example, the public diary has become one of the most common genres of blog use (Nardi et al., 2004). While it can be considered a personal home page, it is often not even thought of that way by its adopters.

The definition that a person has of a personal home page will be strongly affected by the genre he is working within. Yet, an adopter does not have to accept the genre he is given.

He is free to use the affordances of the technology in new ways, such as MDN and PWM did. Over time, genres can thereby evolve based on the use of the relevant social groups, encompassing new uses and meanings (Bijker, 1995; Tenner, 2003).

CHAPTER V

CONSTRUCTING SELF

Erikson's core identity theory concerns itself with the epigenetic development of people—how they mature through the important phases of their lives. Both physical and social development affect identity formation (Erikson, 1963a). One of the critical periods that Erikson focuses on is adolescence, the transitional period between youth and adulthood. In this period, a person develops into a more social creature, finding a place for themselves in the larger social world. As a person tries to negotiate the various expectations that others have of him, there is a developmental struggle between maintaining identity and identity diffusion (Erikson, 1963b). To maintain a psychosocial equilibrium, a person must successfully integrate his new social roles into his core identity.

> [Adolescents] are sometimes morbidly, often curiously, preoccupied with what they appear to be in the eyes of others as compared with what they feel they are, and with the question of how to connect the earlier cultivated roles and skills with the ideal prototypes of the day. (Erikson, 1980, p. 94)

Graduate school is a similar period of psychosocial growth. Through the period of graduate school, a person transitions from being a student to being a professional. In either case, the school experience creates a psychosocial moratorium, allowing the person to negotiate the new demands made upon them (Erikson, 1980). Chapter 3 chronicles the various demands that the academic community of practice makes of graduate students along their journey. It becomes increasingly important for students to present themselves as professionals. Wenger (1998) discusses the importance of identity development as a person becomes part of a community of practice; a person must learn to engage the practices of the community and adopt its values. While this theory addresses the external demands

made for identity formation, it does not consider how the person reacts to these changes. Thus, core identity theory complements the communities-of-practice perspective of identity formation by focusing on the feelings of the individual. Presenting oneself successfully to others is important to constructing a social identity (Erikson, 1980). Like adolescents, graduate students need tools—or as Turkle (1984) terms them, mirrors—that help them reflect on these changes. Since personal home pages present their owners to others, they are a natural medium for owners to reflect on who they are. This chapter is about what personal home pages reflect and how that affects identity formation

First, I discuss how personal home pages can act as a mirror. I discuss the similarity between AniAniWeb use in academia and Bers's notion of an identity construction environment. Second, a case demonstrates how audience expectations can affect how home-page adopters view themselves. CM's core identity conflicts with the reflection of the medium, leading to an identity crisis. Next, the power of text to convey and create meaning is examined. Since creating personal home pages is largely a task of authoring text, common textual-authoring properties apply. The next two sections detail two case stories that demonstrate this point. Writing for others is a reflective process (Bereiter & Scardamalia, 1987). For TI, writing on a personal home page helps him reflect on who he is (to others and to himself). Writing is also persistent—it can be accessed multiple times. For RY, the personal home page is a way to record who she is. Both TI and RY use personal home pages to actively reflect on who they are. Comparing TI and RY's cases, the following section examines the tendency of personal home pages to integrate multiple aspects of an individual into one space. This tendency further fuels the struggle between identity and identity diffusion, as adopters must negotiate how they present themselves to this multifaceted audience. The final section analyzes one consequence of this integrative tendency; it examines how professional personal home pages tend to conform to a polite standard of acceptable content.

5.1 AniAniWeb as Mirror

The objects we create to present ourselves to others allow us to reflect on who we are (Csikszentmihalyi & Rochberg-Halton, 1981; Turkle, 1984, 1995). In that sense, personal home pages are mirrors. An adopter constructs his home page as an external representation of his identity. Others can then view that site to get a better sense of its owner. While the personal home page may be meaningful to outside visitors, for many adopters, the website is more meaningful to themselves. Since the home page reflects its owner, constructing the home page becomes an act of constructing self. Both the act of authoring and the reaction of others informs the owner about himself. As self presentation environments, personal home pages lend themselves to identity construction. In that sense, AniAniWeb is similar to an identity construction environment.

Bers (2001) originally defines *identity construction environments* as technologies and technologically-rich psychoeducational interventions that support explorations of self. Her primary example of an identity construction environment is Zora, a 3-D MUD. In Zora, a virtual community allows children to create different things (virtual places, objects, heroes, and villains) that reflect their respective values. Bers (2006) later expands the term to include an explicit focus on promoting positive youth development. Positive youth development focuses on promoting six aspects of identity for youths: competence (cognitive abilities and healthy behavioral skills), positive bonds with people and institutions, character (integrity and moral centeredness), confidence, caring, and contribution to a civil society.

In several ways, AniAniWeb's use in academia is similar to Zora. In both, users actively construct meaningful representations of themselves. Zora members constructs objects that represent their values to the virtual community. AniAniWeb adopters construct personal home pages to present who they are to their community of practice. Both Zora and AniAniWeb support identity development. In Zora, the focus is on character development. In AniAniWeb, the focus is on becoming part of a community of practice. The nature of the

identity construction is so similar that several of the goals of positive youth development even apply to AniAniWeb use in academia. Through authoring personal home pages, graduate students can gain competence in the important practice of publication (Section 3.1). Graduate students also explicitly try to build positive bonds with fellow students, fellow academics, and potential employers. Other goals of positive youth development, such as confidence, character, and caring, are less applicable to the development of graduate students.

While Zora and AniAniWeb have strong similarities, there are important differences. First, AniAniWeb was not built with the express purpose of supporting identity construction. Thus, it is not an identity construction environment. Rather, like the MUDs that Turkle (1995) observed, AniAniWeb is reflective enough that some users adopt it for identity construction. Unlike in Zora, there is no explicit curriculum to focus AniAniWeb users on identity construction. While there is no explicit curriculum embedded in the AniAniWeb software, the graduate school curriculum does specify tasks, such as writing a research statement and teaching statement for faculty hiring, which explicitly focus graduate students on identity construction.

Second, AniAniWeb is not safe. Bers (2006) explicitly defines identity construction environments as providing "a safe space" for identity construction. Zora was created explicitly to allow its members to plays with ways of thinking about identity and values in a safe environment. For youths, that safety is particularly important. While AniAniWeb too allows its adopters to reflect on their identity and values, it cannot be called a safe environment. A graduate student's home page is a meaningful representation of them to their community of practice. If the image it represents offends, this can have real consequences for the participant, including being denied a job (Section 3.2.4).

Since it is not an explicit focus, not all adopters use AniAniWeb to construct their identity. For PG and MDN, the personal home page is just a useful tool. For PG, it is a communication tool, allowing her to distribute her professional work. For MDN, it is an

organizing tool, allowing him to arrange his life and research. For these two adopters, the medium's reflective properties are less important.

While reflection may not be central to everyone's conception of personal home pages, home pages do reflect: The home page conveys a message about its owner that the person cares about. For PG, it was important that her home page's aesthetics accurately reflect her personality. One student changed the background color of her home page to avoid a negative stereotype. Sometimes the message conveyed by a personal home page cannot be determined by its owner:

One faculty member posted a goofy picture of himself to his home page. He did not think too much about posting the image as it was referenced in the appropriate context. Then, when he was being introduced as a speaker for a conference, the person giving the introduction projected this picture to introduce him. Conference attendees laughed and he felt slightly embarrassed. He did not realize that was going to happen. This event triggered what Erikson (1968) described as a crisis. An external event created an imbalance between how he felt people should relate to him and how they did.

At first, he had a negative reaction. In general, he tries to be professional in professional settings; the picture was obviously not consistent with this image. On sober reflection, he had a more positive reaction. He had posted the picture to his website to showcase his lighthearted side. In the end, he welcomed the opportunity to demonstrate to conference participants that he was not exclusively professional. As this example demonstrates, the meaning a home page has to its owner often depends upon how the audience for that home page interprets and uses the content. Because it is widely accessible and easily repurposed, the content of a personal home page can be perilous. It can also be useful.

5.2 Case: The Chocolate Milkshakes Candidate

Maneuvering through graduate school is a social process. Graduate students tend to make friends with their fellow students. These friends then help them along their journey, whether

that be studying for qualifiers, rehearsing a presentation, or collaborating on theory[1] homework. One unofficial event that supports this in the College of Computing is a happy hour; every Friday evening, graduate students meet at a local restaurant or pub to share dinner and good times. An informal (and usually quite funny) group e-mail informs people where to go. Spouses and friends who are not graduate students are welcomed. Consequently, although research is occasionally discussed, the primary function of happy hour is for students to socialize with their fellow students and friends. While most attendees have a drink, few people drink heavily. The atmosphere is personal, good natured, and inviting. Occasionally, even a few younger faculty members show up.

CM, along with her husband, are regulars at happy hour. CM has a confident, outgoing personality that meshes well with the chatty happy-hour crowd. CM often orders chocolate milkshakes. Many of the restaurants will make chocolate milkshakes even if they are not on the menu. After a couple of times, others began to ask about it, "so, CM, are you gonna order a milkshake?" Obligingly and genially, she does. How good the chocolate milkshake was became a normal topic of conversation and something CM became known for. CM adopted being a chocolate milkshake fan as part of her personality. It was not her intention that she gets known as the chocolate milkshake fan, but she enjoys playing that social role.

When she created her home page, CM included a "chocolate milkshakes" page (Figure 14[2]), where she shared reviews of the milkshakes at various venues. Creating the page was fun and exemplified her outgoing personality. The page was so socially inviting that a friend added a guest review—one of the only interactions on CM's home page with others. That interaction made her feel good; it demonstrated that she had succeeded in creating a page that showcased the fun and outgoing part of her personality. When she taught an undergraduate class, her students commented on the page. "Then students saw the

[1] In the College of Computing, the required theory class is considered particularly challenging. Students often collaborate, working together on homework and studying for exams, to get through the class.

[2] To preserve confidentiality, this screen-shot has been altered. It represents the overall spirit and feel of the actual page, without using the specific text that can be used to easily break the pseudonym disguise.

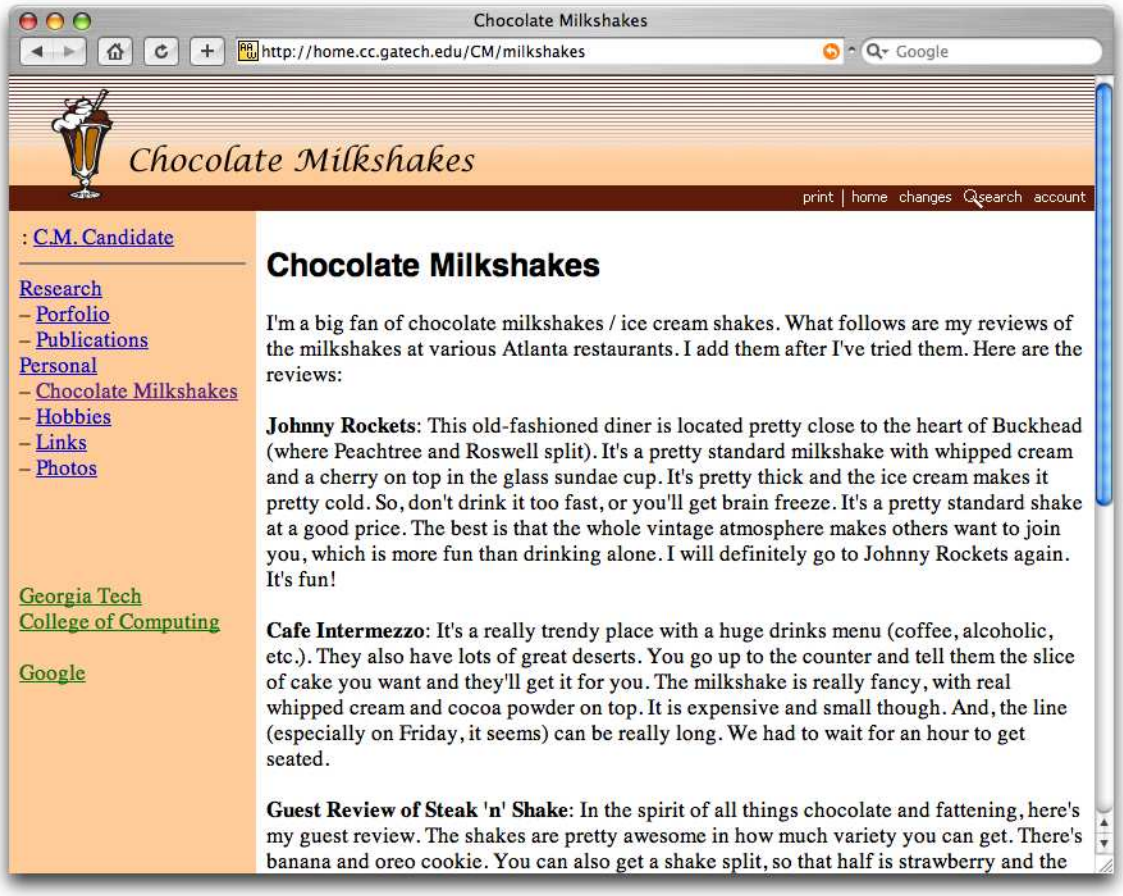


Figure 14: The Chocolate Milkshakes Page

chocolate milkshakes page and I found that I liked that they saw it. I think it made me seem more like a human being or something." Again, she likes the reflection cast by that page. CM enjoys being seen by her students as a whole person, being simultaneously professional and personable.[3] "I want them to see me as professional, but I also kind of don't want them to only see that I have a professional life. I also want them to see that I'm fun."

Graduate school is a learning experience. Successful graduate students learn to conduct research, publish their findings, converse with colleagues, and complete dissertation research while at the College of Computing. All of these skills have to be learned. At times, graduate students are vulnerable to expectation failure; they do something to the best of their abilities, but find that the results differ (often negatively) from their expectations. Some mistakenly expect to pass qualifiers. Others find their proposal to be more contentious than expected. Many remember the frustration of receiving bad reviews for articles they submitted for publication. Advisors, committee members, and fellow students are all helpful in giving advice to avoid major missteps and to put things in perspective.

So, it was natural that when CM prepared to apply for faculty positions that she would seek advice from others. At a doctoral consortium, a faculty member encouraged attendees to update their web presence to be professional. So, CM followed the advice. First, she remodeled her website to more closely match a competent senior student's home page, both in structure and content. Next, she asked that senior student to comment on her page. Then, feeling fairly confident, she asked a web-savvy faculty member to look at her page. The faculty member remarked that, with a link on the front page, the chocolate milkshakes page was too prominent and suggested that CM move it to the personal page. The advice was simple: As a junior faculty candidate, CM should present herself as professional as possible; she should appear less like a student and more like a faculty member. The chocolate milkshakes page detracted from that goal.

[3]I use the term personable, meaning pleasant in personality, rather than personal. CM is trying to be professional and have a pleasant personality simultaneously, rather than confide personal information in a professional setting.

So, CM moved the chocolate milkshakes page to the personal section of her site. As she reflected, "I think my webpage has changed over time and the message I try to send with it has changed... especially this year, because I'm trying to be a bit more professional." From a professional perspective, this may seem like a normal development of both the site and the owner of that site. As CM makes the transition from student to faculty member, she has learned to present herself as more professional (Section 3.2.1). Yet, that interpretation only partially covers the meaning of this evolution to CM.

The chocolate milkshakes page represented an important part of her core identity: "I love having my chocolate milkshakes page. It's one of my things that gives me personality." Moving the page to a less prominent position hurt: "That decision to move that page was kind of like a stab and a twist... I really like my chocolate milkshakes page... I liked it when people noticed it." Under the personal section, it is much less noticeable. The personal section of CM's site is really for her own use rather than for others. It primarily contains links to sites she finds useful. As she remarked about her personal page, "I don't really care if other people see it; I just don't want to draw their attention to it right away." Moving the chocolate milkshakes page meant hiding a part of her that she likes. Now, people do not notice the page, and CM is a little bit sad about that.

Let's consider the faculty member's suggestion. From one perspective, the advice is sound. CM is preparing to be a faculty member. Part of her job as a faculty candidate is to show that she is ready to graduate from being a student to being a professional. The chocolate milkshakes page does not contribute to this function. From another perspective, the advice is more questionable. Several of the faculty members interviewed for this research mentioned that they enjoy seeing that a candidate is more than his research. For these faculty members, some personable content is welcome; it helps demonstrate that the candidate can be an interesting colleague. When I asked faculty participants specifically about a chocolate milkshakes page, they agreed that it would serve that function.

So, the merit of the advice is debatable. CM concurs: "I'm not sure I buy it." She feels

that the page accurately and positively presents her personality and is not controversial (something that faculty members would feel is inappropriate). In comparison, she feels links to online resources and stores from her front page are much more ripe for the picking; they are "too generic" and do not really reflect who she is as a professional or a person.

The faculty member was not aware of the personal significance and meaning that the page had to CM. Nor were the pangs of moving the page obvious to the faculty member. Not only the advice, but also the manner of the advice, was mild; the faculty member merely suggested it. CM was not obliged to follow the advice. Yet, it was the most salient advice given by the faculty member. And, as the faculty member offered the time to look at her page, CM felt like she should follow the advice. She was acting as a good student, taking the advice of senior colleagues. "I try to take others' advice, even if it hurts." Yet, that does not make the decision easy or neutral. "The fact that I moved my chocolate milkshakes page was a pretty big compromise."

This case emphasizes the tension created by the multiple audience problem. In a traditional physical setting, a person can don a mask appropriate to that setting (Goffman, 1959). A person might use different masks for different audiences: family, friends, potential employers, etc. With electronic technology, the ability to don that mask is removed (Meyrowitz, 1985). All audience members view the same personal home page. Thus, the chocolate milkshakes page is as visible to potential employers as it is to the friend who contributed a review or the students in her class. CM cannot chose to only selectively present it. Thus, the multiple audience problem caused this identity crisis. Presenting yourself successfully to others is important for a healthy core identity (Erikson, 1980). When there is a failure in this regard, the person experiences a crisis (or in her words, "a stab and a twist").

CM feels that she should be one person. While she realizes that she plays a different role when she is a candidate, a lecturer, or attendee at happy hour, she feels that there should be a core that should cross these different roles. For her, that core identity includes

her outgoing and fun personality. "My personality doesn't have to just be my work personality." The faculty member's advice was loaded in that it implied the opposite—she should only emphasize her work personality. As a graduate student, one is often both personal and professional at the same time; graduate students regularly befriend their peers. At other times, such as job seeking, one tends to highlight one's professional side and downplay one's personal side. Because one personal home page plays multiple roles, this tension can be particularly problematic. CM wants to appear professional to show that she can be professional. Ironically, once she is a professional, she plans to put the chocolate milkshakes page back on her front page. "When I'm a faculty member, then I'm gonna put chocolate milkshakes back on the top page, because, once I have my job, then I can start having personality again <laughs>." Once she is a professional, she no longer needs to "seem" professional.

5.3 The Power of Text

> Writing about music is like dancing about architecture. (origin unknown)

This oft-cited quote implies that media are fundamentally incompatible; therefore, using one medium to engage another is inappropriate. This is particular obvious for the latter: Dancing about architecture is comically absurd. Is the same true of writing about music? The quote's simile implies that it is; however, the quote underestimates the power of text. Written language (i.e., text) is a particularly powerful medium, capable of describing or even substituting for other media. While writing about music can be unsound, it is often useful and interesting. At a minimum, the journalists at *Rolling Stone* magazine make a living doing it.

When Galileo formulated and proved the laws of uniform motion, he used text (diSessa, 2000).[4] For the modern reader, his formulation feels awkward. Written language is a poor

[4]For example, in Galileo's textual formulation, Theorem 5 states that "if two particles are moved at a uniform rate, but with unequal speeds, through unequal distances, then the ratio of the time intervals occupied

medium to describe the laws of uniform motion. Algebra is a more appropriate medium; however, algebra (more precisely, the modern system for writing and manipulating algebraic equations) had not yet been invented. Galileo had to settle for text. The Galileo example better represents the power of text than the popular quote. While algebra would have been a more appropriate medium to describe the laws of uniform motion, written text was adequate. Similarly, while writing about music may be awkward, it is often possible to do so successfully. Because of its expressive power, text is no ordinary medium.

In terms of defining culture and communicating meaning, text is an exceptional medium. Written language has been instrumental in forming and advancing civilization (Innis, 1951; McLuhan, 1962). The mastery of written language is critical to the education of children; two of the three Rs of the primary school curriculum, reading and writing, focus on text. Text is such a dominant medium that the development of other media are heavily influenced by it (Gitelman, 1999). When the phonograph was invented, it was done so with written language as a model: Edison conceived of his invention as writing sound into the record's grooves. Even the term "phonograph" was appropriated; it originally referred to a written phonetic shorthand language.

As demonstrated by the popularity of the quote, the power of text is often underestimated. Even several notable media treatises (McLuhan, 1964; Bolter & Grusin, 1999) ignore the unique power of text, instead accentuating the universal properties of media. There is more to the story. Unfortunately, the inexperienced reader may not realize this. It is worth noting that while McLuhan and Bolter write about the universal nature of media, both have written major works about written language. McLuhan (1962) wrote about the effect of the printing press on the development of modern civilization. Bolter (2001) wrote about the expressive possibilities of hypertext. So, while these media theorists downplay the individuality of text at times, both acknowledge its importance.

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will be the products of the distances by the inverse ratio of the speeds" (diSessa, 2000, p. 13). In its algebraic formulation, Theorem 5 can be more lucidly stated: $\frac{t_1}{t_2} = \frac{d_1}{d_2}\frac{r_2}{r_1}$

One reason that text is such a powerful medium is that other major media subsume it. Newspapers, magazines, books, written laws, and e-mail all contain primarily textual content. The same is true for personal home pages. Graduate students who create personal home pages are primarily composing text. This is all the more true for AniAniWeb home pages as the system was designed to focus users on creating textual content. So, home page authoring is just a form of written composition.

In their studies of written composition, Bereiter and Scardamalia (1987) characterize two different cognitive processes for written composition: knowledge telling and knowledge transforming. In knowledge telling, a writer simply writes content until he has exhausted his knowledge; there is no role for reflection and revision. As he learns to become a better writer, his composition process matures into knowledge transforming. The act of writing becomes transformative. The writer uses the composition process to reflect on his knowledge and formulate it appropriately for its intended audience. Through reflection and revision, he is able to refine his understanding. Graduate students usually compose text through a knowledge transforming process (Bereiter & Scardamalia, 1987); they are reflecting on their understanding when they write. As home pages are about the author, a graduate student composing his personal home page is actively reflecting on who he is.

Reflection is essential to the process of identity formation (Erikson, 1963a). When learning how to write, we specifically learn to reflect effectively on our writing (Bereiter & Scardamalia, 1987). Thus, writing can be one of the best tools that a person has to reflect on themselves. Many people keep diaries or daily journals to reflect on their lives. Some people publish these writings using blogging tools (Nardi et al., 2004). Turkle (1995) documents how people use textual MUDs and text chat to play with their identity. In these environments, text is important to their use and meaning. So, it is with personal home pages. The textual nature of personal home pages strongly influences their use and meaning. The next two cases, TI and RY, demonstrate this influence. Respectively, they exemplify two pivotal properties of text: the reflective nature of the composition process

and the persistent nature of text.

5.4 Case: Textuality and Identity

For TI, writing is a reflective exercise—knowledge transforming. His writing allows him to understand the world, how he fits into it, and how others connect to him. Writing allows him to try to establish who he is as a researcher, as a friend, as a professional, and as a person. TI began writing reflectively before home pages were available. He keeps a personal journal and is proficient in communicating through e-mail and instant messaging. When he began adopting personal home pages, he always reflected consciously on their meaning. He realized quickly that he must take the audience into consideration when creating a home page (or any writing, for that matter). Personal home pages are fascinating for him in that he now can easily make his writing available to others.

In my interviews, I found that many people did not remember why they made certain decisions about their home pages or made decisions without reflecting much on their implications. This was not true for TI. TI was able to wax philosophically about each decision he had made and recall why he made it. While the home page is constructed for others, it also says much to TI about how he fits in and how he wants to appear to others.

He is methodical about his web presence; this has several results. He realizes that home pages can be perilous. Thus, he wants to be sure that a visitor only has access to the parts of himself that are appropriate as he see fit. To realize this vision, he splits his web presence among several sites. He is willing to use multiple web technologies to best accomplish that task. As a programmer and self-termed "geek," he enjoys trying new technology to solve a problem. Unfortunately, he is often disappointed by the results: His goals are not accomplished or the website technology cannot meet his needs. The next two sections detail two of these aspects. First, I examine how he splits who he is among several sites to best satisfy multiple audiences. Second, I concentrate on what failure means in this context and what it reveals about him.

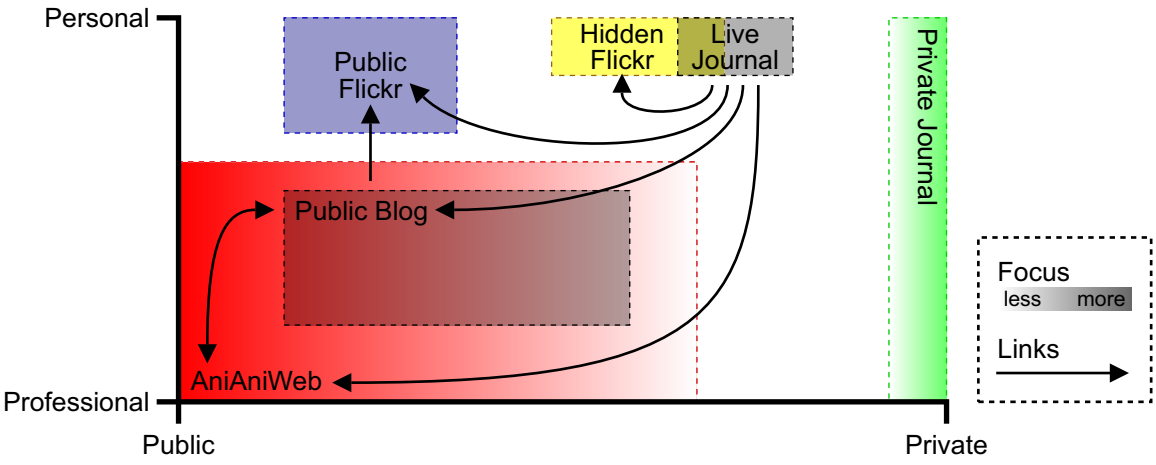


Figure 15: A Map of TI's Six Writing Outlets

5.4.1 Splitting the Self

TI wants to control who can access what about him; however, he does not want to limit the content of his writing. He is not able to meet both of these criteria with one site, so he utilizes multiple (i.e., six) writing outlets. These outlets vary in how professional they are and how public they are. Figure 15 maps the focus of the six writing outlets based on two criteria.[5] The x-axis represents how accessible the content is to others. TI describes purely public content as content that can be accessed by anyone; purely private content should only be available to himself. The y-axis represents how professional the content is. Professional content is associated purely with his work as a computer scientist. Personal content is avocational—not associated with his profession. Each venue covers a certain territory, based on those dimensions.

His *AniAniWeb* is his primary, public image. It is a professional home page, supplemented with personable and semi-professional content. As its coverage is so broad, he further split the site into three sections. First, a graduate student section contains his professional content—affiliations, projects, and publications. If a visitor is interested in him from a purely professional perspective, this is the only section he or she needs to access.

[5]This diagram is based upon a sketch by TI, positioning his writing venues along the two criteria. TI affirmed that the final diagram is accurate.

Second, a personal section contains personable content, such as details of the movie night that he used to organize. As on CM's website, the content of this section is not deeply personal. While it does not relate to his profession, he does not mind professionals visiting this section as it is unlikely to offend anyone. Unlike CM, he does not connect the professional and personal sections; visitors are given a choice on the front page of which section to visit. Third, a programmer section shares information, such as scripts and software, that he finds useful; he created many of these resources and uses his home page to make them available to others. While the content is separate from his research, it does demonstrate his skill as a professional programmer.

He keeps a separate *public blog*. Initially, he set up this site with the purpose of writing about his research in a more informal way. He wanted to use it to comment on others' publications and relate it to his own research. He was never able to realize that purpose. For a while, he considered dissolving the site as spam robots were hitting it regularly. He eventually began using the site for content, such as a trip report, that matches the form of blog entries—short reports organized by date. This site is also open to the public. While it is not as prominent as his AniAniWeb, he does not mind anyone visiting the site. He links the two sites together. If AniAniWeb had more sophisticated blogging features, he could integrate this site into his AniAniWeb.

To communicate with friends, he maintains a *LiveJournal*. LiveJournal is a popular service site providing blogs with social networking support. For instance, TI uses it to aggregate the content from multiple journals to see which friends have posted recently. TI wants the content to remain between him and friends, so he does not publicly advertise his LiveJournal. Instead, he has taken steps to hide it. He uses a pseudonym, so that web searches on his name do not bring unwanted visitors. Furthermore, he uses LiveJournal's access-control system to limit most posts to be viewable only by friends. Because he is assured that only his friends have access to the content, he is more willing to be less polite and professional. For instance, he regularly vents about aspects of his life or work. While

this content would be unacceptable in a professional setting, it is entirely appropriate among friends.

TI frequently takes photographs. To share these digital pictures and their captions, he uses Flickr, a free service specifically designed to enable users to store, organize, and share their digital photographs. To separate private and public photographs, he utilizes two Flickr sites. The *public Flickr* site hosts safe, personable pictures. Although he does not actively advertise the site, he does not mind anybody visiting it. He uses it to host the pictures for his public blog; thus, visitors to the blog can easily make the transition. Not all of the pictures that he takes are so "safe" that he is willing to make them public. While none of the images are terribly risque, there are goofy images, such as pictures from a party, that could be perceived as unprofessional. To host these images, he uses a separate *hidden Flickr* site.[6] The audience for this site is not exactly the same as his LiveJournal, but it does focus on friends and close colleagues. He does not openly advertise this site. He does occasionally link to a new photo album from his LiveJournal or through e-mail. Before he switched to using Flickr, he had a separate static page to keep photos on.

Finally, TI occasionally writes in a *private journal*. He writes in it to "think things through." The writing process helps him to better understand the problem (and perhaps make progress on resolving it). These topics are sensitive and can be very serious, so he wants to keep them private. He even encrypts the entries to make sure that others cannot access them. Because of their sensitive nature, he would be uncomfortable having them reside on any server, even if (theoretically) he would be the only one with access privileges. Once in a while, he may share a piece of writing out of this journal with a specific individual, but it is not meant to be accessed (even by friends). The subject of that journal varies from personal to professional; he reflects on problems both in his social and professional

[6]I intentionally use the term "hidden," rather than "private." Since anyone on the Internet can reach the site with the correct URL, it is not strictly private; however, he does not publicly distribute the URL, so it is effectively hidden. In that sense, the LiveJournal is also hidden. Since he makes some LiveJournal content only accessible to friends, that site can be considered to be a combination of hidden and private.

life.

Several themes characterize these writing outlets. First, links between them are based on how private the forum is. The LiveJournal, as the most-private web space, links to the other four websites; however, none of those sites link back. Thus, his friends can easily make the jump to his public site, but normal visitors to his public sites cannot visit the personal site. The public blog and AniAniWeb link to each other since they cover roughly the same territory. Similarly, it is safe for the public blog to link to the public Flickr site. Second, TI uses multiple technologies to best suit his purpose. He uses blogs, Flickr, and AniAniWeb. All three technologies have affordances that make them appropriate to the task, but deficiencies that make them not capable of completely supplanting the others. Third, through these six different writing outlets, he is well able to thoroughly cover the writing space in Figure 15. AniAniWeb, the public blog, and the public Flickr site cover the public space available to anyone; the content is professional and/or personable. LiveJournal and the hidden Flickr site cover the private space available to friends; the content is personal, but not so personal to justify complete privacy. The private journal completes the space by giving him a writing outlet for issues that are private—only for his consumption.

While TI's writing outlets are based on different technology, that is not the only thing that separates them. Each is intended for a certain audience. TI splits his self for different audiences. In essence, he is reestablishing the masks that Goffman (1959) sees as so important to face-to-face communication. For him, this works out fairly well, but there are some major drawbacks. There is an overlap between his friends and those people that know him from work. So, a particular person might be interested in the content from all five of his websites. Because the sites are not tightly integrated, this transition can be awkward; a friend has to visit all five sites to see if anything has changed. TI is not the only person who finds professional and personal relationships to be closely tied:

> Close friendship ties are as strongly associated with working together as are work ties. (Haythornthwaite, 1998, p. 1109)

For visitors with access to multiple sites, the organization of the content is a little inconvenient. In addition, it is not always clear where content should be posted. A trip report might be professional enough that it should be posted to the public blog; however, some of the pictures may be too goofy to include on the public Flickr site. But, linking the pictures from the hidden Flickr site would allow public visitors to visit this more-private site. According to him, once the door is opened, people can (and will) walk through it. Since the hidden Flickr site also reveals his pseudonym, visitors could easily find his LiveJournal. While TI has done remarkably well at splitting his self, one often cannot split content that cleanly. To borrow Nelson's terminology, the content is too intertwingled:

> Intertwingularity is not generally acknowledged, people keep pretending they can make things deeply hierarchical, categorizable and sequential when they can't. Everything is deeply intertwingled. (Nelson, 1987, p. 31)

5.4.2 Enduring Failure

It is common for people adopting a new medium to experience failure. A user needs to experiment in order to better understand the medium (Bolter & Grusin, 1999); failure is an important (and often healthy) part of experimenting. Because of his high standards, TI is often enduring failure with his home pages. For instance, for a long time he was unsatisfied with the design of his AniAniWeb; his Photoshop expertise was not good enough to create a satisfactory result.

Even his well-reasoned strategies fail. Creating multiple home pages for multiple, overlapping audience is a messy problem; there is no perfect solution that will suit everyone and every situation. He never was able to talk about research on his public blog, although that was its initial purpose. Since he has a strong vision of how others should use the space, he is often disappointed with reality. Often, visitors do not share his vision or do not live up to it. On his AniAniWeb, he freely invites others to edit. So far, there has been only minimal interaction. Since he does not give any specific directions or space for people to

interact, visitors might feel uncomfortable accepting his open invitation.

TI is fairly particular about his preferences, so he is often dissatisfied with what others have done. For instance, he "hates" many personal home pages, because he sees them as vain—promoting the individual without any important content. "Unless you have an actual use for one [a personal home page], I wouldn't advise you to create one." He feels that a home-page owner should only make content available if it is important to others. He is dissatisfied with pages that merely feature trivial content, such as a list of favorite movies. While others enjoy knowing more about a person's likes and dislikes, he does not feel that this content is worth publishing.

TI applies the same high standards to his own page. As a high school student, he created a home page that primarily linked to Star Trek and other space-based science-fiction sites. He was unsatisfied with that kind of a page, so he did not use a personal home page in college. As a new graduate student, he identified personally-meaningful uses for personal home pages. First, he recognized that having a professional home page is standard practice. Second, he started the LiveJournal to keep up with college friends, now separated by distance. Even adopting these practices proved problematic. For some time, he did not feel he had enough content to warrant a professional home page.

Written composition in the knowledge-transforming mode is a reflective process. Sometimes the author is satisfied with the work. At other times, he is not; the composition fails to come together, does not satisfy the goals of its author, or makes the author realize that the original purpose was not useful. In the case of personal home pages, where the writing reflects who the author is, these failures can say a lot about the author to himself. Commonly, these failures are *expectation failures*—the author expects to succeed, yet fails. The response to this expectation failure can be either positive or negative.

From a positive perspective, expectation failure can be a vital step in learning (Kolodner, 1997). It informs the author that something about their conception is wrong and needs

to be worked on. If the author works through the problem, the initial failure can be an important catalyst in allowing the author to *work through* the problem (Turkle, 1984). While a shock to the system, an identity crisis is often the catalyst towards identity development (Erikson, 1968). In that case, failure and frustration can be useful as it inspires the person to address identity problems. On the negative side, the person could become discouraged and give up, not solving the problem. Alternatively, the failure could be indicative that the person is simply *acting out* an existing problem, rather than working through it (Turkle, 1984). While the act is caused by the problem, the act does nothing to combat the problem; instead, it just further frustrates the person (e.g., Erikson, 1963c).

For TI, written reflection can be positive, but it can also be negative. On the positive side, writing in his personal journal is usually therapeutic. Likewise, his LiveJournal connects him to friends who can help; even just venting to friends can be helpful. On the negative side, he is frustrated when his strategies fail (e.g., the public blog). While these expectation failures demonstrate what does not work in this medium, they seldom offer the kind of feedback necessary to choose better alternatives. Thus, the failure remains unresolved

Some of his writing can also be characterized as acting out. One night he woke up with insomnia. He was frustrated with a deep personal problem. He ended up working on his home page. He added a list of some of his likes to his AniAniWeb personal section. As stated above, this is exactly the kind of content that he dislikes. Instead of working through the problem, he was acting out. Not only did he not make progress on the underlying problem, but he is also dissatisfied with the content he created. While his actions were due to the underlying problem, they did not help him address that problem.

5.5 Case: Recording Yourself

Many media (speech, the telegraph, the telephone, etc.) are *ephemeral*—once the communication happens, there is no external record. Written text is more permanent; the same text

can be accessed again and again. Edison thought that the phonograph could do for sound what text did for words: It could record it for others to access in the future (Gitelman, 1999). Any time an ephemeral medium is extended to be more permanent, the meaning of its message is changed (McLuhan, 1964). It can be repeated outside its current context, thereby changing its value. The recordings that Richard Nixon made of his telephone conversations proved to be one of his key downfalls during the Watergate cover-up (Meyrowitz, 1985).

Like Edison's phonograph, personal home pages record. They serve as a record of who the person is that can be accessed by home-page visitors from different places at different times. Since the content of a home page tends to stay around for some time, a home page also provides a record of its owner's history. RY has adopted this affordance for recording: She views her home page as a place to record herself. It is a forum to state who she is and keep a record of who she was. She uses her home page to actively construct who she is. Her use of AniAniWeb is similar to that of Zora users who construct objects to represent who they are to others.

Like TI, RY applies her browsing preferences to her authorship approach. TI dislikes frivolous content, so he tries to avoid it on his home page. RY dislikes going to a home page and finding it out of date or not containing any new information; therefore, she continuously updates her home page. She looks to add things, so that there is always new information. She pulls bits and pieces from what she has seen. As a consequence, she has a large home page. She recommends her iterative approach to others: "As things pop into your head, add them... You can't do it all at once."

Unlike TI, she authors for herself; she has never though of her home page as primarily addressing an external audience. Instead, she is satisfied with creating the page primarily for herself. Since she only has to satisfy herself, she is consistently pleased with the results. She has fun creating the content and enjoys the end result—an organized record of herself. She tracks such details as movies and video games she likes, the concerts she has attended,

and the U.S. states she has visited. It is a good forum for her to keep track of the things she has done, while simultaneously sharing it with other. She would like others to view the home page, but she would update it even if she had no visitors. That sentiment is only theoretical, since she is aware of several visitors: her parents, fellow students and lab-mates, visitors from a social networking site, etc. As detailed in Section 4.2.4, she was also successful at getting visitors to interact and colleagues to collaborate on her site.

5.5.1 Chronology of a Growing Site

RY first created a personal home page in high school. She frequented IRC (Internet Relay Chat) and it was common for people to put a URL to their home page in their signature. Since "everyone had one," she felt pressure to adopt. She posted her first home page to Geocities. While she created the home page to fit in, she soon discovered that she liked maintaining a personal home page. She naively thought authoring HTML was programming.[7] She decided fairly quickly that she would author her home page for herself.

Since adopting personal home pages, she has continued to maintain a web presence. Over time, her site has matured, both in quantity and quality. She moved it to a more reputable[8] provider and purchased the rights to the web domain of her full name, so that the URL would better represent her. Like many others, she uses the site to share pictures. She enjoys creating and posting lists of various things, such as the books she is reading. She posts pictures from her webcam; her personal home page is a convenient venue for playing with this toy in a social setting. Over time, her personal home page became an outlet for writing. Now that she is a graduate student, she particularly enjoys that the content of this writing does not have to be research related. That is why she started blogging.

[7] While authoring HTML is not programming, it does share some of the characteristics of programming. Both HTML and a programming language have a formal syntax that should be followed for the code to produce the correct effect, a renderable page and a compilable program respectively. As such, authoring HTML in a text editor is a common and easy way to introduce students to writing syntaxed text. HTML gave RY a forum to both express her interest in computing and to gain some competence.

[8] As Geocities pages are free and open to anyone, both the quality of the service and the quality of the pages has a (deservedly) bad reputation.

Like TI, she maintains a blog, which she initially updated about once a month. It too is a public site. She uses a blog for several reasons. First, she wanted to play with blogs, the "hot" new medium at the time. Second, others could thus respond to her entries through comments. As usual with personal blogs (Nardi et al., 2004), few people actually left comments. Yet, she likes that they can. She embedded the blog into her personal site, so that it seems more integrated with her personal home page. Over time, her interest in the blog waned; she now updates it about twice a year.

When she became a graduate student, she started a professional home page. Although nobody specifically told her to create a professional home page, she saw that senior students had them. As she already liked authoring home pages, she quickly created a professional home page. As a new graduate student, she had only limited professional content (contact information, a schedule, and a list of the classes) to post. She updates this information at the beginning of each semester.

She adopted the strategy of separating the personal and professional pages from others. While she separated the sites, she did include links between the sites. The two sites have similar but distinct looks. This visual identifier should allow a visitor to know whether he is on the professional or the personal site. She also uses a similar look for her business cards that contain the URL to her professional home page. Where TI tries to separate his multiple sites so that different audience members have different access, RY links the pages together, allowing visitors to decide whether they wish to see that part of who she is. Where TI is worried about visitors abusing what they find on the different sites, RY is less concerned. She sees that it might be impractical to split information like this on the Web.

She began using AniAniWeb when it was advertised for incoming graduate students. Initially, she tried to use the site for social networking—a way to connect with fellow incoming students. For a while, a few students would regularly post messages to each others' AniAniWeb; over time, that use declined and the small number of remaining participants were not enough to sustain the dialogue. In the end, AniAniWeb proved to be an inadequate

tool for this task as it did not include enough support for social networking.

RY integrated a link to her AniAniWeb into her professional site. Thus, people could have a mechanism for interacting with her. She customized her AniAniWeb to match the color scheme of her professional site; thus, the transition between the two technologies would appear more seamless. She began to feel comfortable using AniAniWeb. She particularly enjoyed using its collaborative features, such as polling. She set up polls to plan a movie night and for people to name her research projects. It was fun to have people interact with her in this way. It was RY whose experience with lab-mates voting excessively is detailed in Section 2.3.3.2.

Since she had matched the look of her AniAniWeb to her professional site, she realized that it would be convenient to move the entire professional site over. Thus, she could just maintain one professional site. She also started using her AniAniWeb for other purposes, such as a "to do" list, that were primarily for her own use. At this point, she was left with two home pages. The professional AniAniWeb contained her professional content, a personable interactive section, and a private section. The personal static site contained the majority of her personable content (in static form) and embedded the blog to enable interaction.

With more use, she found that updating the AniAniWeb was notably simpler than updating her static site. She could go to the page that needed updating, press the "edit" button, and edit the text almost instantaneously. On her personal home page, she had to go through FTP; it was a "big pain to update." So, she moved her personal home page content to her AniAniWeb. She still wanted to keep the professional / personal split that she had before; therefore, she maintained the slightly different color scheme for the personal section. A visitor is thus visually aware of the section he is viewing. While she no longer has as much time to update her home page, she has streamlined the updating process.

5.5.2 Integrating the Self

> Ego identity, then, develops out of a gradual integration of all identifications, but here, if anywhere, the whole has a different quality than the sum of its parts. (Erikson, 1980, p. 95)

Like TI, RY is interested in trying out new technologies and is able to use them to achieve her ends. Yet, she differs from TI dramatically in other ways. Where TI separates, RY integrates. TI uses six separate sites to cover his writing space. RY ended up with one main home page, which integrates multiple aspects of herself to serve multiple audiences. One reason for these disparate approaches is a different view of others.

TI distrusts others, hiding content from the public so it will not be used against him; RY trusts visitors to reasonably evaluate her content. On her blog, she does occasionally mention some of her political views. Thus, the pages violate the academic policy of limiting the content to being politely safe (Section 3.3). It does not bother her that professional visitors can access that content. After all, that visitor made the explicit decision to view the clearly-marked personal page. Since her political views do not inform her professional life, it does not bother her that this professional visitor might not share her views. "I can have a professional relationship with people who I disagree with on personal issues." If somebody was offended by the content, her contention is that he or she is not the kind of person she would want to work with anyway.

While she is more trusting than TI, she does acknowledge that privacy is important. She has pages on her AniAniWeb that only she, as site owner, can view. She also uses a pseudonym to post on forums and instant messaging; only friends know this pseudonym. In general, however, she is more willing to share her core identity with others than TI is.

Another big difference between TI and RY is their enjoyment level. TI is often dissatisfied with his home pages, whereas RY is generally happy. She likes having a professional page, even if the initial professional content was limited. She likes working in Photoshop to

create a look that represents her. There are multiple reasons for this difference in satisfaction. First, RY is just generally a happier individual. Second, she has lower standards for success. Her goal of simply pleasing herself is far less ambitious than TI's attempt to serve multiple audiences in different ways. Third, her integrative strategy better fits the medium of personal home pages.

5.6 The Integrating Self Epistemology

> . . . rather than fragmenting the self, personal home pages are attempts to integrate the individual, make a personal statement of identity, and show in a stable, replicable way what the individual stands for and what is deemed important. (Wynn & Katz, 1997, p. 319)

When a person composes a personal home page, that adopter is making a statement about who she is to others and to herself. This section is about how this affects an adopter's understanding of herself. Unlike other electronic media, personal home pages encourage an *integrating self epistemology*, emphasizing a core self that exists across multiple aspects of the adopter's life. First, I review how epistemologies shape our understanding of the world and ourselves. Next, I summarize how MUDs encourage a fragmented self epistemology, jarringly different from the integrating self epistemology fostered by personal home pages. Then, I discuss the reasons why personal home pages differ so radically from MUDs. Finally, I examine the three individual cases in this chapter with regard to self epistemologies.

Epistemologies are the frames we use to understand the world. When we see a flock of geese in the familiar V shape, we might wonder what causes that shape. A simple guess is that the front goose is the leader, leading the other birds. This is a common explanation as we commonly attribute an effect to a central cause—in this case, a leader goose. We use this centralized mindset to explain the world; however, there are many natural phenomena that are not adequately explained using this epistemology (Resnick, 1994). Geese fly in a

V shape to conserve energy. When a goose flies, it creates a significant tailwind. Other birds can ride that tailwind to aid their own flight. As the only bird not flying in the wake of another, the front goose expends the most energy. After some time in the lead position, she will become tired, fall back, and be replaced by another bird. Hence, there is no single leader goose. In order to properly understand the flight of geese, a decentralized mindset (attributing effects to the system as a whole, instead of the individual) is required (Resnick, 1996).

Self epistemologies are the frames we use to understand ourselves. These modes of thinking shape how we view ourselves and, consequently, how we behave. For instance, people behave differently based upon their view of intelligence (Dweck, 2000). People with a fixed view of intelligence believe they cannot gain intelligence. People with a malleable view of intelligence believe that they can become more intelligent with effort. When a person working within a fixed-intelligence epistemology encounters a difficult obstacle, he often views his failure as a sign that he is not intelligent enough. As he believes intelligence is fixed, he stops working on the problem, believing that the solution is beyond him. In contrast, a person working within a malleable-intelligence epistemology will continue to work, believing that the obstacle can eventually be overcome with enough effort. From a learning perspective, the malleable-intelligence epistemology is healthier (Dweck, 2000).

Media are not epistemologically neutral; different media can encourage different ways of thinking (Resnick, Bruckman, & Martin, 1996; Rick & Lamberty, 2005). For example, the StarLogo environment allows its users to move beyond the centralized mindset (Resnick, 1996). Using StarLogo, users can easily program a massive number of independent entities acting in parallel. Users discover that it is easier to model phenomena, such as the flight of geese, in this decentralized manner than having a central actor in control. StarLogo demonstrates the advantages of a decentralized epistemology. Similarly, players of the *Lord of the Rings* board game discover that they must collaborate, rather than selfishly

compete, to win the game (Zagal, Rick, & Hsi, 2006); the game demonstrates the advantages of a collaborative epistemology. Likewise, those media (like personal home pages) that explicitly ask us to represent ourselves can encourage different self epistemologies. For instance, Turkle (1995) finds that MUDs and other electronic media both reflect and nurture a societal movement towards a postmodern fragmented notion of self.

A MUD (Multi-User Domain or, originally, Multi-User Dungeon) is a virtual space on the Internet that multiple people visit simultaneously. Users communicate through text chat. Typically, the MUD is the basis for an online community of its users. As with any community, the MUD users share certain values, common experiences, and practices. Users are represented in the space by avatars; often these avatars have defined characteristics (name, gender, appearance, species, magical power, etc.) that are different than the user's characteristics. It is common and acceptable for MUD participants to play a character (or multiple characters) quite different from themselves; this can allow users to experiment with different notions of identity (what is it like being a woman? black? a dwarf fighting the evil forces of Sauron?).

Because the virtual persona is not tied to an actual body, the Internet is a particularly fertile ground for playing characters radically different than your physical self (Stone, 1998). So, an able-bodied man can convincingly play a crippled woman in a chat room. In an infamous case, this actually happened (Van Gelder, 1985); when others discovered that their online friend was just a guise, many felt deeply betrayed. Turkle (1995) concludes that electronic media foster a *fragmented self epistemology*, where it is possible to be radically different in different settings; however, there are several electronic media where it is unacceptable and uncommon for the presented self to be substantially different from the physical self.

For example, in Zora, users play themselves; they built their avatars and virtual rooms to represent their personal history, values, and desires. By actively constructing and sharing their identities, participants were able to reflect on who they were (Bers, 2001). It would

not have been acceptable for a Zora member to pretend to be someone else; it also would have been impossible to maintain such a disguise as Zora members would also meet face to face to discuss their online interactions.

Personal home pages are more like Zora and less like Turkle's MUDs in that the home page represents an actual person. It would not be acceptable for an academic adopting personal home pages to adopt a fictional persona, separate from their physical self. So, constructing one's identity in a personal home page differs substantially from creating multiple, fragmented personae in a MUD.

But, while home pages may not further the fragmented self, they do not simply hearken back to a traditional model of self, embodied in the physical world. The same ability of electronic technology to shatter limitations of time and space that enabled MUDs to nurture the fragmented self significantly impacts personal home pages. Traditionally, time and space have enabled us to separate different notions of ourselves:

> The ways we spatially and temporally divide up objects, people, and activities reflect and promote the mental boundaries we place around these certain ways of being, of thinking, and of acting. (Nippert-Eng, 1996, p. 34)

The same physical self plays different roles when at work or at home, with one's children or with one's spouse, with one's supervisor or with one's subordinate. Because these situations are separated by space and time, a person can behave differently (i.e., donning a mask), often radically so. With personal home pages, as with other electronic media (McLuhan, 1964; Meyrowitz, 1985), the separating properties of time and space are removed. Anybody, from anywhere, at any time, may access the same home page.

A personal home page presents its owner to its visitors. When a person adopts personal home pages, he must decide which self that home page should reflect. How we represent ourselves is always complexly related to whom we are presenting ourselves (Goffman, 1959). We act (or even think) in different ways in front of our friends, family, or colleagues.

Often, one personal home page serves each of these audiences. A search engine does not treat family, an old friend, or a potential employer differently; all would stumble upon the same home page. So, a home-page adopter often does not have the luxury of neatly splitting the self for each audience.

In addition to these external visitors, a home page needs to serve the needs of its owner. One of the primary audiences to emerge from this research is that of the self (Section 4.2.5); unlike conventional home-page adopters, AniAniWeb adopters often use the technology in ways, such as a "to do" list, that are for themselves. Because it is so quick to update, these self-serving uses emerge. They, in turn, further complicate the multiple audience problem. Should potential employers have access to your "to do" list? How to best serve these multiple audiences is a difficult problem that home-page adopters have to negotiate.

Integrating multiple realms is not unique to personal home pages. Before the industrial revolution, it was common for home and work environments to be closely linked, often occupying the same building. With the industrial revolution, work and home became separated by time and space. Consequently, people segmented their home and their work life. While this is still a standard practice, many professions are more integrative. Jobs requiring a doctoral degree are more likely to encourage the integration of home and work than other jobs (Nippert-Eng, 1996). Graduate students are natural integrators; it is common for them to forge friendships that extend outside the work environment. Many companies also allow employees to telework—work from home; thus, home and work are integrated into one location.

When integrating home and work, the person must adopt values and practices that enable them to function (Nippert-Eng, 1996). Similar strategies can be employed with personal home pages. Teleworkers adopt practices, such as literally wearing different hats, to indicate their focus (Ellison, 1999). Similarly, some home-page adopters tag sections of their site as explicitly personal or explicitly professional; thus, visitors get a better sense of the context for the content.

Personal home pages are not the only new medium to integrate. iTunes, a popular program for playing digital music, allows people to share their music with others on their network. Since people commonly listen to music at work, some utilize such a network at work. Through these networks, employees now have access to the musical preferences of their coworkers. Traditionally, musical preference is separate from a person's professional persona; hence, these musical networks integrate previously-separated personal and professional concerns. Musical tastes can be informative; preferences for classical music, Broadway musicals, "Weird Al" Yankovic, gospel, or heavy-metal can affect how others view a person. Thus, employees often change their music libraries to adjust to the new integrative properties of the shared network (Voida, Grinter, Ducheneaut, Edwards, & Newman, 2005).

While integrating previously separate realms may cause a person to change their practices, these changes are not inherently unwanted and negative, nor inherently wanted and positive. Many people choose telework because they find its advantages to outweigh its disadvantages (Ellison, 1999). Many people find the integration of home and work life to be to their liking (Nippert-Eng, 1996). A shared musical taste may be useful for forging a professional connection. Some people like to have access to personal information about a possible coworker (Section 3.3).

In addition, just because a technology tends towards a certain effect does not mean that the individual has to accept that effect (Bijker, 1995); people can often successfully resist an effect to lessen or delay its impact. People can successfully resist integration. Teleworkers can designate a space for work, thereby reintroducing a spatial separation. Even in communities where it is normal to integrate home and work life, it can be acceptable for some employees not to do so. People can choose not to share their iTunes music. Some home-page adopters, like PG, successfully limit their site to professional content.

While the effect can be managed, it does have to be addressed. Home-page adopters must choose how they want to negotiate the integrative properties of the medium. Different

adopters employ different strategies. The strategy someone chooses reflects who she is to others and to herself. Specifically, the strategy indicates her self epistemology—how she views herself. In turn, the success and failure of the strategy can change how the adopter views herself. When that self epistemology conflicts with how others view her, it can lead to an identity crisis, which can provide an important opportunity for psychosocial growth (Erikson, 1968).

There are two opposed strategies for serving multiple audiences: integrate versus separate. The integrator combines the content for multiple audiences into one home page. The separator splits the content into multiple sites to accommodate multiple audiences. These strategies reflect integrating and fragmented self epistemologies respectively.

CM is an *integrator*. Her decision to integrate professional and personal content is not just a choice of convenience, but reflects her integrating self epistemology. She feels that she has a strong core identity that should be accessible to anyone. She wants to be valued for that whole. So, when she was told to move the chocolate milkshakes page, it hurt. The mild suggestion felt like an attack on her core identity and how she viewed herself. People with strong cores struggle when part of what makes them who they are is criticized (Erikson, 1963a). CM had a strong reaction against separating content.

TI is a *separator*. Ideally, he feels that each audience member should only have access to a site that is warranted by the relationship(s) he has to them. Essentially, he sees himself as a different person for each audience, reflecting a fragmenting self epistemology. He is readily willing to split his self to accomplish this goal. Unfortunately for TI, the integrating tendencies of personal home pages make it difficult for him to succeed with this strategy. Several visitors fit into multiple audience categories and thus need access to multiple sites, something that is a problem since the sites are not connected; if the sites where connected, the wrong visitors could make the transition. Additionally, since there can only be one site at the top of the search rankings, it is hard to attract appropriate visitors to the other sites.

RY is an interesting case. Initially, she created multiple sites, like TI, believing that a

fragmented self was more professional. Like TI, she learned that this separation strategy had significant drawbacks. Unlike TI, her separating preference was not very strong; it was mainly based upon her perception of professional standards, rather than a strong self epistemology. So, she abandoned the old strategy and integrated the sites. She is happier this way. She feels that she is one person with different interests; a visitor should be able to understand that. To assist visitors, she clearly marks sections as professional and personal. Thus, an academic visitor can easily identify what she is professional about. She is happy with the integrative nature of personal home pages, because it matches her integrating self epistemology. Her AniAniWeb use helped validate her natural preferences towards an integrating self epistemology. In contrast, TI is often dissatisfied with both his home page and home-page technology, because it does not support his separating self epistemology.

While home pages tend to integrate, there is a legitimate need to separate. People need privacy. Even people with a strong core need to have a private space. While CM is an integrator, she has a need to separate. When she used her AniAniWeb to collaborate on an article for publication, she grew uneasy. She realized that others had access to this page; however, she would not like visitors judging her based on that immature content. She would have liked to restrict access to this content. To assist home-page adopters in negotiating this problem, an access-control system can be useful. TI found it helpful that he could restrict some of his posts on LiveJournal to an audience of friends. A good access-control system could bring back Goffman's masks and allow for different content to be presented to a different audience. Section 6.3.3 further discusses the needs and possibilities for access control in AniAniWeb.

At the beginning of this chapter, I introduced the core tension between identity and identity diffusion that Erikson (1963b) observes in adolescence. Graduate students too must negotiate this tension, as they become professionals. A graduate student must decide how the academic-professional aspects of his life relate to his core identity. Self epistemologies

are essential to that development. He can decide to integrate his new responsibilities into his core identity or choose a more-fragmented notion of self. As tools that tend to reflect identity (Section 5.1), personal home pages not neutral in this regard. Through the feedback he receives from others and from constructing the site, the home-page adopter learns how to present himself successfully. As personal home pages tend to integrate, adopters may find that an integrating self epistemology is more advantageous (e.g., RY).

By nurturing an integrating self epistemology, personal home pages are changing the way academics think of themselves. Before the arrival of electronic media, in the mechanical age, space and time often separated concerns. This allowed for people to don a mask to present themselves differently to different people. Since the self was still tied to the one physical body, there was still a strong core; however it was possible to mask that core based upon whom one was interacting with. In the electrical age, barriers of time and space disappear (McLuhan, 1964); the world becomes a global village, because the separating powers of time and space are diminished. For Turkle (1995), the Internet allows for people to further fragment as they can leave the physical body behind. Yet, other electronic media, such as television (Meyrowitz, 1985) or personal home pages, integrate. While these self epistemologies (masked, fragmented, and integrating) are fundamentally different, they can each be useful and appropriate. While a medium may not be neutral, it is possible for it to better accommodate each adopter's self epistemology through tools like access control.

The next section focuses on one of the consequences of the integrating nature of personal home pages. Because personal content is available in a professional context, there is a natural tendency of that content to conform to the standards of the profession. Consequently, the professional home page is also the polite home page.

5.7 The Polite Home Page

As described in Section 3.3, it is common and even advisable for a professional home page to have a personal section. What adopters include in that section varies. It is fairly common

to find pictures of trips, friends, family, pets, fellow students, etc. Some people list their favorite movies, hobbies, states they have visited, what they are currently reading or listening to, etc. While the content varies, it is universally polite—adhering to conventional social standards of what can be safely addressed in public. People generally stay away from subjects that might trigger strong reactions from others, such as matters of sex, religion, politics, and drug use. While there may be some indication of religious or political affiliation, these are often incidental and not intended to sway or provoke others.

It is not that academics who adopt personal home pages do not relate to these subjects. For some of my research participants, religion and politics are important aspects of their life; however, these adopters choose to keep these concerns private. Why? Addressing these sensitive subjects in such a public forum is considered unprofessional. Faculty members remarked that it is inappropriate for an academic to publish this material.[9] In addition, faculty members suggested that students avoid any material that would reflect badly on the institution or on others. While it is acceptable and common for graduate students to criticize policy and bemoan the current state of the College of Computing internally, it is considered unprofessional to do so externally. Again, the home page is expected to be polite—in this case, discreet to the benefit of others.

Since almost anyone can visit a home page, an adopter should be prepared for anyone to visit the home page. If the home page contains content that might offend a visitor, that could cause a professional faux pas. Hence, the academic home page gravitates towards the polite home page. While the home page may accurately present the person, it does so in a limited way: The self expressed on the home page is notably polite.

Personal home pages are not the only media to portray an artificially polite image. During the 1740s and 1750s, zograscopes were popular among England's polite society

[9]One faculty member referred to a professor (at another institution) who was using his personal home page to espouse his strong right-wing conservative viewpoints; he felt that this overtly political site was inappropriate and was potentially embarrassing to his institution. In particular, he believes it is inappropriate to mention his university affiliation as that wrongly associates the university with the opinions of the site.

(Blake, 2003). The zograscope used a convex glass to make a drawing appear to have three-dimensional qualities. Commonly, zograscope prints featured famous public places. Yet, the images were not faithful to reality: They were intentionally made more polite. While it might be impossible to visit the actual location without seeing (and smelling) beggars and refuse, the prints conveniently removed such offensive material. As such, polite society could admire the beauty of England, while ignoring its less admirable aspects. A similar system functions for personal home pages in academia. Through personal home pages, academics have access to personal information not transmitted by conventional publication. Yet, the personal information is limited to the polite content acceptable to academia. Just as the zograscope's polite image suited the world-view of England's high-society, the personal home page's polite personal section matches the *zeitgeist* of the modern academy.

Over time, it became more difficult for polite society to sustain such a polite image of the world and the popularity of the zograscope declined (Blake, 2003). As home pages evolve to contain more information, the polite conventions of academia may be undercut by the same technology that is now reflecting this preference. In other words, by introducing personal content into a professional setting, personal home pages may have started a progression toward integrating personal and professional concerns that cannot be reversed. McLuhan (1964) envisions electronic technology bringing about a global village. This vision encompasses the notion that professional and personal concerns will merge over time, as is common in a village. In the mechanical age, people learned to separate concerns. In the electrical age, people must learn how to usefully integrate concerns. By introducing personal content into the professional world of academia, personal home pages move us one step closer towards the global village.

Academics are increasingly operating in what Meyrowitz terms a middle ground: They simultaneously inhabit both the front stage (the respectable professional) and the back stage (the private person). Academics are not the only professionals who find these two previously separate spheres merging. For politicians and other celebrities, the spheres merged

through the immediacy and fidelity of television (Meyrowitz, 1985). During his presidency, most Americans did not know that Franklin D. Roosevelt was wheelchair-bound. At his request, the press kept this personal information to themselves. Thanks to the wide adoption of television, no modern President would be afforded the same luxury. Over the last 40 years, Presidents have learned to adjust to this new public perspective (Meyrowitz, 1985). Academics too will have to adjust to the new image reflected by personal home pages.

CHAPTER VI

THE DESIGN SPACE

The previous three chapters described the results of my research on personal home pages in academia. They approach the findings from the perspectives of the community (academia), the medium (personal home pages), and the individual (the adopters) respectively. This chapter shifts the focus to the technology—AniAniWeb. This research is design-based research. I designed AniAniWeb to specifically allow me to understand a new medium (personal home pages), its use and meaning, in an authentic context (academia). While it is vital to report findings about the subject in design-based research, it is also necessary to reflect on and improve on the design (Brown, 1992; Collins, Joseph, & Bielaczyc, 2004). This chapter is that reflection.

Consequently, it takes a different tone than the previous chapters. First, it is written more technically. It is written to be concrete, so that someone designing a similar system can learn from it. As such, technical terms like RSS and CSS are sometimes used; I have tried to limit this technical verbiage in previous chapters, but it is necessary here. Second, there are often references to sections of previous chapters. These links serve as pointers to the findings that the design decisions are driven by. Third, much of the content is written in first person. I am the designer of the system and my (often intuitive) understanding of the design space, the existing system, and how others have used it is critical to AniAniWeb's evolution. Thus, I cannot separate myself from the story.

This chapter is organized into four sections. In the first section, I introduce my process for designing AniAniWeb, including a chronology. The middle two sections reflect on the two technological theses, introduced in Section 2.2, that drove the initial design. For each of these sections, I start by restating the original thesis. Then, I show how the results of

this research reflect that thesis. Section two reports the results of applying a wiki approach to personal home pages. Section three reports on the major features (structure, a looks system, and an access-control system) that were added to AniAniWeb to go beyond wiki technology. Finally, section four introduces a few promising directions for future systems in this general design space.

6.1 The Design Process

Personal home pages are still evolving. New innovations in the design space, such as a prominent social network and GUI editing, will continue to shape the meaning of personal home pages. This work is an attempt to understand that design space and the potential of the new medium. AniAniWeb was designed to test the utility of certain technical improvements (interaction support, wiki editing, access control, etc.) in the authentic context of academia. All of these features proved important to adopters and to evolving the meaning of personal home pages.

Design-based research is iterative. Understanding of the subject informs changes in the design. Changes in the design effect changes in the subject. Through a process of iterating between the subject space and the design space, the design can be refined and the subject better understood. Design, just like other problem-solving activities (Klahr, 2000), is an iterative process (Schön, 1987). In traditional design-based research, that iteration is often episodic (Brown, 1992). One trial of an intervention leads to design changes that are then tested in another trial; this process is repeated. This research is less episodic. Instead, the design process of AniAniWeb often focused on fine tuning a running system, through small improvements.

I regularly observed how others used AniAniWeb and I tried to support them in their endeavors. I made myself available to help adopters with their sites. By helping someone work out how to use the looks system, I could directly observe the problems with that system and tweak it based on that experience. Often, when I introduced a new feature, a

user would discover a bug or would suggest refinements for that feature. I tried to respond to these requests as quickly as possible, often completing the changes on the same day.

In addition to implementing new features, I put considerable effort into documenting existing features and improving the interface for using these features. Getting others to read external documentation is always difficult. While I provided an extensive help page, users would still occasionally ask me questions that could be answered by looking at the help page. When possible, I tried to embed documentation into the interface. Thus, the documentation for modifying the looks of the site is located on the looks page. I created a short crib-sheet (Figure 8 on page 41) on the edit page to help adopters learn the basics of the wiki mark-up language.

I also sought to standardize on a few simple conventions. For instance, I changed the wiki mark-up for referencing uploaded files to use the same syntax as the plug-ins used for polls and blogging. This had several small benefits. First, it simplified the conventions of the mark-up language. Second, it made the use of plug-ins more prominent. Since the upload page is a commonly used feature, users get more exposure to the plug-in syntax. The upload page can automatically generate a reference, so users do not even have to write the syntax themselves. Third, since the plug-in syntax is more flexible, it enabled further options for referencing an uploaded file or image: automatic image scaling, linking an embedded image to a specific page, specifying the whitespace surrounding an image, etc.

In addition to these smaller refinements, the system had several major design revisions. Table 1 details a timeline for the major design changes, shown in context with when the research data was gathered. The software was made available to users in August, 2003. For the first nine months, the initial system was fine tuned, based on observed usage, bug reports, and informal conversations with users. For instance, a preference was added that allowed owners to determine whether "last modified" information was shown on each page, since some users did not want this information to be displayed. Initially, changing the parent of a page was separate from editing; this proved awkward and the two functions

Table 1: Timeline for Gathering Research Data and Major Design Changes

Time-frame	Event
August 2003	Survey of static personal home pages is collected.
29 August 2003	AniAniWeb is released to the public and members of the "Introduction to Graduate Studies" class are recruited as possible research participants.
20 May 2004	The looks system is changed from a fixed-width to a variable-width main area.
6 October 2004 – 7 January 2005	Student adopters of AniAniWeb are interviewed. These are the main source of data for this research.
26 January – 9 February 2005	Based on the student interviews, faculty members are interviewed to provide a supplementary perspective.
12 February 2005	The new GT color scheme is introduced to provide a better looking color scheme for newcomers.
5–15 April 2005	Follow-up interviews are conducted with select student research participants to investigate system issues. To avoid overly positive feedback, these are conducted by a different interviewer.
19 April 2005	The new access-control system is introduced.
6 December 2005	As the initial bugs in the new access-control system have been fixed, AniAniWeb is released to the public as open-source software.
22 January 2006	The looks system is overhauled to better support cascading style sheets. The new SIDE color scheme is introduced to take more advantage of CSS.

were combined.

The first major change was to the looks system, converting the standard look from fixed-width to a variable-width main area, as discussed in Section 6.3.2. I consider this change major, because it forced several adopters to redesign the look of their sites to fit with the new system. I felt that the old fixed-width system was so flawed that I did not want to support backwards compatibility. After fine tuning the initial system, I conducted interviews with research participants. Based on those interviews, I made major changes to both the looks system and the access-control system, detailed later in this chapter. Again, I spent some time fine tuning AniAniWeb based on observed usage and feedback from users.

In December, 2005, I released AniAniWeb as open-source software. It had always been my intention to release the software to the public; however, I did not want to release it before it was ready. I had released CoWeb (the wiki engine that AniAniWeb is based on) as open-source software almost immediately. While this increased CoWeb's user-base tremendously, it also had an unintended negative effect: It was difficult to make major changes to the system, as the system needed to remain backwards compatible. By keeping AniAniWeb closed, I could confine its use to one server that I had complete control over. Upgrading one server with a small user-base is much easier than making those upgrades available in script form. This allowed me to implement large changes to both the looks system and the access-control system. After I was happy with those systems, it made sense to make the software available to others. I had also promised early adopters that I would make AniAniWeb available, so they could take their sites with them after leaving Georgia Tech. After I released it, PG did just that, setting up an AniAniWeb server at her university.

The result of this design process is a large complex system, which evolved based on the feedback of actual users. Counting just the textual code and documentation, the AniAniWeb system is roughly the same size as this document. Considering that AniAniWeb builds upon the already extensive CoWeb system that I also developed, designing and supporting this system has taken a tremendous amount of time and energy. As a developer, I am happy

with the results. For many users, it is a useful, advanced, and stable system for supporting personal-home-page creation.

6.2 Applying Wiki

Thesis 1 Wiki features (quick authoring, interaction support, and collaboration support) can enhance the authoring of personal home pages over traditional (static) tools by better supporting established uses and by making new uses possible.

Wikis have proven to be useful for content creation and facilitating collaboration in several settings; however, they are generally used for purposes other than personal home pages. This work applies the essential features of wikis to this new domain. This section reflects on the importance of wiki features to the use of AniAniWeb. Elements of interaction and collaboration have already been examined in Section 4.2.4. Additionally, broad elements of authoring content have been discussed in Section 4.2.3. This section complements those two sections by examining the more specific features of wikis, often a product of the mark-up language. It reflects on both the advantages and limitations of using wiki features. Furthermore, it suggests how and why a more-sophisticated interface could address these limitations.

AniAniWeb was built on a wiki engine to utilize its quick editing cycle. All that is needed to edit the content of an AniAniWeb page is to press the "edit" button.[1] For quickly and easily authoring content, AniAniWeb proved to be a big improvement over traditional HTML tools. Because wiki editing is easier, people tended to edit more often and author more content with AniAniWeb than with traditional tools (Section 4.2.3). While not all home-page adopters would be satisfied with this content focus, faculty participants preferred content over looks, when viewing academic home pages. While a sophisticated

[1]The user has to be signed-in to AniAniWeb to do this. For most adopters, this is not a problem; they access the site from a small number of machines and their browsers keep them signed-in. For one adopter who often used the site from new machines, this proved more problematic. Although it was easy to sign-in, it required finding the page to be edited again afterwords.

aesthetic might leave a good first impression, faculty members are more interested in the depth provided by serious (textual) content when evaluating faculty candidates. Thus, AniAniWeb is particularly suitable for creating professional academic home pages.

AniAniWeb uses a wiki mark-up language, which is edited in an HTML text area. Specifically, AniAniWeb inherits CoWeb's mark-up language. CoWeb's mark-up language was designed for Georgia Tech users (Guzdial et al., 2000). Since many Georgia Tech users are familiar with HTML, it allows users to write HTML, in addition to the mark-up conventions. For users switching from a static site to AniAniWeb, this simplified moving their static HTML content. Building on CoWeb's mark-up language had an additional benefit for this research: As many College of Computing members were already familiar with CoWeb, the transition to AniAniWeb was easy.

Wiki editing was an important feature to research participants. MDN adopted AniAniWeb largely for this feature; he had "hijacked" a part of a public wiki before then to serve as his home page. RY found the wiki editing so useful that she eventually moved her extensive static page to AniAniWeb; this made maintaining the content easier. To further support reorganizing content, AniAniWeb, unlike some wikis, allows users to change the name of a page; every research participant used this feature.

Like a wiki, AniAniWeb records the history of a page over time; users can use this history to recover older content that may have been inadvertently replaced. One person reported once wiping out her entire static home page by inadvertently uploading a file with the same name. That action simply clobbered the old content and she could not restore it. This would not happen with AniAniWeb.

Like other wiki mark-up languages, the syntax particularly supports users in authoring hypertext content: It is optimized for integrating formatted text and links, either internal or external. Users reported that they enjoyed the conciseness of the mark-up language. It was significantly more convenient to author than the verbose HTML of static pages; however, the language does not fully cover all HTML functionality. Occasionally, users had

to resort to HTML to create sophisticated structures, such as complex tables and embedded applications. This often became fairly messy. For instance, editing HTML table code by hand can be difficult. Creating a convenient and expressive syntax for generating tables is a difficult task that was never satisfactorily solved.[2]

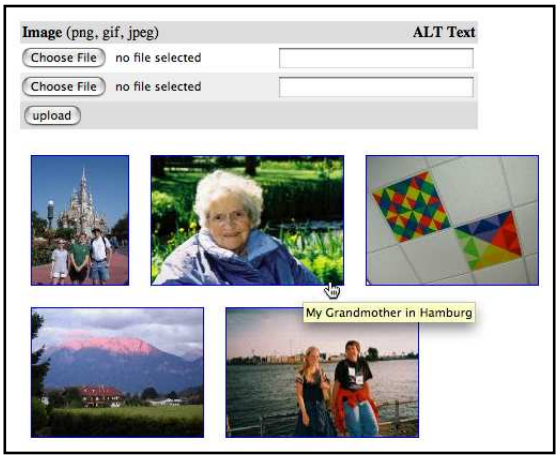
While users enjoyed using the mark-up language, it was not trivial for them to learn all its features. A few common mark-up conventions are displayed in the form of a crib sheet on the editing page; more sophisticated features had to be learned from the help page; the vast majority of that extensive page is dedicated to explaining the extensive features of the mark-up language. While that page is easily accessible, most computer users do not like checking external documentation.

One oft-suggested remedy for the deficiencies of the mark-up language is to move editing from plain text to a graphical user interface, such as word processors use (see Section 4.3.2 for a discussion of the technology necessary to realize this approach). It is foreseeable that the view and the edit mode could even be merged (or, at least, more tightly integrated); this would relieve the inconvenience of users having to find the text they want to edit again when switching to edit mode. A more sophisticated editing interface could also feature spell checking, WYSIWYG table support, better support for embedding external content, etc.

While hypertext is the most relevant content for personal home pages, a good system needs to support other media. Many research participants used their websites to distribute pictures. Initially, the support for this activity in AniAniWeb was minimal: Users had to use complex HTML to create their picture gallery. To address this, a gallery feature was created to support a simple picture gallery. While that feature is a substantial improvement to authoring the gallery by hand, it cannot compete with the flexibility and sophistication of

[2] A table is organized along two dimensions: rows and columns. While it is possible to linearize this two-dimensional space, the results are always a bit awkward to author. In addition, there are many table features to integrate into the syntax: header rows, borders, alignment, cell spacing, column spanning, etc. Naturally, linearized tables tend to be verbose and obfuscated, even in standard mark-up languages like HTML and LaTeX.

An AniAniWeb Picture Gallery



Its Corresponding Edit Mark-up

```
<?gallery times=2 height=120 space=10
border=1?><?image src="atDisney.jpg" height=120
space=10 border=1 alt="Helene, Egon, and I at Magic
Kingdom (Kelly is taking the picture)"?><?image
src="karen.jpg" height=120 space=10 border=1
alt="My Grandmother in Hamburg"?><?image
src="m-je77.jpg" height=120 space=10 border=1
alt="The DigiQuilt Tiles Above my Desk"?><?image
src="GlowingAlps.jpg" height=120 space=10
border=1 alt="The View Outside my Grandmother's
House"?><?image src="inHamburg.jpg" height=120
space=10 border=1 alt="In Hamburg with Sister
(picture by Monika Rick)"?>
```

Figure 16: Embedding a Picture Gallery into an AniAniWeb Page

commercial sites set up to explicitly support photo sharing. Like tables, the gallery suffers from being forced into the mark-up language; the generated mark up is verbose and hard to browse (Figure 16).

While pictures were the most sought after non-hypertext media, specific users had other needs. MDN wanted to construct a textual database that he could query. For graphics researchers, support for video content is important, as they often distribute a video reel with their portfolio. Also, interactive media, like voting systems, are important. While AniAniWeb supported simple polls, they were somewhat difficult to create and users often abused them by voting more than once. Again, the textual interface proved awkward for this task. An elegant graphical user interface, that integrates well with the average browser, would solve many of the existing problems in authoring content.

6.3 Beyond Wiki

Thesis 2 Wiki technologies need to be augmented with more access control, more structure, and more support for customizable looks to better support the authoring of personal home pages.

While wiki technologies were useful to AniAniWeb adopters, AniAniWeb is more than

a wiki. Specific features were added to compensate for several weaknesses of a wiki approach to personal home pages. This section reflects on the three major differences between AniAniWeb and a typical wiki. First, I reflect on the use of the page hierarchy and the menu area to usefully structure a home page. Second, I chronicle the evolution of the looks system for designing the appearance of a site. AniAniWeb takes the approach of separating looks from content; the utility of this approach is discussed. Third, issues of access control are detailed. The design of the new access-control system is both motivated and detailed. A major theme throughout this document has been that personal home pages tend to integrate; however, people also have a need to separate. Access control is the vehicle for achieving a useful balance between these two opposing needs. As access control is so core to the design of a personal-home-page system, this is the longest and most detailed section.

6.3.1 Adding Structure

Unlike most wikis, AniAniWeb is structured through a page hierarchy. When a new page is created, it automatically becomes the child of the page it was created from. When viewing a page, links to the pages above it in the hierarchy are automatically embedded (e.g., Figure 18 on page 191). This helps visitors navigate the site and encourages an owner to clearly organize his site. Through the edit interface, owners can change the parent of a page, thereby easily reorganizing the site. Adopters reported that this feature was useful and easy to use.

Averaging across all the AniAniWebs of research participants, 2.2% of all pages were at the top of the page hierarchy (i.e., the front page). 24.4% of all pages were one level down in the hierarchy. 43.0% of all pages were two levels down in the hierarchy. 21.1% of all pages were three levels down in the hierarchy. 9.3% of all pages were four levels down in the hierarchy. All research participants created pages at those five levels; no participant created a page at five levels down or more. Considering that even large personal home pages have only about 100 pages, it is not too surprising that the plurality of pages are two

levels down. Typically, the front page links to several section pages and those link to the specific content pages.

In addition to supporting organization, the page hierarchy proved to be a useful tool for implementing other important features. When defining a new look or changing the access control, users often want those changes to apply to many pages at once. While it makes sense to have a central look to the site, some sections might deserve a distinct look. The page hierarchy defines such sections. So, I designed AniAniWeb so that both the look of a page and its access-control settings are automatically inherited. Thus, when a user changes one of these settings for one page, all the pages in that section inherit that change. Another use for the page hierarchy was in defining the menu area for a page.

Each page includes a menu area, separate from the main content area (Figure 7 on page 41). By default, the menu content for a page is inherited from that page's parent. From there, adopters can choose to keep it as is, add to it, or override it. The menu area was used by most adopters to help visitors navigate the site. Since the menu is inherited by default, it was easy to change its content for the entire site or for an entire section of the site. Thus, the menu content of a parent page could serve as the navigation area for itself and its child pages; visitors could use that navigation to move between pages in the same section, without having to backtrack.

6.3.2 Designing the Look

One of the major challenges in designing a personal-home-page system is creating a looks system. AniAniWeb differs from most wikis, because it places more emphasis on adjusting the look of the site. Most wiki engines, such as Wikipedia's MediaWiki or CoWeb, have an easily-identifiable distinct look. While these looks may be aesthetically pleasing and professional, they also convey an immediate impression of being a wiki, with prominent edit buttons, etc. That is not the impression that an owner wants visitors to take away from her personal home page. Instead, the personal home page should primarily convey

an impression of who its owner is. Visual aesthetics are important for conveying a first impression (Kress & Van Leeuwen, 2001); that impression is formed before the visitor has time to read any text. So, a home-page owner needs support for changing the looks.

The looks of personal home pages, even within academia, vary quite a bit; however, there are some fairly common practices that can be observed by just browsing a few sites. AniAniWeb is founded on these conventions. It contains a navigation column on the left, a main content area on the right, and a purely aesthetic banner at the top of the page (Figure 7 on page 41). This has become fairly standard way for websites, and particularly home pages, to organize content. AniAniWeb additionally adds a button bar between the banner area and the content area that allows users to access AniAniWeb-specific features, such as editing, search, creating an account, etc. This layout is core to AniAniWeb and cannot be changed by the user; however, users can tweak the look of their site based on this core layout. Through a web interface, users can add a few key graphics and edit the CSS text to change the look of their site. Through these means, the banner, the backgrounds, the fonts, and the colors used can be changed. This allows for different AniAniWebs to have distinct looks.

For many users, the core layout proved successful. For example, PG wanted a site arranged in that manner before AniAniWeb was even made public. RY also used the same style of layout for her site before adopting AniAniWeb. CM liked the look of the site enough that when she had to create a static site, she used her AniAniWeb as a template.[3] For creating a competent professional academic home page, AniAniWeb succeeded. While the look system worked well as a standard template, a few adopters wanted something more flexible. For instance, MDN wanted to erase the navigation column. This challenged the entire notion of the looks system. The system tries to separate looks from functionality;

[3]One reason that CM was able to appropriate the design is that the HTML that AniAniWeb generates is simple and straightforward. It was designed to allow adopters to browse the source code of a page to discover how the style-sheet affects the looks.

however, looks and functionality are not entirely separable. Removing the navigation column would change the look, but it would also remove functionality (e.g., the page hierarchy would be removed); therefore, this possibility was not envisioned by the initial design. Yet, some adopters may want to tweak both looks and functionality. For those wanting more control and flexibility, the looks system could be improved.

In the initial version, the size of both the navigation column and the main column were limited. This was done intentionally, because it is often easier for people to read text in a smaller column than the full width of the screen. For this reason, it is common practice for news websites (e.g., *The New York Times* Online) to limit the size of their column width. While this configuration worked in most cases, it failed occasionally. Users would add graphics wider than the column width. The original version of the software tried to compensate for this by scaling pictures so that they would fit. While this allowed the column to stay limited in size, users complained that they wanted the full picture to be shown. Also, when one user embedded a web application, it could not be scaled. So, this initial design sometimes failed to satisfy the users' needs. A new look was introduced that scaled to the full size of the screen. This fixed the deficiencies of the old look and even allowed the site to work better for different screen resolutions.

There were also mixed results of building on CSS to change the looks. CSS (Cascading Style Sheets) are designed to separate the looks (CSS) from the content (HTML).[4] So, it seemed like a natural fit for AniAniWeb's looks system. By editing the CSS, a user has the power to flexibly customize his site. For a few adopters, this worked well as changing the CSS text in the browser was easier and faster than pre-planning the design with Photoshop. For others, that solution was frustrating. CSS is not the *lingua franca* that HTML is in the College of Computing; most research participants did not know how to take full advantage

[4]The HTML file specifies the content and the class of that content. Then, the CSS file specifies the style of that class. For example, an HTML file might contain the following paragraph: A sample paragraph. ; the CSS file can then determine the style of this paragraph: p.bodytext {color: red; align: center}.

of CSS. For instance, it was possible to do quite sophisticated things in the banner area using CSS, but it required a good understanding of CSS. I had to help a few adopters make the CSS reflect their vision. For many adopters, a simple wizard system that hid the CSS would have been more useful. Such a system would constrain the choices that a user has, but many adopters would prefer this approach's ease of use over the flexibility of manually editing the CSS. On the other hand, for TI, the extent to which CSS was supported within the generated HTML was not enough; he wanted even more control. When designing the system, I had hesitated from using CSS too pervasively as several browsers still had problems with supporting CSS and I wanted the site to be backwards compatible. As browser technology has advanced, CSS support has improved and it is now possible to rely more on it.

In the first version of AniAniWeb, I intentionally made the initial look of a new site boring and unattractive (see Figure 9 on page 44). I had hoped that this would be a useful incentive for new adopters to use the looks system. For a few adopters, the incentive worked; however, for most people, it failed: They never altered the look of their site. For many of the early adopters from the "Introduction to Graduate Studies" class, this design decision had an unintended negative consequence: Because their site did not look good, they abandoned the technology early on. To address this problem, I created a new default color scheme, GT (Figure 17), that looked good to begin with. That color scheme was specifically designed to be aesthetically similar to the Georgia Tech home page. Adopters could therefore quickly create a good-looking site that associated them with Georgia Tech. Initially, they could focus on creating the useful content of their site. Over time, they would have a more natural incentive to create a customized look. For the few later adopters, this strategy proved effective.

One difficulty in designing a looks system is that personal-home-page adopters vary widely in both their experience and aesthetic preferences. Some, like PG, are happy with a standard looking site; others, like TI, want complete control. Some adopt a new technology

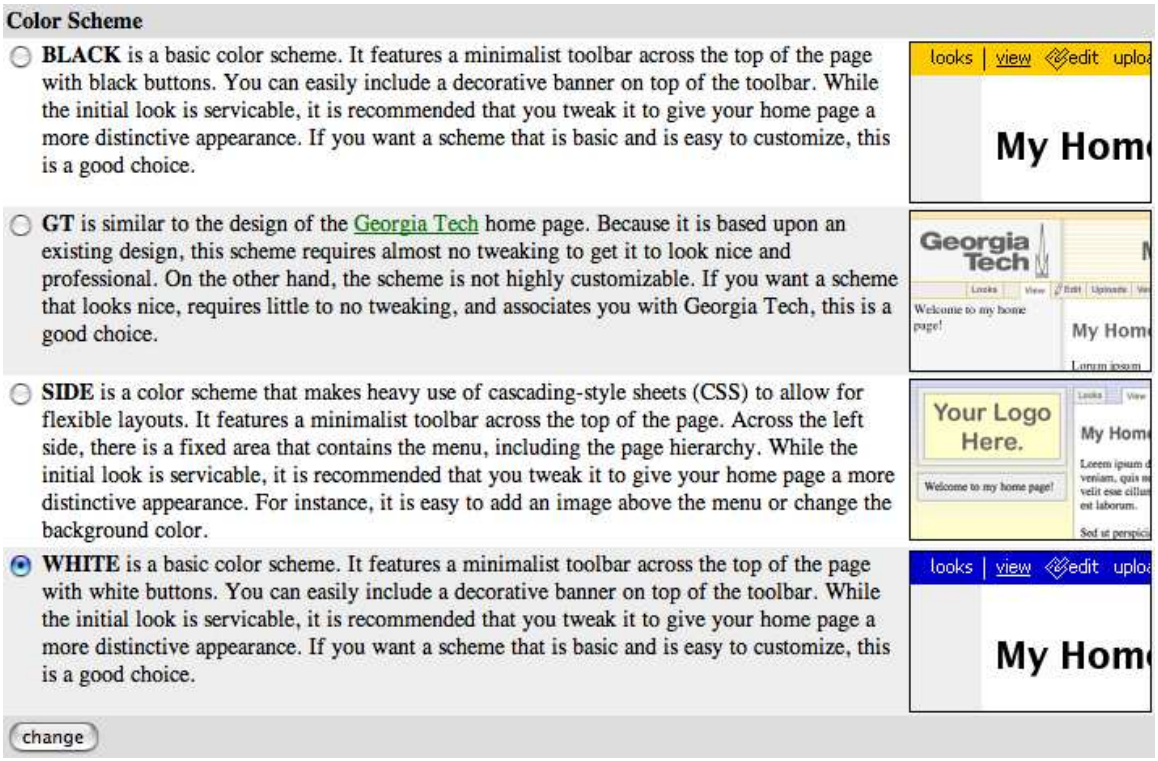


Figure 17: The Color Scheme Choices

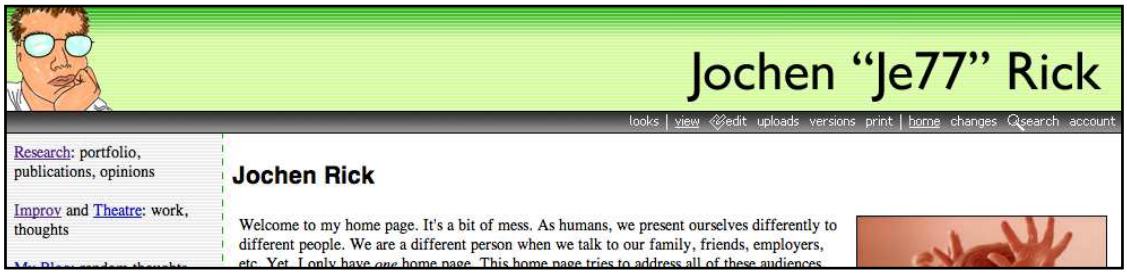
as their first foray into authoring web content; others have years of experience with HTML and CSS. Because of this variety, it is difficult to create one system that serves all users. A good looks system needs to provide multiple alternatives that meet the needs of different user groups. AniAniWeb tries to address this by having different color schemes to choose from (Figure 17). For complete novices, a good-looking standard template, such as GT, can be most useful. While it is difficult to customize, it allows adopters to work on the content, before investing effort into the looks. Blogger, a popular blogging engine, implements this template strategy successfully. For experienced adopters, BLACK and WHITE offer a simple look that can be easily customized to have its own aesthetic. SIDE was specifically designed to take full advantage of CSS. It no longer uses HTML tables to align content, instead relying on divisions that can be more flexibly controlled with CSS. Using that color scheme, MDN could erase the navigation column.

One AniAniWeb feature that proved successful for adopters was its support for multiple

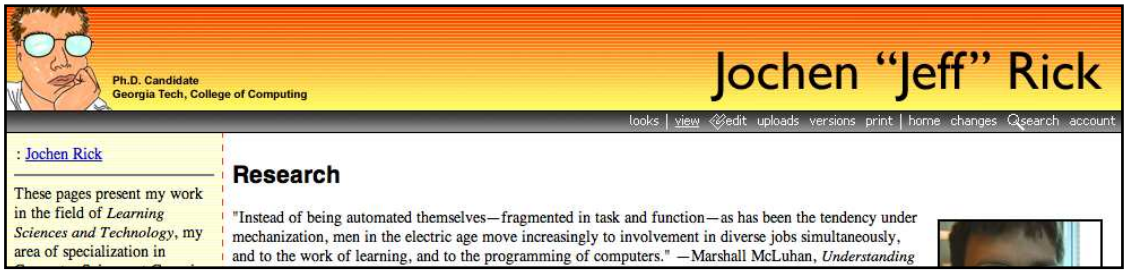
looks on the same site. Like access control, the look of a page is determined by its position in the page hierarchy. By default, a page inherits the look of its parent page (the page it was created from). From there, the owner of the site can customize it. This allows users to easily change the looks of an entire section of their site. The user simply changes the look of the top page in that section and all the other pages inherit it. Figure 18 demonstrates why it is useful for different sections to have a different look. The top excerpt is the default look of my current home page. Because I have two more substantial areas of interest to visitors (research and improv), I created a modified version of that look for those two sections (the second and third excerpts in Figure 18 respectively). Thus, a visitor can visually identify which part of the site he is in, but still feel that he is on the same site. All three looks contain my sketched image in the upper left hand corner, a gradient on the banner, and the same shoelace separation between the menu area and the main area. They differ by their accent color. The front page is green. The research page is orange. The improv page is purple. The improv page, one level down from the front page, overrides the look of the front page. Thus, all pages in that section of the site have the same look by default. The *Eggshell #1* page (bottom of Figure 18), one level down from the improv page and two levels down from the front page, looks different from the improv page. *Eggshell #1* is a theatrical play that I helped write using improv methods. While it belongs in the improv section, it deserves its own look.

Associating the look of a page with the page hierarchy has been an effective solution. In my example, I can tweak all the pages for the play by just changing the look of that one page. Though no other adopter used the look system as extensively as I did, others have found it convenient to change sections of their site. People tend to organize their information into meaningful sections. Giving these sections a different look can help visitors distinguish them from one another. I gave my research section a distinct look so that vocational visitors could immediately know what I am professional about. As it is common for academics to separate professional and non-professional concerns (Section 4.2.2), this way

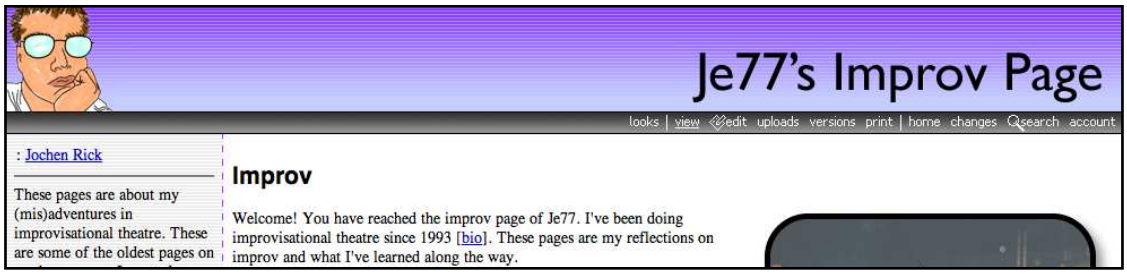
Front Page



Research Page (one level down)



Improv Page (one level down)



***Eggshell #1* Page** (two levels down)

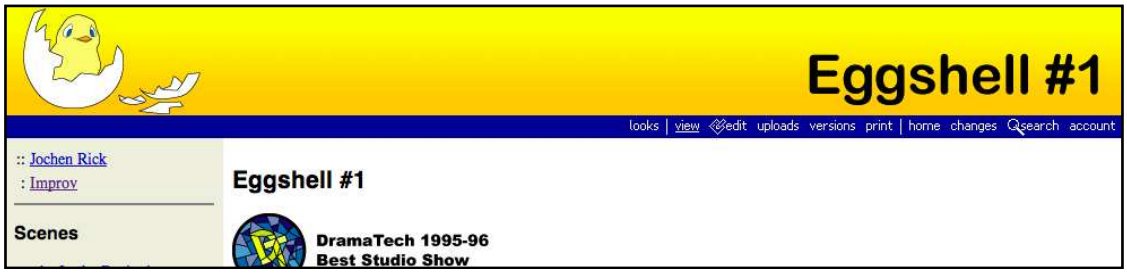


Figure 18: Four Page Excerpts Demonstrating Different Looks

of changing the look fits well with people's needs. RY, for instance, also separates professional and personal sections using the same strategy—variations on a central theme. CM changed the looks of her chocolate milkshakes page to draw attention to its uniqueness.

6.3.3 Access Control

> As we look at the way a person uses the Web, it is simplest to improve the reception of information by adding new forms of graphics and multimedia. It is more difficult to imagine how best to allow a person to interact with the information, to create and modify it. Harder still is imagining how this computer screen can be used to allow one person to interact as one of many people interacting as a group. This is the order in which development has occurred to date, and will occur in the future. (Berners-Lee, 1999, p. 160)

Designing an access-control system for personal home pages is a daunting task. The system must address two complex and intertwined problems: 1) How can the same home page address multiple audiences? 2) How can the home page go beyond simple publication to enable interaction and collaboration?

Different audiences visit the same home page. As each of these audience has different expectations and interests, it is difficult for the owner to author one home page that serves them all. This problem is compounded by an advanced authoring system, like AniAniWeb. In comparison to static-home-page users, AniAniWeb adopters created more content (Section 4.2.3) and often authored content that is primarily intended for themselves (Section 4.2.5). An access-control system should allow the owner to restrict sensitive content (e.g., a "to do" list) to the appropriate audience. While restricting viewing access is important, extending access beyond viewing is also important. AniAniWeb adopters wanted to use the software to interact and collaborate with others and found such interactions to be motivating (Section 4.2.4). So, a good access-control system has to go beyond limiting view access to granting further access (i.e., adding and editing content).

In face-to-face conversation, people behave differently depending on the context—time, place, and audience (Goffman, 1959). Many electronic communications media, such as television, remove the context of communication (Meyrowitz, 1985). The U.S. President cannot make a speech to a specific audience and not expect his words to be broadcast to a much wider audience. As a public figure, he has little control over the access that others have to that content. Personal home pages tend to also erase the context. Traditional static personal home pages contain the same content no matter who is accessing the page. Personal home pages can reinstate context into electronic communication through an access-control system.

Context is important to communication; at minimum, we are used to relying on it in face-to-face conversation. Communication in a specific context can be tailored towards that context, adhering to its practices, values, and standards. It can contain content that might be considered inappropriate in other contexts. Since the audience is confined, there is a degree of privacy that assures that the content of the communication will not be abused. Since the audience is typically trustworthy, interaction and collaboration becomes less dangerous.

While context is important for collaboration, it is not well supported by the Web. Unfortunately, the Web often evolved based on what was the easiest to implement, rather than what would address difficult problems (Berners-Lee, 1999). So, support for context and collaboration on the Web has trailed behind. People have had to invent *ad hoc* solutions to these problems, relying on pseudonyms and multiple sites on different servers to achieve a sense of context (e.g., TI's case). While web technology has been less supportive of authoring and collaboration than its originator, Tim Berners-Lee, intended, it is possible to create innovative systems of access control in the local confines of a server (e.g., Burrow, 2004; Stevens & Wulf, 2002).

When I designed the first version of AniAniWeb in 2000, I felt that a personal-homepage system would require a fairly sophisticated access-control system. I designed the

first access-control system to correspond roughly to Unix file permissions.[5] While I tinkered with the system off-and-on for some time, I could not arrive at a satisfying solution. Eventually, I gave up, abandoning the system. In 2003, I resurrected the system for this dissertation research. I arrived at a solution for the access-control problem: I would initially implement a simple access-control system. Wikis have demonstrated that even a simple access model (i.e., everyone can edit) can be useful (Guzdial et al., 2001; Leuf & Cunningham, 2001). As adopters experimented with the simple system, I could discover the needs that they had for access control. With a better understanding of these needs, I could better design a more sophisticated system.

The simple version of access control, described in Section 2.2.5, was limited. The owner of the site could determine two properties for each page: 1) whether anonymous visitors could view it; 2) whether signed-in users could edit it. Anonymous visitors were not allowed to edit any pages. Signed-in users were allowed to view all pages. Implementing this system was easy and solved many of the problems that had doomed previous attempts. While this implementation was limited, it was flexible enough that users could adopt it to support a variety of activities. Furthermore, adopters were able to reflect on the system to suggest features for a more sophisticated system.

What follows is my findings on access control, based on observed usage and adopter interviews. These observations are split into three parts: access to content, prominence of content, and avoiding abuse. The central problem that adopters have had is controlling who has access to what content. While strict measures to limit access are necessary for some uses, often simply changing the prominence of content can work well enough. Since offering access to content can be dangerous, a central problem of access control is avoiding abuse. After these user needs are detailed, I introduce the new access-control system that I designed to address them.

[5] On a Unix system, every file has an owner and a group. It also has a set of permission flags which specify read, write and execute permissions for the owner, group, and world (everyone else).

6.3.3.1 Access to Content

Personal home pages tend to integrate multiple audiences into the same virtual space (Section 5.6). Visitors can fall into a number of categories: friends, family, research collaborators, colleagues, professional visitors, possible employers, etc. To complicate matters, these audiences frequently overlap, as professional and personal connections often do in academia (Haythornthwaite, 1998; Nippert-Eng, 1996). Each audience has different expectations and needs. Content that may be appropriate for one audience might be unsuitable for another.

As a faculty member commented, he preferred to limit the distribution of baby pictures to family and close friends. Protection is also sometimes required by law. Academics often distribute research articles on the Web. Unfortunately, many of these articles cannot be posted to a public forum without violating copyright agreements. Posting the articles in a password-protected forum solves this problem. Another example of usefully restricting content to a specific audience occurs on Facebook, a social-networking site for university communities. Facebook profiles are made available only to friends and, depending on the preferences of the user, others at the university. When surveyed, Facebook users reported that they felt most comfortable sharing their profiles with friends and least comfortable sharing them with strangers; family and classmates fell between these two groups (Stutzman, 2006a). As Facebook's user-base expanded, many early adopters voiced their concerns about the dangers of new audiences accessing their profiles.

In addition to simply publishing content to others, research participants sometimes wanted to collaborate, allowing visitors to author content (Section 4.2.4). Wikis have proven themselves useful as a collaborative space; their simple open-to-everyone pages offer a chance for quick collaboration that could be useful for activities such as organizing a potluck dinner or scheduling participants for a research project. The initial version of AniAniWeb required users to create an account to edit content. This proved to be a huge hurdle for these uses; it was too inconvenient for an external visitor to create an account

just for this purpose. This impeded the amount of interaction and collaboration. In addition to opening content for anyone to edit, supporting collaboration between specific people or user groups would be useful. A research article might need to be kept from the outside world until it is ready to be published. While such participants might be more likely to create an account, it would be more convenient if they only had to know a password.

While the personal home page is generally considered an instrument for publishing content to others, it can be useful for keeping private content, such as AniAniWeb adopters authored: bookmarks, financial records, an appointment calendar, access information for other sites, personal writings, a "to do" list, etc. Access to this content should be restricted to the owner of the site. Such self use was quite common among AniAniWeb adopters (Section 4.2.5). Given AniAniWeb's convenient accessibility and short authoring cycle, it usefully supported posting such private content.

In summary, the accessibility of content might usefully vary from open pages (like a wiki) to completely private pages. In addition, the access control of a page might need to change throughout its lifetime. Private writings might mature to the point where they can be published to a wider audience; MDN, for instance, evolves his writing in this manner. An open collaborative page might be restricted once it has served its collaborative purpose. New members might be added to a project group and need access to the site.

6.3.3.2 Prominence of Content

Ultimately, visitors assess a site based on the content they browse, rather than all the content on the site. Since people tend to browse websites by following only the information they are interested in (Huberman et al., 1998), one of the most practical ways to limit the access that visitors have to some content is to reduce its prominence. While it would still be possible for visitors to reach obscure content, the vast majority of visitors will neither seek it out nor stumble upon it.

Interviewed faculty members felt that an academic personal home page should primarily convey a professional image. Goofy personal content, such as party pictures or gossipy blog entries, detract from that image. Faculty members had no problems with people distributing this kind of content, but it should be kept away from professional visitors. It was from this perspective that a faculty member objected to CM's chocolate milkshakes page; its prominence, not its existence, was problematic.

Since academic visitors are often only interested in professional content, it has become standard to separate professional and personal content into separate sections (Section 4.2.2). As long as professional visitors can quickly find the professional content, most are not likely to browse the other (more personal) content. Thus, clearly separating professional and personal concerns can largely satisfy the professional-image guideline. Whether this prominence-based solution to the multiple audience problem suffices is up to each adopter.

Some adopters, such as TI, prefer a more-secure solution. For these adopters, access control, separate sites, and pseudonyms can further reduce the chances that visitors encounter inappropriate content. Access control can make sure that visitors cannot access some of the more controversial content on a site. Creating entirely separate sites can further ensure that visitors to the prominent professional site will not visit the more-obscure personal site. Pseudonyms are commonly employed to effectively hide such sites from search engines.

For other adopters, the prominence-based solution is adequate. RY, for example, keeps impolite content on her site. Since it is separated from her professional content, she does not feel this to be a problem. If a professional visitor decides to browse through obviously non-professional content and discovers such impolite content, she believes that the visitor should be okay with it. After all, he or she actively looked for it.

6.3.3.3 Avoiding Abuse

One of the dangers of creating a public, interactive space is that the *content* or the *technology* could be used in ways not agreeable to the owner of the site (Section 4.1.2). The content available could be accessed by unwanted parties and the information misappropriated. Bots can harvest e-mail addresses that will be used for spam e-mails. Given the ample information that people are willing to reveal online, someone could use that information for identity theft (Stutzman, 2006a). Stalkers could find such information equally convenient. For academics, publicly releasing preliminary research, such as a thesis proposal, could make them vulnerable to scooping.

A good access-control system should stop visitors from accessing content through the normal channels; however, there are other ways to access the information. A hacker could exploit vulnerabilities in the access-control system, the server software, the server itself, or the network. For instance, since HTTP is not encrypted, any node along the communication path has access to the transmitted content. Additionally, the content on the server can be accessed by the service provider and the relevant governing bodies (Section 4.5). Fortunately, these kind of accesses are rare and not usually threatening to users.

While it is important to protect certain content from being viewed, there is also the danger of content being added, edited, or erased. While an interactive space has its benefits, it also has its dangers. There is little stopping someone from creating an account on AniAniWeb and editing the site of any of the majority of adopters that leave their site somewhat open. In particular, just as bots can harvest e-mail addresses, some bots can spam interactive websites directly. Due to the popularity of interactive sites, such as wikis and blogs, spam-bots have become quite common. These take advantage of the open nature of these sites to post unwanted content. This content usually serves one of two purposes. First, it can provide free advertisement. Second, it can help nefarious sites raise their page ranking on search engines.

While there is great potential for abuse, the gap between that potential and the actual

amount of abuse is wide. Wikis, for example, demonstrate that even an open environment that allows anonymous strangers to edit can be used appropriately by visitors. People tend to behave in ways that are socially acceptable (i.e., befitting the nature of the forum). Wikis are predominately used as collaborative spaces; consequently, their practices are quite different than the predominately individual practices of personal home pages. Because wikis are communal property, rather than individual property, the vulnerability of any particular person is less. In addition, the larger user-base of a wiki can assure that attacks are combated quickly. Wikipedia is famous for thwarting attacks on its content quickly; however, Wikipedia is unique: It is by far the largest wiki on the Web and has a large, dedicated, and active user-base.

To account for the differences in vulnerability, a layer of safety was added to the version of AniAniWeb used at the beginning of this study: Anybody who wanted to edit content had to create an account. This provided a barrier to entry that made adopters feel more secure in leaving their sites (partially) open. In addition, any edits could be traced back to the e-mail address of the person. This provided a greater level of accountability than seen with anonymous wiki editing. The system has worked well: Except for spam-bot attacks, discussed further in Section 6.4.1, there have been no reports of malicious editing. Another feature that has made people feel more secure from abuse is that certain pages can be more protected. So, software-download pages[6] and curricula vitae can be secured from editing. Which pages need to be protected and which can be left open for potential abuse is up to each adopter. Different adopters will have different preferences, depending on their experience, position, and inclination.

Abuse does occasionally happen. In AniAniWeb, the biggest problem so far has been controlling spam-bots from posting content. To deal with these attacks, several features are useful. First, several AniAniWeb features allow owners to realize quickly when their

[6]TI used his AniAniWeb to distribute software. To prevent hackers from replacing his valid software with a corrupted copy, he locked the page. Unfortunately, such attacks are not unheard of.

site has been attacked. Registered users can sign-up to receive e-mail alerts when a page has been edited by someone else. Some adopters embedded a listing of recent changes on their top page; since they visited that page frequently, they could see if anyone had made changes. Second, since spam-bots tend to attack the entire server, it is practical for the attack to be dealt with at the server level. AniAniWeb provides tools for the server administrator to roll back changes made by a specific user (as identified by their IP address).

6.3.3.4 The New Access Control

Based on the findings of this research reported in the previous sections, a new access-control system was implemented to better serve users' needs; the new system was released to AniAniWeb users on 19 April 2005. Implementing an access-control system is a complex task, as it must satisfy two opposing criteria: flexibility and usability. The system needs to be flexible enough to enable a variety of uses; however, it needs to be simple enough that adopters can easily use the system and incrementally learn its extended features.

One characteristic of personal home pages that complicates matters is that most external visitors to a site have little invested in their visit. They are unlikely to be willing to learn how to use a complicated system. To support external visitors in CoWeb, "add to the page" boxes were added (Guzdial et al., 2000); these required little to no instruction to use. To support these low-investment visitors, the visitor interface for AniAniWeb must be simple and intuitive. As owners of the site are more invested in the technology, their interface for controlling access control can be more complex; however, even there, the system needs to be simple enough that novice adopters can feel comfortable using it.

Another obstacle for creating a good access-control interface is that HTML was not designed for creating sophisticated interfaces. To assure that the interface would function on all browsers, the system was built using plain HTML and simple Javascript. This limited interface elements to drop-down lists, check boxes, radio buttons, and text input.

Since some people disable Javascript in their browser, the interface also had to function adequately without Javascript. To make access control visible to owners, it was critical that the interface was compact enough that it could conveniently fit on the edit page; thus, the owner of the site could set the access control for a page at the same time as authoring the content. While it is not strictly necessary to combine editing and managing access control, the previous work on CoWeb had demonstrated the utility of this approach.

Satisfying all of these design criteria is inherently complex. Designing a suitable solution is not a straightforward task. It takes a while to work-out a potential solution far enough that it can be judged by the design criteria. Thus, the reflection cycle, so important to design (Schön, 1987), is costly time-wise. Additionally, a good solution should both be usable and full-featured. Since usable and full-featured are often at odds, designing products for people is inherently a difficult enterprise (Norman, 1988).

I started by sketching out various approaches on paper, judging each design by how well it satisfied the user needs and the implementation constraints. In particular, I wanted to ensure that the system could support the uses (open pages, hidden pages, private pages, gaining access through a password, etc.) envisioned by my research participants. Some potential solutions were rejected because their interface would be too complicated for users or too complicated to be implemented in HTML. Other potential solutions did not match the identified needs well. I felt it was essential to this design-based research to actually implement a solution to demonstrate that an adequate solution is even possible.

I finally chose one paper-based design and implemented it over several weeks. After implementing it, I was dissatisfied with the results: It was neither as capable nor as usable as I had hoped. I ended up abandoning that code and implementing a completely new system. Luckily, I am satisfied with the results of this second attempt. The system is more sophisticated than other access-control systems I have seen, such as those employed by LiveJournal and Facebook. Yet, the interface for controlling it is fairly simple.

Access control, in the new system, is defined by user groups (Figure 19). The old

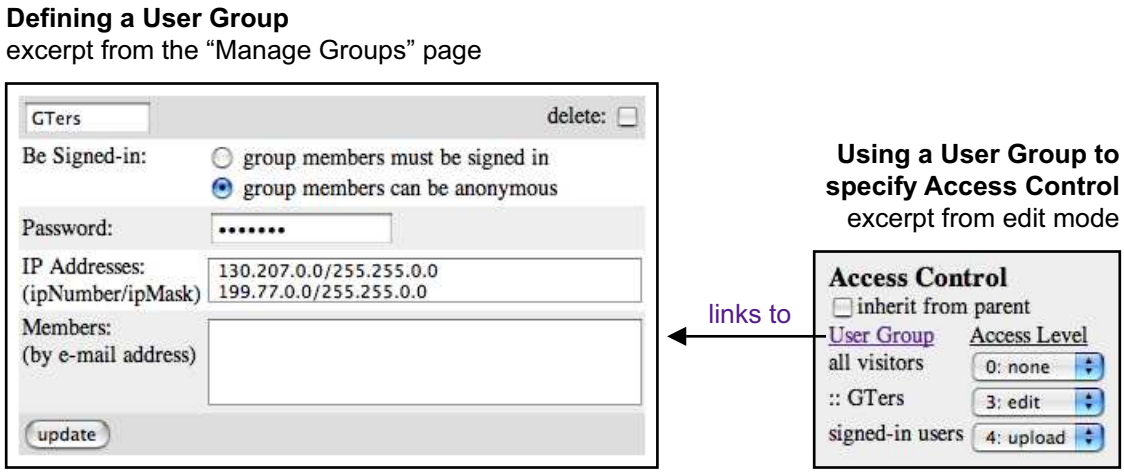


Figure 19: Specifying Access Control, based on User Groups

system already defined two of these groups: those with an account and those without an account. In the new system, those groups are still present as "all visitors" and "signed-in users" respectively.[7] These two groups are created automatically when the site is created. From there, the user can define new groups. Figure 19 shows one such user group, GTers. I created this group for Georgia Tech visitors. Anyone accessing my site from a campus machine (i.e., within the IP ranges specified), automatically is part of this group, whether they realize it or not. People from off-campus could also join the group if they knew the appropriate password. *Membership in a group can be determined by either password, IP address, or by manually adding AniAniWeb members.* Each user group is either a subgroup of anonymous visitors or a subgroup of signed-in users. Once the group is created, a slot for defining its access level for a page is added to the access control part of editing a page. In Figure 19, the GTers group is listed under "all visitors," because group members do not need to be signed-in users.

The access-control settings for a page can then be specified using these groups. By default, the access control for a page is inherited from its parent page. Using inheritance, the user can easily change the access control for an entire section of the site; the user simply

[7]Not only did these groups make sense, the inclusion of these groups allowed me to convert the existing sites to the new access control without a change in the access levels they had specified.

Table 2: Group Access Levels, from Least to Greatest

Level	Description
0: none	The visitor has no access to the page.
1: hidden	The visitor can view the page, but the page is hidden. Would-be-links to the page appear to the visitor as plain text. The page is also excluded from search results and recent changes.
2: view	The visitor can view the page.
3: edit	Additionally, the visitor can edit the page.
4: upload	Additionally, the visitor can upload files to the page.

changes the access control for the top page in that section and all the other pages inherit the change. When the access control is inherited, the interface is still visible, but disabled through Javascript. To override the access control, the user simply clears the check box next to "inherit from parent." From there, the user can use the drop-down lists next to the names of the user groups to specify their respective access level.

Table 2 details the five access levels. The access levels are cumulative, so an access level of "4: upload" allows group members to view the page, edit the page, and upload files. The access level that a visitor has to a page is determined by the maximum access level of all of the user groups he belongs to. In the example given in Figure 19, the page is inaccessible to anonymous visitors, but can be edited by Georgia Tech visitors. It can also be fully accessed by signed-in users. If a visitor fits into both user groups (GTers and signed-in users), their access level is "4: upload," since that is the higher access level of the two groups. Because the access that a user has is based on the maximum access level of his user groups, it does not make sense to allow owners to specify an access level for a group lower than its general category (all visitors, signed-in users). To enforce this, the edit interface removes all the choices that would be illogical from the drop-down lists.

The above covers how the access control is set by the owner of the site. The second, perhaps lesser, challenge in creating an access-control system is the visibility of the access control as users browse the site. The access control needs to be sufficiently visible to be usable, but sufficiently lightweight to not impede normal use. Visibility can be broken

Table 3: How Links Appear to the Owner, based on Access Control

Appearance	Meaning
Page Name	This page is private: Visitors not belonging to a user group cannot access it. If visitors can gain access by joining some user group, the tool-tip for the lock image reads "Inaccessible to Visitors." If not, the tool-tip reads "Inaccessible to All."
Page Name	This page is hidden: Visitors not belonging to a user group do not see a link to it. If the page is hidden to all visitors, the tool-tip reads "Hidden to All." If the link is visible to some user group, the tool-tip reads "Hidden to Visitors."
Page Name	This page is visible: Any visitor can view it.

down into two parts: 1) how does the page reflect its accessibility; 2) how does a link to a page reflect the accessibility of that page. Both of these affect the owner, who determines accessibility, and external visitors differently (Figure 20).

As the owner of the site can access any page on the site, the access-control indicators were designed to simply remind the owner what access others have to a page. Small lock graphics on the view and edit buttons indicate that the page is respectively locked from viewing by anonymous visitors and editing by signed-in users. The links to pages are decorated to indicate their accessibility (Table 3). Initially, more-detailed link decorations were implemented; however, these proved to be overbearing and complex. Eventually, the solution of only indicating whether visitors could view a page was implemented. Since the primary relationship that visitors have to another's site is as viewers, this simplification works.[8] Owners can quickly see that a page is private or hidden.

For visitors, the decorations indicate the access level that the user has. Small lock graphics are added to the edit and upload buttons of a page to indicate when these features are restricted. If the user can gain access with a password, the link still functions, but leads users to a page to enter the password. Once the password is confirmed, the user can

[8]In the original access-control scheme, the indicators showed both whether a page was locked from viewing and locked from editing. This worked well for most adopters, who only occasionally locked a page from editing; however, it was awkward for MDN, who locked his entire site from editing. All his links had an edit-lock decoration. With the new scheme, the decorations are visibly less obtrusive.

The Same Page Content, Viewed by...

<?image align=right border=2 space=5 linkToPage=4 src="image.png"?>AniAniWeb has an access-control system that allows the owner of the site to set different access levels for different user groups. The owner and visitors view a page slightly differently based on these access levels. A link to *a completely private page* or *a hidden page* appears as plain text to visitors. The difference is that a visitor can view *a hidden page* if they know the URL. A visitor will see a link to a *locked page* that requires him to enter a password before proceeding to that page. If he already has access, the *unlocked page* will be differently decorated.

The buttons at the top of the page too are affected by the access level. As a base level, this page is viewable to all visitors. A visitor can gain edit and upload access with the correct password; therefore, the 'edit' and 'upload' buttons are viewable to even anonymous visitors. Clicking on these buttons will prompt the visitor to enter the password before proceeding.

Several plug-in features build on the access control system. So, an embedded image (as above) can be linked to a specific page. If the visitor does not have access to that page, the link is not present. Text can be <?text private="shown for the owner" public="hidden from visitors who are not allowed to edit the page"?>. The gallery plug-in only shows itself if that user is allowed to upload files:

<?gallery?>

...the Site Owner.

looks | view edit uploads versions print | home changes search account

An Example Page

AniAniWeb has an access-control system that allows the owner of the site to set different access levels for different user groups. The owner and visitors view a page slightly differently based on these access levels. A link to a completely private page or a hidden page appears as plain text to visitors. The difference is that a visitor can view a hidden page if they know the URL. A visitor will see a link to a locked page that requires him to enter a password before proceeding to that page. If he already has access, the unlocked page will be differently decorated.

The buttons at the top of the page too are affected by the access level. As a base level, this page is viewable to all visitors. A visitor can gain edit and upload access with the correct password; therefore, the 'edit' and 'upload' buttons are viewable to even anonymous visitors. Clicking on these buttons will prompt the visitor to enter the password before proceeding.

Several plug-in features build on the access control system. So, an embedded image (as above) can be linked to a specific page. If the visitor does not have access to that page, the link is not present. Text can be shown for the owner. The gallery plug-in only shows itself if that user is allowed to upload files:

Image (png, gif, jpeg) **ALT Text**

Choose File no file selected

upload

...an Anonymous Visitor

view edit uploads versions print | home changes search sign-in

An Example Page

AniAniWeb has an access-control system that allows the owner of the site to set different access levels for different user groups. The owner and visitors view a page slightly differently based on these access levels. A link to a completely private page or a hidden page appears as plain text to visitors. The difference is that a visitor can view a hidden page if they know the URL. A visitor will see a link to a locked page that requires him to enter a password before proceeding to that page. If he already has access, the unlocked page will be differently decorated.

The buttons at the top of the page too are affected by the access level. As a base level, this page is viewable to all visitors. A visitor can gain edit and upload access with the correct password; therefore, the 'edit' and 'upload' buttons are viewable to even anonymous visitors. Clicking on these buttons will prompt the visitor to enter the password before proceeding.

Several plug-in features build on the access control system. So, an embedded image (as above) can be linked to a specific page. If the visitor does not have access to that page, the link is not present. Text can be hidden from visitors who are not allowed to edit the page. The gallery plug-in only shows itself if that user is allowed to upload files:

Figure 20: Viewing a Page, based on Access Control

Table 4: How Links Appear to Visitors, based on Access Control

Appearance	Meaning
Page Name	This page is either hidden or only viewable by the owner. What would normally appear as a link remains plain text, effectively hiding the existence of the page.
Page Name	This page is locked. When the visitor follows the link, the server prompts him to authenticate that he is part of a user group that can view the page. The tool-tip for the red lock reads "Locked."
Page Name	This page is normally locked, but the visitor belongs to a user group that has access. Following the link brings the visitor to the page. The tool-tip for the green lock reads "Unlocked."

proceed to edit the page or upload files. If the user cannot gain access through a password, the button is made inactive. When possible, the page specific buttons (view, edit, upload, and history) are still hidden from anonymous visitors. This allows the site to still look more like a traditional static home page than a wiki. The links to pages are decorated according to the access level that the user has (Table 4). Again, the decorations are simplified to only indicate whether the user has viewing privileges for that page.

This system addressed many of the reported needs of research participants. By setting the access level to "0: none," a completely private page is created. MDN could use such a page to keep his password information to himself. By setting the access level of all visitors to "4: upload," a completely open page is created. This page would function like a wiki page. Given the affordances of wikis for collaboration, home-page adopters could use them to collaborate with others. Of course, these pages would also be subject to the same problems as wiki pages, such as spam-bots. By setting the access level of all visitors to "1: hidden," the page is effectively hidden from search engines and visitors that stumbled onto the site. Yet, the URL could still be e-mailed out to others. For example, a home-page adopter might be hosting a party at his house and want to distribute directions. By using hidden pages, he can mail out the URL for a directions page without worrying that the information will be accessible to strangers (who might abuse it). The owner of the site can also create user groups to give others, who are more trusted, more access. CM

would be able to create a private page that she and her collaborator could use to work on their article, without having the products of that collaboration viewable to outsiders. PWM could create a private section to support sensitive group work—her original motive for adopting AniAniWeb. While the system addresses the discovered user needs and allows for a variety of uses, it does have some drawbacks:

First, limiting the access of subset user groups is not possible, since access is based on the highest access level. In Figure 19, I could not specify that GTers have less access to a section than anonymous visitors. While it is difficult to imagine a situation when this would be appropriate, such a situation could exist. For instance, when planning a surprise birthday party, an appropriate access model might grant access to all friends except for the guest of honor.

Second, the access levels (Table 2) are simplified for usability. The abilities to see the link to a page, edit a page, and upload files do not have to be cumulative. Some owner might want a page that is hidden, but can be edited when someone visits it. Another owner might want a page that allows visitors to upload files, but not edit content. Since these scenarios were not mentioned by research participants, I deemed it safe to make these simplifications. Such approximations are necessary when creating a system that is simple enough to use. Another such approximation is employed for "add to the page" boxes. Currently, anyone who can view the page can use its existent "add to the page" boxes. While it is possible to differentiate adding content from viewing in the access levels, this would further complicate the system. In CoWeb's access-control system, these two actions are separated; this granularity has proven useful for combating spam-bots.

Third, the inheritance model of access control does not always function cleanly. PG wanted an access-control scheme where her top page was locked from editing, but the other pages could be edited. Since the top page is so prominent, she did not want others to be able to edit it. To implement this scheme, she would have to override the top-page's access control for all its children. While this is inconvenient from an interface standpoint,

she would still be able to execute this scheme fairly quickly.

6.4 Core Changes

The previous sections of this chapter focus on how AniAniWeb was improved to be a better version of itself, retaining its core uses and values. This section is about the possibilities of changing the core of AniAniWeb, based on user suggestions and observed usage. The changes suggested here would alter the foundations of personal home pages. It is possible that the results of these core changes would create a radically different system, perhaps no longer recognizable as personal home pages. As core changes in a medium often radically change its use (Rick & Lamberty, 2005), I am not advocating these changes as ways to improve on personal home pages. Instead, I am suggesting them as possibly fruitful directions for future research in this general design space.

First, audience awareness is reconsidered. Then, the possibilities for social networking are examined. More social-networking support would further enable sites to interconnect and for users to interact. Finally, other applications to integrate into AniAniWeb are considered. Just as personal home pages tend to integrate audiences, they tend to integrate diverse media (e.g., hypertext, images, polls, etc.) into the same space. It could be useful to integrate other applications, which are usually thought of as independent from personal home pages.

6.4.1 Audience Awareness and Control

One of the unusual characteristics of personal home pages is that authors have only a vague idea of how the audience engages their site, or even if anybody is visiting the site. The only trace that is left when someone visits the site is a few cryptic lines in a log file. Many homepage adopters cannot even access this file and would not know how to decipher its meaning if they could. Thus, their audience awareness is quite low. Section 3.2.2 documents the large number of academic visitors to PG's site during faculty hiring; however, PG had no feedback from her home page about this increase in audience. Her only clues that others

Date	Time	User	URL	Referer
5 January 2007	8:23 pm	search.gatech.edu	/je77/62	none
5 January 2007	7:29:59 pm	dj501008.inktomisearch.com	/je77/62	none
5 January 2007	7:27 pm	search.gatech.edu	/je77/2	none
5 January 2007	2:42:33 pm	crawl-66-249-72-104.googlebot.com	/je77/2.print	none
5 January 2007	2:41:05 pm	crawl-66-249-72-104.googlebot.com	/je77/62.print	none
5 January 2007	11:32:56 am	krill.cc.gatech.edu	/je77/2	http://home.cc.gatech.edu/je77
5 January 2007	11:31:33 am	krill.cc.gatech.edu (Jochen Rick)	/je77/2	http://home.cc.gatech.edu/je77
5 January 2007	10:08:12 am	dj101006.inktomisearch.com	/je77/62	none
5 January 2007	8:16:30 am	c-75-68-192-9.hsd1.vt.comcast.net	/je77/2	http://home.cc.gatech.edu/je77/96
5 January 2007	6:55:17 am	host35.embarqservices.net	/je77/62	none
5 January 2007	6:55:09 am	host35.embarqservices.net	/je77/62	none
5 January 2007	6:54:58 am	host35.embarqservices.net	/je77/62	none

Figure 21: The Spy Plug-in

were viewing the site came from other sources, such as e-mail messages.

It is possible to analyze log files and present the results appropriately, so that the owner can better understand how others view the site. In a newest version of AniAniWeb, a "spy" plug-in allows an owner to observe the hits that she get to her home page (Figure 21). The majority of the hits are from search engines, indexing the site. While these hits are useful, they do not inform the owner much about how other humans view the site. One of the most useful features of HTTP requests, in terms of audience awareness, is that most requests from real users include the *referring page*—the URL of the page that led them to this page. Thus, the log entries contain a record of how a certain visitor navigated the site. Additionally, it can show how the person arrived at the home page. For web searches, it can show the terms that led a visitor to the site; I, for instance, discovered that a search on "improv topics" ranks my site highly. Also, external links to the site can be discovered this way. One Georgia Tech Ph.D. graduate discovered that he was on the short list of faculty candidates for an institution by visiting the referring pages. I too noticed links from possible employers to my home page (using the spy plug-in); although, in my case, the originating sites were password protected.

In addition to understanding how visitors engage the site, it is important to understand how the site fits into the Web. Referring pages can convey what external sites and web

searches link to the site, but they do not contain much information of how prominent the site is. Many people arrive to a site through web searches. So, it is important for people to know how prominent their site is on search engines. Several research participants performed web searches on their name to make sure that potential visitors could easily find their site. In MG's case, the reverse was true: She checked to ensure that random visitors did not find her AniAniWeb through a search engine. Having that awareness and being able to take action to better control it would be useful. For instance, several adopters have found it useful to add HTML keywords to their page to increase its prominence.

Of course, not all audience members are welcome. It would be useful if adopters were aware of these visitors and could block them. One particularly annoying visitor is the nefarious bot. There are two major threats from bots: information harvesting and content spamming. People tend to offer information freely on their personal home pages (Stutzman, 2006a); some of that information could be misused (e.g., identity theft). Some bots troll the Web looking for valid e-mail addresses. These are then appropriated by e-mail spammers. Many home-page adopters have taken to disguising their e-mail address to avoid this attack. One AniAniWeb user complained that the system displayed his e-mail address when he edited a page. This feature was originally put in place for accountability; home-page owners could easily contact the people who edited their page. To protect e-mail addresses from being captured by bots, the system was changed to only display the e-mail address to users who had created an account.

In addition to misappropriating information on the site, spam-bots have been known to add bad content. Georgia Tech's AniAniWeb server has been subject to a number of these attacks. Most have simply posted content into "add to the page" areas, since anyone who can view the page can use these to add content. One attack was much more sophisticated. The attacker created an account, then turned that identity over to a bot that attached unwanted files. Then, the bot spammed blogs with links to the AniAniWeb files, which redirected visitors to the site using the bot. To thwart this attack, AniAniWeb was changed

to refuse uploads of certain types of files (HTML, PHP, etc.) from users who did not have their own AniAniWeb. One feature that helps genuine adopters recover quickly from an attack is that of e-mail updates. Users can get alerted when someone, besides themselves, edits the site.

6.4.2 More Social-Networking Support

We are all connected to others through work, school, friends, family, and history. These social ties can form the basis of a social network (Haythornthwaite, 1998). In academia, social networks exist surrounding institutions (e.g., College of Computing) and research areas (e.g., Learning Sciences). It is important for an academic to build strong social networks and use them effectively (Agre, 2005). Since these networks are so important, it might be useful to make them visible and utilize them to support personal home pages. That is what social-networking support does; it makes the network visible and allows people to utilize it.

Recently, social-networking support has greatly expanded the meaning of personal home pages (boyd, 2004). MySpace, Friendster, and Facebook successfully combine pages that represent individuals (i.e., a traditional notion of personal home pages) with a prominent social network to create a popular web destination.[9] All of these sites use similar tools to support interaction in their respective networks. Walls, similar to AniAniWeb's "add to the page" feature, allow users to add comments directly to another's page. Integrated blogs allow the home-page owners to add updates, which visitors can comment on. Mail systems allow users to send messages to their fellow users.

While their tools are fairly similar, the sites that implement social networking still vary widely on other properties, so as to serve different purposes. To demonstrate this, I will briefly compare MySpace, Friendster, and Facebook. All three allow users to befriend each other, technologically speaking. Thus, the social network is formed. Of the three, MySpace

[9] At the time of this writing (11 November 2006), all three sites are in the top 30 of English-language sites on the Web, according to http://www.alexa.com/.

is the most like a traditional personal home page. MySpace was designed with the needs of independent musicians in mind. Artists can easily upload songs for listeners to sample, announce tour dates and venues, and fill fans in on what they are doing. To better serve this purpose, MySpace pages are open to any visitor.

Facebook and Friendster take a different approach: They grant access to pages based on the social network. Friendster was designed to be a dating site (boyd & Heer, 2006). Users can only see the profiles of individuals within four degrees of separation—their friends' friends' friends' friends. The designers felt that such a social network could provide a suitable setting for dating. Since each person in the network is connected through friends, there is a greater sense that the strangers in the network are trustworthy. Facebook began as an online community to complement college and university communities (Boogart, 2006). Over time, Facebook has expanded to include other networks: high schools, cities, etc. Access is granted based on friendship ties and the networks (e.g., Georgia Tech) that the user belongs to.

While these three sites are currently the models for social networking, blogs have utilized social networking tools for longer. Specifically, blogrolls interconnect blogs. A blogroll lists links to other blogs of interests that have been recently updated. By embedding a blogroll into his blog, the owner can share his social network with visitors. By prioritizing new content, the blogroll encourages conversations (Efimova & de Moor, 2005). These conversations can enable an online community to form. TI, for instance, uses LiveJournal to communicate with his network of friends.

While blogs can support social networking, most adopters choose not to use these features, preferring to keep their sites more isolated (Herring, Kouper, et al., 2005). In terms of interactivity, blogs lie between the traditional static home page and the explicit social-networking sites. They can be used to converse and build a community, but frequently adopters choose not to do this. Even when blog users use their sites to converse, the social network can be quite hidden (Efimova & de Moor, 2005). Many people have started using

RSS aggregaters to replace the function of the blogroll. RSS (Really Simple Syndication) publishes blog content in an XML format that can be easily processed by computers. RSS aggregaters simply integrate the RSS feeds of multiple blogs into one coherent view. Unlike the public blogrolls, aggregaters are generally private. Consequently, outsiders cannot follow the social network as the sites are no longer openly connected.

As the preferences of blog adopters demonstrates, social-networking support is not a universal good. Some home-page adopters do not want it; however, the popularity of social-networking software on the Web shows that there is a demand for these kinds of features. When AniAniWeb was made available to incoming Ph.D. students, many early adopters began leaving each other messages on their AniAniWebs. As newcomers to the CoC community, they had a need to connect with each other. The initial AniAniWeb user-base contained enough incoming students to make it a viable setting for social networking. AniAniWeb's tool-set, including "add to this page" boxes and polls, was sufficient to allow adopters to experiment with using it as a social-networking application, rather than as a publishing tool. In the end, the social networking failed: Adopters stopped using their sites for this purpose. The community was not strong enough and the tools were not supportive enough to allow the community to prosper. More social-networking support could have realized the vision of these early adopters, transforming AniAniWeb into social-networking software.

While this might be a fruitful avenue of future research, there are also several reasons to be wary. First, social networks further exacerbate the multiple audience problem. Friendster's support for dating broke down as bosses and mothers started joining (boyd & Heer, 2006); users feel obliged to accept friend requests from these audiences, but their presence makes it awkward to pursue dating on the same site. PWM also found that integrating audiences of friends and family proved awkward on her blog. Facebook is implementing more privacy controls to allay users' concerns about the new larger networks threatening privacy. For example, it is now possible to add friends in such a way that they have a limited

view of the person. Second, the social networks formed online are often not representative of real friend networks. Users frequently claim over 100 friends on Friendster; even optimistically, most of these "friends" are just acquaintances. Third, people do not always appropriate the social network as intended. On Friendster, a phenomenon of fake accounts became so common that the phenomenon received its own term, *fakester*. Fourth, online social networks can expire and lose their usefulness. When users stop using Friendster, their profiles still remain (boyd & Heer, 2006). These shells can be a burden on the remaining users as communication attempts with them prove futile. Fifth, social-networking support can completely transform the medium. New practices and forms will evolve. In essence, a new medium is created. It is not clear that such a new system would better serve the needs of academics for personal home pages.

6.4.3 Integration with Other Applications

Personal home pages are a flexible medium. A home page can incorporate other media, such as images and videos. Including pictures on a personal home page has been standard since their inception (Dillon & Gushrowski, 2000; Erickson, 1996). So, it seems natural to integrate an image gallery application into a personal home page. There are many other applications that have proven themselves as valuable to adopters: polls, comment areas, blogs, RSS feeds, etc. Why stop there? One interesting way for a medium to evolve is to combine itself with another medium. For instance, the qwikWeb system allows its users to simultaneously create an *ad hoc* mailing list and wiki (Eto, Takabayashi, & Masui, 2005). Discussions on the mailing list are archived on the wiki, where they can be linked, annotated, refined, etc. qwikWeb also automatically handles access control, allowing only members of the mailing list to access the wiki. AniAniWeb adopters suggested two applications that could be usefully integrated into a personal-home-page system: calendaring and e-mail.

Several AniAniWeb adopters use their sites to distribute their schedule and calendar.

They need to distribute this information to others in the academic community; the need to make their availability publicly known was particularly important to faculty members, who have busy schedules. Since AniAniWeb was easy to edit, it was a convenient venue for distributing this information. The system's hypertext was flexible enough to allow for light calendaring. Of course, calendaring can become much more complex. Certain appointments may recur on a bi-weekly, rather than a weekly basis. Trips may supersede routinely scheduled events. Privacy and access control too becomes a concern as some appointments should not be announced to everyone; different people should perhaps have a different view of the same calendar. AniAniWeb's hypertext is ill-equipped to serve these more demanding uses. So, a calendaring application could better serve adopters' already established needs. To integrate sophisticated calendaring, it would not even be necessary to fully integrate an interface for editing the calendar into AniAniWeb. Several calendaring applications can broadcast a schedule to servers via Web-DAV; thus, AniAniWeb would just have to provide a Web-DAV interface for these calendaring systems.

Electronic mail is a huge part of how academics communicate. It is the dominant form of asynchronous communication; given the busy schedule of many academics, the asynchronous message allows the receiver to respond to messages when it is convenient for them. In addition to individual communication, there are mailing lists for research areas, lab groups, Ph.D. students, classes, seminars, etc. MDN uses his personal home page to augment his memory. Yet, he also uses his e-mail archive to augment his memory. Combining the two would allow him to have all of his augmented memory in one location, where he could link them together and annotate them. In essence, the same motivation underlies his idea as does qwikWeb's design. Wikis and e-mail both have different affordances that could be usefully combined. As technology has matured, it becomes possible for people to archive their identity digitally (Stutzman, 2006b). For MDN and RY, AniAniWeb is a convenient medium to center this archive around.

Both of these suggestions would evolve AniAniWeb towards a *personal information*

management system. Personal information management (PIM) is the practice of managing information (addresses, phone numbers, appointments, documents, URLs, e-mail addresses, etc.) that helps us in our daily lives. People often appropriate convenient and oft-used technologies, such as e-mail or a calendar, for PIM (Belotti & Smith, 2000). So, it is not too surprising that several adopters used their AniAniWeb for this purpose. It was a convenient option, because of its quick editing cycle, convenient web-browser interface, and ease of access from anywhere. Traditionally, PIM has been limited to self use: Only that person has access to the information. An evolved version of AniAniWeb could expand the definition of PIM by including publication and collaboration. As the calendar example points out, people often have reason to make their information available to others.

CHAPTER VII

UNDERSTANDING NEW MEDIA

In this chapter, I return to media theory. Chapter 4 used media theory as a guide for understanding personal home pages. Based on media theory, that chapter concretely described how adopters of AniAniWeb used personal home pages; such a description, based on authentic use, is essential to understanding a new medium, its use and meaning. This chapter shifts away from the concrete details to focus on the theoretical aspects of understanding new media. It reflects on the problem of understanding new media through this case study of personal home pages in academia.

First, the technique of situating a new medium is reexamined, based on the findings of the previous chapters. Then, I introduce the media theory of Marshall McLuhan for understanding media more broadly (i.e., in relation to each other, in relation to people, etc.). McLuhan puts particular emphasis on the technical properties of a medium and how those properties affect its use and meaning. Finally, I apply McLuhan's theories to the analogy between a home and a personal home page. I find that this analogy is quite deep and can be useful for understanding personal home pages.

7.1 Situating a New Medium

New media are important; they change how we relate to others, to ideas, and to ourselves. With the advent of electronic technology, the number of new media has increased dramatically (Postman & Weingartner, 1969). The computer, in particular, is a terrific tool for creating and distributing new media (Kay & Goldberg, 1977). So, understanding new media is becoming increasingly important. Unfortunately, a new medium is difficult to study; its use and meaning is determined by many intertwined complex components: related technologies, inventors, patents, early adopters, society, etc.

The study of media has traditionally been carried out with the benefit of hindsight. So, media scholars can use the tools of historical analysis to investigate a medium's use and meaning. This may be a particularly insightful way to understand established or defunct media. Unfortunately, it cannot be easily applied to the study of new media. There is little historical hindsight available for a new medium. In addition, a new medium is often still evolving. When a medium is created, it takes a while for the meaning of that medium to reach closure, the point where its meaning becomes fixed (Bijker, 1995). Initially, the interpretative flexibility of the medium is high and its meaning is fairly fluid.

While the lack of closure makes it difficult to study a new medium, it also can be advantageous. As the destiny of a medium is still fairly open to change, it is a viable subject for design-based research. The goal of design-based research is to simultaneously understand and improve on a subject (Brown, 1992; Collins, 1992). New media, their use and meaning, often get shaped through the use of early adopters (Bijker, 1995; Gitelman, 2006; Tenner, 2003). Thus, *by applying a design-based approach to understanding a new medium, there is an opportunity to shape as well as study the new medium*.

As with other design-based research, I did not just take an observational approach. Other research (Dillon & Gushrowski, 2000; Papacharissi, 2002; Vazire & Gosling, 2004) has already studied personal home pages in this manner. Instead, I tried to improve the use of personal home pages in academia by designing AniAniWeb. AniAniWeb was designed to build on technology trends already occurring elsewhere (wikis, blogs, social networking software, etc.) and introduce those trends to academia, which still generally relied on older, static technology to author personal home pages (Appendix A). By advancing the technology, it was possible to observe aspect of personal home pages, such as interaction and access control, which will become increasingly important as web technology evolves.

Blogs and social networking software (e.g., MySpace) increasingly facilitate interaction on personal home pages. Visitors can leave comments on blog posts or post a message to a Facebook wall. Similar activities can be done with AniAniWeb. In addition, visitors can

participate on a poll or edit a page, moving the interaction into the realm of collaboration. Because of its flexibility, AniAniWeb adopters could experiment with different ways of interacting.

New technologies (e.g., wikis) also simplify the authoring process. Historically, such expediting changes have changed the meaning of the medium (Innis, 1951; McLuhan, 1964). So, it happened with AniAniWeb. Due to the quick wiki editing, it was easier to add content to a site. Consequently, AniAniWeb adopters had significantly larger sites than corresponding static adopters (Section 4.2.3). That, in turn, increased the severity of the multiple audience problem. Thus, AniAniWeb adopters had a greater need for sophisticated access control.

In both the case of interaction and the case of access control, the results of the research were not anticipated by the survey of static personal home pages or by the intuitions of AniAniWeb's designer. Users interacted far less on AniAniWeb than they typically do on wikis, although the technologies are similar. While the amount of interaction was disappointing, even the small amount of interaction proved to be motivating and useful (Section 4.2.4). The need for access control was anticipated in the initial version of AniAniWeb; however, the complexity of the problem was not. Emergent uses, such as self use, drove the need for access control. So, the design-based approach yielded an understanding that could not have been gained from studying existing practices. Research on social networking (e.g., Boogart, 2006) is confirming these findings.

One difficulty with understanding a new medium is that the minimal ontology (Barab & Squire, 2004) required for studying the medium is particularly large.[1] New media are influenced by so many different factors that they cannot be studied in simplified conditions, as found in a laboratory setting. Design-based research has already accepted that research on learning cannot be conducted solely in the laboratory (Brown, 1992). People behave

[1]The minimal ontology is particularly large for social networking applications. A large number of people must join the network, before the network yields a significant benefit.

differently in these simplified conditions than they would normally (Lave, 1997). The ontology for understanding learning *in situ* often includes a community of practice (Lave & Wenger, 1991). A community of practice is driven by real needs, practices, and values (Wenger, 1998); these can all affect how a medium is used. So, an important first step in understanding a new medium is determining a context that is appropriate to the task.

Through historical analysis, Bijker (1995) shows that early-adopting social groups can be critical in shaping new technology. When the bicycle was being developed, an early group of adopters were affluent daredevils; they valued the high-front-wheel bicycle for its difficulty, speed, and danger. Only once a low-front-wheel bicycle proved itself to be faster could it replace the high-front-wheel bicycle as the standard bicycle. Similarly, Edison's phonograph was shaped by the short-lived nickel-in-the-slot phonographs: "They taught capitalists and musicians alike that phonographs made sense as amusement devices to play pre-recorded musical selections" (Gitelman, 2006, p. 44). Capitalists, musicians, and their audience superseded Edison's vision of using the phonograph as a business-oriented transcription machine. These examples suggest that *an appropriate context for situating this style of research is in a relevant social group of early adopters*.

For personal home pages, academia is such a context. In academia, the personal home page is an important vocational tool. Through this research in academia, it is possible to see how the use and meaning of personal home pages is driven by its context of use. The context of use affects how the medium will be used by affecting how people understand the medium, what needs they have for the technology, and what standards of use must be adhered to.

In academia, the personal home page is largely treated as a form of publication, a central practice to this community of practice. Personal home pages both enhance and supplement traditional publication practices. By making a published article available on the home page, the owner has increased the accessibility of that article. The owner can also publish content that would not be accepted in traditional forums. A portfolio, project descriptions, and

informal advice can all be meaningful to academic visitors, but would not be published through conventional means. In addition, the context can reveal the different needs that people have. In academia, the use of the personal home page changes over time (Section 3.2.1). A good personal-home-page system needs to accommodate these changing needs. The conventions of the context too influence use, as is demonstrated by the adoption of the polite home page (Section 5.7).

One difference between situating a new medium and other design-based research approaches, such as design experiments, is that the researcher cannot tightly control how adopters use the technology (Rick & Guzdial, 2006). Ultimately, the adopters of a popular medium cannot be tightly controlled by the intentions of the designer or inventor. Adopters must find their own way to adopt a medium to serve their purposes. Thus, users become important to defining the meaning of a new medium (Gitelman, 2006). In that sense, the *participants in this research act as fellow researchers*. Through their use, they discover the meaning of the new medium, given their needs, preferences, experience, and expertise. The role of the principal researcher transitions to that of supporting their use and reporting their findings. Similarly, Bers (2006) advocates that identity construction environments "should be designed following a participatory method in which potential users, both professionals and children, become partners in the different stages of the design and development process" (pp. 201–202).

Intentionally, AniAniWeb users were left to adopt the technology as they saw fit. While several did use AniAniWeb as a traditional academic home page (e.g., PG), several users went well beyond that genre. MDN and PWM used it as a place to organize their lives. RY used it as a place to record who she is. These adopters discovered that self use was a viable use for personal home pages, given the technological affordances of AniAniWeb. Additionally, users discovered what worked for interaction and collaboration and what did not work (Section 4.2.4). By seeing which of their uses succeeded and which failed, it was possible to get a better sense of the ultimate destiny of this medium.

The end goal of situating a new medium is to discover its use and meaning. The use and meaning of any medium is multifaceted. Media are complex and can be understood usefully in a number of ways. Consequently, this research uses multiple data sources and analysis methods to investigate the same phenomenon. Observed usage, student interviews, faculty interviews, a survey, and log files represent different aspects of personal home pages in academia. Media theory, communities of practice, and core identity theory are useful for analyzing different aspects of personal home pages in academia. Sometimes it is useful to consider how adopters generally use the technology; at other times, it is useful to focus on one adopter and the specifics that define his use and meaning.

Since this style of research utilizes multiple divergent methods, it is unlikely to yield a single linear narrative. Instead, multiple aspects of the same phenomenon are chronicled. At times, they fit into a larger whole. The multiple audience problem and its integrative properties cut across social (Section 5.7), individual (Section 5.6), and technological perspectives (Section 6.3.3). At other times, an aspect might provide a unique supplementary perspective. How and why a website changes over time in academia is primarily explained through a communities-of-practice perspective (Section 3.2.1). *By viewing the whole from multiple perspectives, the whole can be better understood.* By using multiple data sources and analytical frameworks, the different social, individual, and technological elements of personal home pages can be addressed.

While much of this work was concerned with what adopters did with the system, it was also important to point out the limits of the medium (Section 4.5). In addition to studying the current use of AniAniWeb, future directions are suggested (Section 6.4). While most of the work concentrates on the concrete use of adopters, it was also important to understand personal home pages theoretically, as is done in the latter part of this chapter.

This multifaceted approach to reporting on a medium has been dubbed the *galaxy approach* by McLuhan (1962), who uses it to map the galaxy surrounding the printing press.

So, it is not too surprising that the theory of media that McLuhan developed after his analysis of the printing press is also particularly useful for understanding this research on personal home pages.

7.2 Introducing McLuhan

> Rather than insist that we immediately reduce everything to the interplay of social forces, the theory of technological politics suggests that we pay attention to the characteristics of technical objects and the meaning of those characteristics. (Winner, 1986, p. 22)

The properties of a medium—how it structures and constrains use—matter. Marshall McLuhan authored perhaps the most influential theory of how the properties of a medium influence the destiny of that medium.[2] McLuhan argues that the properties of a medium determine how it can be used. Then, how it can be used affects the techniques that people adopt for the medium. Finally, these techniques shape society. As he bases his theories primarily on the properties of the medium, rather than social analysis, his theory is often seen as advocating technological determinism. Technological determinism holds that the development of technology follows a path largely beyond cultural or political influence and that technology has effects on societies that are inherent, rather than socially conditioned.[3]

In many ways, technological determinism is flawed; often inventors, social conditions, corporate power-plays, and cultural norms also drive the evolution and meaning of a medium (Bijker, 1995). Technology is only one component of a socio-technical system; therefore, a description that includes the other elements can often be more useful (Hewitt, 2004).

[2]Innis (1951) and McLuhan (1964) are generally considered the two founders of media theory. Even when others refine or debate McLuhan's ideas, they acknowledge his prominence and stature. For instance, on the cover of *Convergence Culture* by Henry Jenkins, there is a prominent quote by Howard Rheingold that asserts "Henry Jenkins is the 21st century McLuhan."

[3]To be precise, McLuhan is not an advocate of technological determinism, since he acknowledges that the nature of the society that a medium is embedded can radically alter the meaning of the medium. His concepts of cool and hot societies addresses the role of society in determining the meaning of a medium; however, these theories are complicated and (consequently) not commonly cited.

Given the importance of these other factors, technological determinism is an imprecise instrument at best. If it is such a blunt instrument, why is it useful? When trying to discover and shape the destiny of a new medium, as this research tries to do, the properties of the medium are a solid foundation to build upon. The study of new media cannot use the tools of historical hindsight, so it has to use the best methods that currently exist.

I find McLuhan compelling as he was able to offer insights about electronic media that are still valid over forty years since their writing.[4] His ideas often are prescient of the Internet that exists now. McLuhan (1962) coined the term "surfing" before people did it on a regularly basis on the World Wide Web. He wrote about superhighways of content many years before the phrase "information superhighway" was used to describe the Internet. His term "global village" is still commonly used to describe the effects of modern communication systems.

The following sections examine two of McLuhan's insights. First, McLuhan's definition of media as the extensions of man is examined. The insights gained from this exercise will later be employed to understand the relationship between home and personal home page. Second, the implications of "the medium is the message" will be detailed, leading to the concept of a global village. The global village in turn explains many of the integrative properties of personal home pages observed in this research. Through McLuhan's insights, new media, such as personal home pages, can be better understood.

7.2.1 Media: The Extensions of Man

In *Understanding Media: The Extensions of Man*, McLuhan (1964) contends that media change our society, because they extend a body's senses and abilities. Interpreted simply, this is a tautology: If something is to affect us (change society), it has to affect us (change our abilities). Beyond this, McLuhan contends that media can be understood by considering

[4] Another notable predictor of the future, Alan Kay, who envisioned the personal computer in the 1970s, built upon McLuhan's understanding of media.

the effects of these extensions to the ratios of our abilities.[5] It is not only important which abilities are enhanced, but also which are thereby reduced.

For example, the phone extends our ear and voice. As such, it allowed for factory owners to abandon their downtown factories; instead, they could phone in directions to their managers from their suburban offices. Yet, the phone did not extend their sight or body, so the labor conditions of workers went unseen. Consequently, the labor conditions took a backseat to production and sales—out of sight, out of mind. So, McLuhan (1964) argues, it is not coincidental that, shortly after the invention and adoption of the telephone, it was necessary for labor to organize.

Much of McLuhan's message is missed when we define media solely in terms of senses, rather than senses and abilities. It is easy to conceive of media as media when they extend our senses, particularly our eyes and ears. Eyes see; thus, we have views. Ears hear; thus, we have sounds. Most of what we commonly accept as media—music, television, telephone, photographs, film, books, newspapers, etc.—extend our eyes and ears. Yet, the other senses too engender expressive media. Noses smell; thus, we have scent. The perfume industry makes its living off the expressive power of scents. Tongues taste; thus, we have flavors. The food industry makes its living off the expressive power of flavors. The skin feels; thus, we have feeling. The fabric industry makes its living off the expressive power of feeling.

That covers our five senses, but media can extend not just the things we use to sense meaning, but also those things we use to create meaning. With our voice, we can talk, shout, scream, sing, laugh, etc. With our legs, we balance, walk, run, jog, and kick. With our teeth, we bite and chew. With our nails, we scratch. With our hands, we open doors, shake hands, wave, etc. With our fingers, we type, gesture, play music, etc. McLuhan points out that these functions too can extend our abilities and that new media can extend

[5]The ratio is about which abilities are used the most. When the printed word became the dominant medium of society, the eye gained an advantage over the ear (Innis, 1951; McLuhan, 1962). The ratio of use between the two was changed.

these. In this sense, clothing extends our skin, weapons extend our nails and teeth, and cars extend our legs (McLuhan, 1964). It may not be obvious, but our highway system is a great medium for communication. We can live in the suburbs, but work downtown. We can visit our parents and friends rather than send them letters. Because of cars, we can communicate in person, rather than through other media. Just as highways connect us physically, so the information superhighway of the global village connects us virtually. Just as a home provides a convenient place to keep things, so does the personal home page; both are media that help us manage information, tools, and interact with others.

As media extend our abilities, we gain new competence when we adopt a new medium (Rick & Lamberty, 2005). The new ratio of our senses allows us to understand things more clearly. The programming language Logo explicitly extends users' body movements to a virtual "turtle" (Papert, 1993). By examining their own movement for walking in a circle, learners can better understand how to program the turtle to move in a circle.

Media relate in several ways. First, one medium can extend another. New media can be created by extending our senses and abilities in new ways. Similarly, new media can be created by extending older media in new ways. Extending the medium changes its properties and thereby changes its meaning. For example, StarLogo extends Logo's concept of programming one turtle to programming multiple turtles at once (Resnick, 1994). Instead of learning about geometry, StarLogo users learn about decentralized thinking. Second, the content of a medium is another medium (McLuhan & Fiore, 1967). Hypertext contains text. Text contains letters. Letters contain marks. Third, even stylistic constraints can generate a new medium. Consequently, even forms and genre are media.

So, when McLuhan asserts that "the medium is the message," it is not nearly as reductionist as it is often read. The maxim is more about defining media than it is about defining messages. Because media are so interwoven, they can also be coerced to behave like each other. Bolter and Grusin (1999) label the process by which one medium is made to behave like another *remediation*. They show that people often understand a new medium by trying

the established practices and forms from other media in that new medium. By trying different things, they discover the properties of the new medium. Consequently, it takes some time for the unique forms to emerge for a new medium that allows master authors to author masterworks (Murray, 1997).

Remediation forces us to take analogies seriously. Analogies allow us to model a new thing, based on something we know. Linking Logo's turtle to our movement allows us to better understand the turtle and, through it, geometry. Since we have competence in one half of the analogy, we can apply its principles to the other half. Later, I discuss the implications of using home as an analogy for personal home pages. Both share many of the same properties and engender similar practices.

7.2.2 The Medium is the Message

"The medium is the message" ostentatiously summarizes McLuhan's central tenet that media matter greatly. They confine the messages we communicate. On a large scale, the dominant communications media of a society shape or reshape that society (Innis, 1951; McLuhan, 1962; Meyrowitz, 1985). Just like Adam Smith's capitalistic invisible hand, the message of a medium is extremely strong; even if individuals and societies fight against its message, they will be hard pressed to suppress it. Like the invisible hand, the power of the medium comes from the slight biases that accumulate from many small transactions.

McLuhan's maxim was designed to be controversial, thereby encouraging debate. For many critics, it overreaches by implying that *only* the medium matters, not what people do with it or how different cultures receive it (Bijker, 1995). In his extended writings, McLuhan is more sympathetic to this perspective, building theories of how different cultures receive different media and acknowledging that his theory only applies on a macro-level. Yet, he does make the point that it is extremely difficult for people to contradict the medium's message, even on a small scale. Consider the following scenario, borrowed from Meyrowitz (1985):

Two young siblings, Jack and Jill, are left in a strange playground. Both feel uncomfortable and start to cry. After some time, their adult guardians address their predicament. Jack is pulled aside and told "boys don't cry." He should be brave and suppress his tears to comfort his sister. Jill is pulled aside and told that it is okay to cry, but that she should look to her brother to protect and comfort her. When the two siblings are reunited, both play their new parts. Jack acts strong and comforts his sister. Jill looks to Jack to comfort her. Both are pleased to find that their new roles seem to be quite compatible. Jack finds that he can comfort his sister by being brave. Jill finds that she can find comfort in the strength of her brother.

While this is perhaps an overly simplistic scenario, it demonstrates one way gender roles are formed by different access to information. Jack is privy to the information that boys need to suppress their feelings and protect girls. Jill is privy to the information that it is okay to show your feelings and that males will protect you. These may be outdated gender conventions, but one can see that they function well in the scenario: Both siblings feel better about their situation. Because they are not privy to the information told the other sibling, they may not realize that these roles are largely socially constructed, rather than biologically determined.

Now, consider two different siblings, Anna and Adam, watching a television broadcast of Jack and Jill. Anna and Adam will have a different perspective on gender roles than Jack and Jill. They will be privy to both Jack's conversation and Jill's conversation. While they might choose to model the gender roles of their counterparts, they will be more aware of why the other behaves in that way.

Meyrowitz (1985) argues that the message of television has been to expose the previously separated worlds of other people. Thus, he reveals television to be a powerful force for change. Anna and Adam have greater access to how the other gender works than Jack and Jill. Consequently, Anna and Adam are more likely to challenge their gender roles than Jack and Jill, even if the television content still models the traditional conventions.

Hence, the medium is the message. It is no coincidence that the civil rights movement and women's liberation movement came with the broad adoption of television; in both cases, the separate worlds of the privileged and underprivileged were combined in ways that could not sustain the disparity.

> Electric circuitry has overthrown the regime of "time" and "space" and pours upon us instantly and continuously the concerns of all other men. It has reconstituted dialogue on a global scale. (McLuhan & Fiore, 1967, p. 16)

The ability to integrate previously separated spheres is not limited to television. Electronic media, in general, allow communications that defy spatial limitations. It is in this sense that McLuhan (1964) coins the term *global village*. As electronic media bring the world together, the communications practices of a village reemerge. It is now possible to find out what is happening halfway across the world today with the same speed that it would take for information to circulate around a village. In essence, the message of electronic media is the global village—an extreme integration of different spheres. The global village has an effect on both the social and individual level:

> The expansiveness of civilization, together with its stratification and specialization, force children to base their ego models on shifting, sectional, and contradictory prototypes. (Erikson, 1980, p. 21)

Given the integrative properties of electronic media, it is not surprising that personal home pages tend to integrate. The personal home page is the analogous home in the global village. It is visible to everyone. Much of the information around it is spread to anyone who wants it. Just as there is a need for privacy in a village, so there is a need for privacy in the virtual home. Thus, access control becomes important for a personal home page.

7.2.3 Refining McLuhan

While McLuhan's theories are a useful basis for understanding media, they are limited. McLuhan paints with broad strokes, reducing complex social interactions to binary decisions (i.e., hot versus cool media, hot versus cool society). Others since McLuhan have done a better job of trying to understand these complexities. One such refinement has already been discussed in Section 5.3: Often societies understand and shape a new medium according to its relation with written text. In addition to this, McLuhan's theory does not separate different types of media, go beyond the macro-level, or explain the origin of new media.

McLuhan's broad definition of a medium forms a framework for relating and understanding media; however, in its generality, it does not draw distinctions about classifications of media. At times, such distinctions are useful. Jenkins (2006), for instance, draws distinctions between a medium, a genre, and a delivery mechanism. Music is a medium. Rock 'n' Roll is a genre. The compact disk (CD) is a delivery mechanism. For McLuhan, all of these are media. This distinction allows Jenkins to draw some useful conclusions: 1) unlike delivery mechanisms, media never become obsolete; 2) delivery mechanism can be swapped out—an album could be delivered by phonograph record, CD, or MP3 file.

While such distinctions can certainly be useful, they cannot replace McLuhan's insights. Ideas such as "the medium is the message" are weakened by such a split, since Jenkin's definition of medium is so much more limited. McLuhan would insist that all three of Jenkins's terms are media, thereby affecting the message. It matters whether content is distributed by record or CD. Artists adjust how they produce music based on the delivery mechanism. Because of their ability to hold more music, albums produced for CD tend to be much longer. The first five Eminem albums are nearly twice as long as the first five albums by The Beatles.[6]

[6]The Beatles albums average 32:41 in length. Eminem albums average 64:56 in length. Considering these calculations includes Eminem's relatively short (37:54) independently-produced debut, the Eminem albums

Additionally, the delivery mechanism affects the message, even for the same content. I recently purchased *Don Juan's Reckless Daughter* by Joni Mitchell. My initial impression was that the album did not flow well. There is a 16 minute experimental piece, "Paprika Plains," which seems out of place. Since the album was released in 1978, it was designed to be released as a double record—four sides. "Paprika Plains" takes up one of those sides. In essence, the album is a composite of four different conceptual sides. Because all four sides of music fit on one CD, that separation is lost for listeners of the CD version.

Both McLuhan and Jenkins achieve useful conclusions with their media theories. I feel that it is best to acknowledge both as valid and interesting positions, even if they are not entirely compatible (e.g., both define a medium differently). At times, it is useful to separate forms, genres, delivery mechanisms, and tightly-defined media; at other times, it is useful to consider them as an integrated whole.

One obvious omission of McLuhan's theory is the effects of media on the micro-level (individual, community). His take on technological determinism only applies to the macro-level (society). So, "the medium is the message" does not apply to individual communications; an e-mail can convey an individual message, independent of the medium. Technological determinism is often a useful explanatory theory at the macro-level, but not at the micro-level (Misa, 1988). In this research, I have utilized core-identity theory and communities of practice in order to better focus on these aspects of personal home pages.

Another omission of McLuhan's theory is explaining how media come to be created. Technological properties might drive techniques, but often those techniques, in turn, drive the evolution of the medium (Tenner, 2003). The creation of a new medium is partially done at a micro-level and is therefore less susceptible to technological determinism. Media evolve based on individuals, relevant social groups, technological properties, and other media. The creators of the technology can create artifacts that reflect specific messages not inherent to the medium (Winner, 1986). People often use multiple media to accomplish a

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are considerably longer.

task (Efimova & de Moor, 2005); therefore, the meaning of a new medium may be framed by existing practices in these media.

Bijker (1995) uses historical analysis to create a framework for understanding the evolution of a medium revolving around *technological frames*. "A technological frame comprises all elements that influence the interactions within relevant social groups and lead to the attribution of meanings to technical artifacts—and thus to constituting technology" (p. 123). Technological frames often shape the way that people behave. Over time, conflicting technological frames drive the evolution of the medium until it reaches *closure*, when an agreed upon meaning has been arrived at. That is why this research has been done largely with the technological frame of the academic personal home page. Because of its early adoption and prominence, academia may prove to be an important social group for determining the destiny of personal home pages.

7.3 Home on the Web

The concept of "home" is often associated with personal home pages (Döring, 2002). Seabrook (1995), for instance, compares a personal home page to somebody's home on the Internet. Such analogies are fairly easy to conceive as the word "home" is even located prominently in the middle of "personal home pages." This section investigates that analogy. First, the power of analogy to determine meaning is discussed. Then, personal home pages are compared to a home along various dimensions of media. Based on this analysis, the two media are remarkably similar. Finally, the analogy is further applied to see what implications it has for the use and meaning of personal home pages.

7.3.1 The Power of Analogy

Analogies allow us to map our understanding from one complex domain to another. If the analogy is fruitful, competence in the former can thereby help us build competence in the latter (Kolodner, 1997). Hence, scientists commonly use analogies to communicate ideas or even to brainstorm new ideas (Dunbar, 1995).

The same applies to new media. Because of their newness, new media often do not have established practices; therefore, new adopters cannot build on strong guiding examples. Instead, adopters borrow techniques and forms from other media as models (Bolter & Grusin, 1999). They make an analogy between the two media and predict that what works in the one medium will be useful in the other. Because people tend to build their understanding based on the concrete examples they already know well (Kolodner, 1997), their adoption of the new medium can be heavily influenced by the other media they are familiar with (Bijker, 1995). Over time, new practices, uniquely suited to the new medium, will emerge.

When Thomas Edison invented the phonograph, he framed both his design and marketing efforts on an analogy to written text (Gitelman, 1999). He conceived of the phonograph as writing sound onto foil. While the phonograph and its predecessors have been appropriated for uses well beyond the original driving analogy, that analogy was important to both its inventor and its early adopters.

To further demonstrate the power of analogy to orient use, I briefly consider two similar technologies: AniAniWeb and blogs. Both technologies can be used for authoring personal home pages—pages on the Web representing an owner. Both enable publication and interaction. While the technologies are similar, their uses are often radically different. One reason for this discrepancy is that the technologies are shaped by different driving analogies. AniAniWeb builds on static personal home pages, which are analogous to a home on the Web. Blogs instead tend to remediate journals, diaries, or radio broadcasts (Nardi et al., 2004).

Because blogs organize content chronologically, the analogy to diaries or daily journals seems appropriate. In the early days of blogging, many adopters co-opted the practices of the diary when posting content to their blog: They would post content similar to diary content. Unfortunately, blogs differ radically from diaries in their openness. Diaries are typically private; blogs are typically open to any Internet users. Many early blog adopters discovered that their blog posts were open to audiences (e.g., mothers and bosses) that

were never meant to view the content (Bandlow & Jensen, 2002). Over time, blog adopters have become more sophisticated, realizing that they need to censor content. Now, new adopters are more likely to emulate these practices, rather than remediate diary practices. The technology too has evolved to address this problem. Modern blogging software allows owners to restrict content to a limited audience, such as friends.

While blog use has matured beyond the diary analogy, many of the diary practices remain associated with blogs (Nardi et al., 2004). For many adopters, the content tends to be similar to a personal journal—informal, uninhibited, about current events, etc. For a few notable adopters, the content can still be indiscreet (Section 3.2.4). Consequently, blogs have a reputation for inane and unfiltered content. This reputation caused several faculty members to have strong reservations about a blog on an academic home page. A strong academic home page should be useful and polite; blogs have the opposite reputation.

On the one hand, blogs are just a technology; that technology could be appropriated to create a professional site. For instance, Jill Walker, a blogging researcher, uses her blog[7] to post academic content. TI uses his open blog to post academic content. On the other hand, reputation matters. Since blogs are not known for this content, people are less likely to seek such content in this forum. As academics often are not interested in personal content, a potential visitor might ignore the professional blog, believing it to be non-professional. Hence, an accepted form of use too determines the message that a medium conveys.

Unlike blogs, personal home pages in general do not have a reputation that worries faculty members. Adopters do not use them as a public diary. While AniAniWeb can be used as a public diary, no graduate student adopted the medium in this manner. The dominant analogy for the personal home page is still the home on the Web. Using Jenkins's (2006) terminology, blogs and AniAniWeb are two different genres of the same medium, personal home pages.

Home can be a powerful driving analogy for personal home pages. People are highly

[7] *http://jilltxt.net/*

familiar with how a home works. They understand what practices are acceptable and useful within a home (Csikszentmihalyi & Rochberg-Halton, 1981). So, analogy users have an outstanding base of understanding to apply to the other side of the analogy. Consequently, architectural analogies are fairly common. For example, Bruckman (2002) uses the analogy of the front porch for understanding the visibility of amateur art on the Internet. Often, these analogies help guide policy makers to make decisions about how a new medium should be regulated and conceived of. If the analogy is appropriate, the understanding of the familiar subject can usefully inform the understanding of the strange subject. One property that makes an analogy useful is that the similarity goes beyond the surface level to include internal dimensions (Dunbar, 1995).

7.3.2 Dimensions of Media

Media can be classified along many different dimension. A common split is to separate media along the axis of physical versus virtual—commonly, old versus new media. A record is physical; an MP3 is virtual. A home is physical; a personal home page is virtual. While this is an interesting distinction to make, McLuhan (1964) reminds us that the primary distinction between media is in how they relate to us (e.g., if we used them the exact same way, there would be no important difference between a record and a CD). So, physicality is simply a relationship that our bodies have to a three-dimensional world. Virtual reality tries to replicate physicality in a virtual setting (Bolter & Grusin, 1999). In a truly transparent virtual reality, such as the one imagined in *The Matrix* movies, the separation between the virtual and the physical breaks down (Jenkins, 2006). So, other dimensions may be more important in terms of shaping the medium's message.

In this section, I classify personal home pages, as represented by AniAniWeb, along several other media dimensions. If properties determine affordances as McLuhan argues, then these properties are important for determining AniAniWeb's uses and meaning. Along with AniAniWeb, I classify three other media that recur throughout this document: home,

Table 5: Comparing Different Media by Media Dimensions

Dimension	Home	AniAniWeb	Publication	E-mail
Ephemeral / Long-Lived	Long-Lived	Long-Lived	Long-Lived	Ephemeral
Static / Dynamic	Dynamic	Dynamic	Static	Static
Linear / Spatial	Spatial	Spatial	Linear	Linear
Unimodal / Multimodal	Multimodal	Multimodal	Multimodal	Multimodal
Synchronous / Asynchronous	Both	Asynch.	Asynch.	Asynch.
Public / Private	Both	Both	Public	Private
Integrate / Separate	Integrate	Integrate	Separate	Separate

publication, and e-mail. All three relate to personal home pages. As detailed above, personal home pages are often likened to a home on the Web. In academia, personal home pages act as an unusual form of publication (Section 3.1); therefore, I compare AniAniWeb to formal publications, such as academic journal or conference publications. Electronic mail is a primary means of electronic communication between academics in computing. Both personal home pages and e-mail have been adopted by this community of practice.

Home and publication are older physical media; AniAniWeb and e-mail are new virtual media. Yet, that does not guarantee that they will be alike among other media dimensions. Table 5 summarizes the classification of these four media along seven important dimensions of media.

The first dimension is based on how long a communication stays around after its inception. At one end, a medium can be ephemeral, disappearing soon after the communication happens. Face-to-face communication is ephemeral; besides the memory of the individuals involved, there is no record of the communication. On the other end, a medium can be long-lived, lasting well beyond its origin and accessed over and over again. A digital recording of a face-to-face communication could be archived and accessed in perpetuity. When President Nixon recorded his White House phone conversations, he changed this dimension of the communication from ephemeral to long-lived. When certain critical recordings were "accidentally" erased, it significantly undermined his innocence claim in the Watergate investigations (Meyrowitz, 1985). Home, AniAniWeb, and publication all

are long-lived. People often return to them several times, being relatively assured that they will still be around. Like a newspaper (Gitelman, 2006) and unlike the other three, e-mail is ephemeral. An e-mail message is often deleted once the receiver has read it. Even if the e-mail message is saved, it is not likely to be revisited often. While e-mail is more long-lived than face-to-face communication, it is ephemeral compared to the other three.

The second dimension is whether content contained by the medium changes over time. At one end, a medium can be static, remaining the same over time. A movie, a television episode, an album, and a painting all commonly are static; they contain the same content if accessed at different times by different people. On the other end, a medium can be dynamic, changing over time. A theatrical performance, a video game experience, a garden, a wiki page, and somebody's appearance all change over time. Publication and e-mail are static. Once an article or a message has been respectively published and sent, it is unlikely to be altered. An academic citing a quote from an article can rest assured that the source will not be changed.[8] Home and AniAniWeb are dynamic. The content of a room and the content of a page are likely to change over time with extended use.

The third dimension is how the content is organized. Content can be organized linearly or spatially (Bolter, 2001; Kress & Van Leeuwen, 2001). A movie, an album, and a book are all linear as there is a natural progressing order in which the content should be accessed. Hypertext, images, and virtual spaces are all spatial as each person tends to browse them in different ways. Wikis in particular tend to be browsed spatially, because of their many hyperlinks (Leuf & Cunningham, 2001). A written biography of a historical person is a linear document. The Wikipedia entry for that historical person is spatial; viewers are likely not to simply read the page text from top to bottom, but rather to follow up on links of interest. Formal publications and e-mail messages tend to be linear. There is a defined order of how people access them—from the beginning to the end of the text. Home and

[8]In contrast to a published article or book, a website is more difficult to cite, as it could (and often does) change over time. In this document, I have included the date of access for any reference to a website.

AniAniWeb are spatial; there is no dominant pattern of access. Even if a webpage contains primarily textual content, people browse them differently, skipping content and following links to find what they are interested in (Huberman et al., 1998; Nielsen, 2006).

The fourth dimension is about how many modes of communications are encompassed within that one medium. Unimodal communication addresses one sense in one way. An MP3 file only contains audio.[9] A picture only contains an image. Multimodal communication uses several ways of communicating to convey a message. Advertisements often use color, text, and spatial layout to convey a message more than the sum of its parts (Kress & Van Leeuwen, 2001). In this regard, all four media being considered are multimodal. Homes tend to contain many different media and tools. AniAniWeb home pages communicate with hypertext, but also the look of the site and embedded media (images, tables, applications, etc.). Even publications, with their strong emphasis on linearly coherent text, often contain figures, tables, and equations. E-mail messages often contain hyperlinks and attachments.

The fifth dimension is about the time-gap between when content is authored and when it is accessed. In synchronous communication, both happen almost at the same time. P.A. (public address) announcements, phone conversations, face-to-face conversations, and video conferencing are synchronous. In asynchronous communication, authoring and accessing are usually separated by a significant amount of time. Letters, books, movies, and albums all are accessed at a different time than when they are produced. As a medium, home interactions can be both synchronous and asynchronous. A party at the home is synchronous; a sticky note left on the refrigerator is asynchronous. AniAniWeb, publication, and e-mail are all asynchronous. There is usually a significant time-gap between when they are authored and accessed.

[9]To be more precise, MP3 files often contain meta-information, such as the artist's name or the song's title; however, this information is secondary to the audio itself.

The sixth dimension is about who has access to the communication. The communication can be either public (accessible to many) or private (limited to a few or just the author). A home can be both public and private. While homes often serve as a private sanctuary for people to escape to, they are often also opened up to visitors, friends, and family (Nippert-Eng, 1996). Likewise, an AniAniWeb can be both public and private. Content can range from being open to any of the one billion people on the Internet to just limited to the individual. Since both a home and a personal home page are considered personal space, visitors tend to respect the space. Visitors at a party do not feel they have the right to look into drawers or rearrange furniture. Likewise, few visitors have added content to another's AniAniWeb. Formal publication is intentionally public. Good publications can be easily accessed in libraries or through the Internet. In contrast, e-mail is private. Only the mailer and the receiver(s) have access to the content.

The seventh dimension is whether different spheres of influence converge on the same communication. Media that integrate tend to join together groups, either in person or through the artifact, that are normally separated (Meyrowitz, 1985). For example, people from all walks of life can view the same television broadcast. Media that separate maintain a separation between worlds. The communication can be tailored to the specific audience. Classroom lectures or job talks can be optimized for a specific audience. Home and personal home pages tend to integrate. A home might be the setting for a dinner party for co-workers, a slumber party for children, or a Christmas party for family. Each of these groups may normally be separated, but in their respective times occupy the same space. Co-workers may see family pictures and children's drawings. Children unfortunately might get into the good china. Similarly, personal home pages can be accessed by many different audiences: colleagues, friends, family, etc. Additionally, both a home and a home page often serve both personal and professional purposes. For many people, telework combines home and work life into the same physical space (Ellison, 1999). For many AniAniWeb adopters, the home page serves as both the professional academic home page and as a personal space.

In contrast, publication and e-mail separate. Each has a specific intended audience. A journal article is written for the research community that reads that journal, representing its values and practices (Sumner, 2002). An e-mail is tailored for its receivers.

As Table 5 summarizes, personal home pages share many of the same features as a home. Along the seven dimensions discussed, AniAniWeb is closer to a home than it is to either publication, which it is often used for, and e-mail, another Internet medium important to academia. So, the analogy of the *home* page is quite apropos. Along many different criteria, the personal home page can be very similar to a home; therefore, the analogy goes beyond the surface-level to include several important media dimensions. So, it is not too surprising that some of the same practices (picture galleries, private areas, combining home and work life, etc.) are found in each medium.

7.3.3 Applying the Analogy

Because of its power and depth, the analogy of personal home pages to a home on the Web can be a useful driving analogy. The analogy is both important to the person adopting personal home pages, the designer creating a personal-home-page system, and the researcher studying personal home pages. The analogy can drive both the design of personal home pages and explain the use and meaning of personal home pages.

The design of personal home pages can be inspired by and understood as a home. A home model was successfully implemented for AniAniWeb's initial access-control system (Figure 6 on page 39). Homes have different rooms that compartmentalize different contexts and functions. The formal dining room and the children's playroom are vastly different contexts which support different practices and articulate different values. Similarly, a home page can be split into different sections that address different needs. It is common for academics to split professional and non-professional content into different sections. Additionally, the room analogy would suggest that different tools might be appropriate for different pages. A kitchen and a bedroom are marked by different technologies to serve

their respective purposes. Similarly, a picture-archive page or a calendar page might require different tools on the personal home page (Section 6.4.3). In a home, different rooms are frequently separated by doors that can be locked to outsiders when appropriate. Similarly, AniAniWeb's new access-control system allows owners to lock certain pages; only visitors with the appropriate key can cross the threshold.

The use of personal home pages can also be usefully understood in its relation to a home. A home often acts as a mirror for the person to reflect on and construct their identity (Marcus, 1995). Similarly, the personal home page can be a mirror for the person to understand who she is (Chapter 5). Often, the preferences that a person has for a home are determined by their histories, character, position, etc. So, people vary dramatically in their conceptions of the ideal home (Csikszentmihalyi & Rochberg-Halton, 1981). Similarly, personal-home-page adopters vary widely in their conceptions of the ideal home page. PG and MG use diametrically-opposed strategies when preparing their home page for pursuing future employment. PG seeks visitors; MG hides. RY and TI use diametrically-opposed strategies for dealing with different types of content. RY integrates; TI separates. Just as different home styles better support different people, so can different technologies better support different home-page adopters. Different personal-home-page styles can have analogous home styles. A social networking site might be closer conceptually to a commune than a traditional home: Other people in the community are more prominent and have more access. Even traditional static pages, with their lack of access control, leave a different impression:

> When you go online, you make some of your personal space available to other people; that is partly the point of the exercise. In this sense, online home life is closer to socialism than anything most people in the United States experience at home. (Seabrook, 1995)

Of course, the analogy is limited. Personal home pages and home vary in several important ways. A home is three-dimensional physical space engaged by the body. A personal home

page is a website engaged through keyboard and mouse. There are vast differences. Several people can visit the same personal home page simultaneously and not notice each others' presence; this would not be possible in a home. People can interact synchronously in a home, but not on a home page. While these differences explain why the use of personal home pages vary dramatically from a home at times, they also suggest future directions for improving software to support personal home pages. It would perhaps be fruitful to have some sense of presence on a personal home page, such as provided by the Loops system (Erickson & Kellogg, 2003) for text chat. It might be interesting for two visitors to my improv page to be aware of each other; they might be able to start a useful conversation.

CHAPTER VIII

REFLECTIONS

In this research, I attempt to further the evolution of a new medium, personal home pages. To investigate its use and meaning, I conducted a case study, evolving a new personal-home-page system in an authentic context. Adopters explored the new medium through their use. This document primarily reports on their efforts and insights. I further connect their concrete observations to the relevant theories for understanding this case study.

This chapter reflects back on this research. First, I summarize the findings. Media are multifaceted. Thus, in a galaxy approach to understanding new media, it is important to address all the important elements surrounding the use of a medium, even if those elements do not form a single defined story. Then, to complement this summary approach to understanding this work, I focus on six specific contributions. Finally, I suggest some future directions for work on personal home pages.

8.1 The Personal Home Page Galaxy

A new medium changes the way that individuals, communities, and societies function. The meaning of the medium is determined at all of these levels. In the previous chapters, I documented the important community, identity, and technology aspects of personal home pages. Understanding these aspects leads to a better understanding of personal home pages and the galaxy of meaning surrounding them.

> Rather than talking about personal media, perhaps we should be talking about communal media—media that become part of our lives as members of communities, whether experienced face-to-face at the most local level or over the Net. (Jenkins, 2006, p. 245)

Chapter 3 details how a community shapes the use of the new medium and how the new medium, in turn, shapes that community. Relevant social groups are often important in determining the ultimate destiny of a new medium (Bijker, 1995); therefore, this research is situated in academia, a context where personal home pages have a vocational meaning. As a prototypical community of practice, academia has a strong foundation of shared history, values, and practices (Wenger, 1998). One of the most prominent practices of academia is publication; in essence, personal home pages are a new form of publication. This research concentrates on graduate students, who are on the quintessential journey of joining a community of practice (i.e., from the periphery to the core). As the role that a graduate student plays in academia changes, his use of personal home pages changes. In particular, a home page becomes important at transitional times, such as graduation. Both MG, a masters graduate, and PG, a Ph.D. graduate, found that they had to concentrate on their personal home pages as they applied for positions. Due to the difference in their communities of practice, they had vastly different experiences.

Chapter 4 details how people adopt the new medium. People discover the affordances of a new medium through significant use (Bolter & Grusin, 1999). Their use is driven by their needs, their preferences, and the capabilities of the technology. Different people adopt different authoring strategies to serve their audiences and themselves. Because AniAniWeb proved to be a particularly flexible authoring space, it enabled a broad variety of uses and conceptions of personal home pages. Some adopters were able to use AniAniWeb to interact with others; both the right technology and the right social setting are necessary to enable interaction and collaboration. One of the major differences between AniAniWeb and static personal home pages is that self use is more prominent; some adopters primarily used AniAniWeb for themselves, instead of adhering to the traditional purpose of addressing an audience.

Chapter 5 details how the new medium affects individuals. Since the personal home page reflects its owner, the reaction that the owner and others have to the home page can

inform the owner about who he is. A theme throughout this entire document is that personal home pages tend to integrate different audiences into the same place. Adopters felt these effects, but reacted to them differently. Some chose to fight this integrative trend; others chose to embrace it. One bigger consequence of this integrative property is that adopters tend to limit the content on their sites to being polite. This has both implications for the individuals and for the communities that adopt them.

Chapter 6 shifts the focus from the adopters to the technology, concentrating on the design of AniAniWeb. It reflects on the technological theses that informed the design of AniAniWeb. Wiki editing was important to adopters, but has some limitations; many of these can be overcome through a more graphical (i.e., not strictly text based) user interface. Additionally, personal-home-page authors benefit from more structural support, more configurable looks, and more flexibility in access control than a typical wiki. Access control is particularly important to balance the integrative nature of personal home pages. By reflecting on the design of AniAniWeb specifically, the design space for personal home pages in general is illuminated, exposing opportunities for future directions for related software (e.g., social-networking software).

Chapter 7 shifts the focus towards theory. McLuhan's theory of media addresses how the properties of a medium affect its meaning. One of McLuhan's most famous predictions holds that electronic technology remove the traditional barriers of time and space, reverting communication patterns to that of a village—a global village. This research supports this theory, as it demonstrates the important integrative properties of one electronic technology—personal home pages. People from all over the world can visit someone's home page to find out about them. This kind of accessibility is more indicative of a village. Another McLuhan theory holds that the meaning of a medium is strongly determined by its properties. In comparing personal home pages to other media, the home stands out as a medium with similar properties. So, it is not too surprising that some of the same uses and conventions apply to both media.

8.2 Specific Contributions

Contribution 1 This case study conveys the potential use and meaning of personal home pages, by studying adopters of that new medium in an authentic context (academia) and supporting their use with an advanced tool (AniAniWeb).

In the academic community of practice, personal home pages are becoming an important means of communication. They are an informal form of publication—a central practice of academia. This work examines how personal home pages can be used in this authentic setting, one of the first vocational settings to adopt this new medium. Due to the use of an advanced tool, new uses, such as interaction and self use, emerged. This work demonstrates how the different elements of the setting influenced the meaning and use of the new medium.

Contribution 2 AniAniWeb is a concrete embodiment of the design principles for supporting personal home pages in academia.

As design-based research, this work tries to both investigate and determine the future of personal home pages. While the findings of what people did with AniAniWeb are a contribution, so is the system itself. AniAniWeb is an advanced system for authoring personal home pages that was designed to meet the needs of its adopters. For many adopters, it proved to be a useful, usable, and stable system for the task. The concrete design embodies many technical improvements for supporting personal home pages in academia. Going into the research, I had two technological theses, motivated in Section 2.2. First, wiki features (quick authoring, interaction support, and collaboration support) could benefit the authoring of personal home pages. Second, that other features (access control, more structure, and customizable looks) would be needed to convert a wiki into a suitable personal-home-page system.

All of these features proved important to adopters and to evolving the meaning of personal home pages. As AniAniWeb shortened the editing cycle, adopters published more information (Section 4.2.3). As AniAniWeb provided interaction and access control, adopters began using the technology for new collaborative (Section 4.2.4) and self uses (Section 4.2.5). AniAniWeb proved to be a flexible medium, allowing people to adopt it in different ways.

Personal home pages are still evolving. New technologies will enable simpler authoring, new forms of media, and new opportunities for interaction. As technology matures, adopters will adopt new practices that fit both their needs and the new affordances of that technology. New innovations in the design space, such as a prominent social network and GUI editing, will continue to shape the meaning of personal home pages. This work is an attempt to understand that design space and realize the potential of the new medium. AniAniWeb is a concrete instantiation of the features that future technologies for authoring personal home pages might enable.

Contribution 3 This research identifies the importance of the *multiple audience problem* to personal home pages, shows how the problem develops and its ramifications, and suggests how technological features (mainly access control) can help adopters to address it.

One of the recurring themes throughout this research is that personal home pages tend to integrate. They integrate different audiences (self, friends, family, colleagues, employers, etc.) into the same space (Section 4.1). This can have some important effects on the community and the individual. Because personal home pages in academia are used professionally, adopters censor controversial content (Section 3.3). The result is a polite home page that is acceptable to academia (Section 5.7). The polite home page acceptably introduces traditionally-personal content into the professional sphere. Conforming to the polite home page can be a struggle for some adopters wishing to be defined as more than that

(e.g., CM and RY). To moderate the integrative nature of personal home pages, flexible and powerful access control can be useful (Section 6.3.3). Such a system can better support private collaboration and personal use.

Contribution 4 This case study establishes several technological frames by which people author and view personal home pages: the professional academic home page, the indiscreet home page, an organizational repository, the home page as mirror.

Before a medium has reached closure, different frames for conceptualizing the medium tend to coexist (Bijker, 1995). Over time, other meanings tend to be replaced by a dominant meaning. As personal home pages are still new and evolving, it is not surprising that they have multiple common meanings. This research discusses several of these. In academia, the frame of the professional home page guides much of the usage (Section 3.3). The professional home page integrates personal and professional aspects of the self (Section 5.6), while adhering to the polite conventions of academia (Section 5.7). In contrast, in a corporate setting, the personal home page is often negatively viewed as possibly being indiscreet—revealing information that should be kept confidential (Section 3.2.4). For several research participants (PWM, MDN, and RY), AniAniWeb emerged as a useful organizational repository; this frame could become more established as new technologies further enable self use. For certain adopters, the personal home page can be a reflective mirror, as they construct a site that represents who they are to others (Chapter 5).

Contribution 5 This case study details how the use of a medium (personal home pages) changes throughout an adopter's journey from the periphery to the core of a community of practice (academia).

Graduate students are on the quintessential journey of joining a community of practice—from the periphery to the core. This work chronicles how the use of one tool changes according to the position of its user in the community of practice (Section 3.2.1). Identity

change is an important aspect of becoming part of and belonging to a community of practice (Wenger, 1998). Personal home pages, as self-presentation tools, reflect the changes that a person goes through when joining a community of practice. Thus, this work contributes an example of how a technology can both represent and further that development.

Contribution 6 This research shows how personal home pages, as a self-presentation tool, can be a reflective medium, allowing for some adopters to reflect on and actively construct their identities.

When people adopt a new technology, it changes what they are able to do. The new practices and techniques they adopt can change how they perceive the world. The personal home page is a virtual representation of its owner's identity; thus, it can act as a mirror, reflecting for its owner who she is and how others perceive her. This reflective function is particularly important for graduate students, who are actively constructing their identity in their community of practice. This work complements the work of others (Bers, 2001; Turkle, 1984), who show how the use of self-presentation tools can affect identity formation.

8.3 Looking Forward

While this dissertation makes significant contributions to understanding the use and meaning of personal home pages, it also suggests some possibilities for future research in this area. While AniAniWeb addressed many of the important elements of the design space, it is a large design space that can be further explored. While academia is a fruitful setting for studying personal home pages, other settings too show promise for refining the understanding of this new medium.

Section 6.4 introduces three core changes suggested by the research findings to be fruitful in developing personal-home-page technology. First, a future system could better address the *audience awareness problem* (the owner of a site only has a foggy idea about who is visiting their site and how they came there). Second, social networking could become

important to the meaning and use of personal home pages. This technology has already become popular in a related setting—undergraduate social pages in Facebook. Due to its popularity and applicability, social networking software may eventually subsume what is currently thought of as personal home pages. Third, personal home pages can be expanded to include more support for personal information management. Although AniAniWeb was not designed for this purpose, several adopters began using it in this manner. In addition to these changes, graphical editing could greatly expand the possibilities for this technology (Section 6.2). For instance, it would make it easier to incorporate new media, such as polling.

This research focused on the use of personal home pages in one important setting—academia. Consequently, many of the findings of this work are confined to this setting. Other communities are adopting personal home pages (or similar technologies). Blogs are becoming useful forums for political candidates to share their ideas. MySpace is a useful forum for independent artists to market their wares. Corporations employ profile databases to connect employees to each other. A greater understanding of the use of personal home pages in these settings would help to further understand the use and meaning of this new medium.

APPENDIX A

A SURVEY OF STATIC PERSONAL HOME PAGES

This appendix details the results of a survey given to Ph.D. students at the end of their first year. This survey was administered in Summer 2003 (before AniAniWeb was released) to establish a baseline of how students used static personal home pages. This data was used both to provide insight on how students used personal home pages and how a better system could further that use. The results confirmed that graduate students are using their home pages largely for academic pursuits. It also captured some of the limitations of static pages and how going beyond those limitations might affect use.

All first-year Ph.D. students in the College of Computing are required to take an introductory class on graduate studies. In that class, they learn about the different areas of computing and how to pursue research in those areas. The majority of the class revolves around several small (~20 hours of work) projects that the students do with potential research advisors. As part of that course, students create a personal home page and, at minimum, post their project write-ups to it. So, all of these students have a home page and some familiarity with home-page technology. 24 students took part in the survey (Appendix B).

The surveys responses were divided into four groups, based on how much time participants reported spending on their home pages: Nine students reported spending less than four hours per year; Five students reported spending between four and eleven hours per year; Eight students reported spending between one and three hours per month; Two students reported spending between one and two hours per week; Nobody reported spending more than two hours per week, so no fifth group was necessary. The following sections report on the results of the survey.

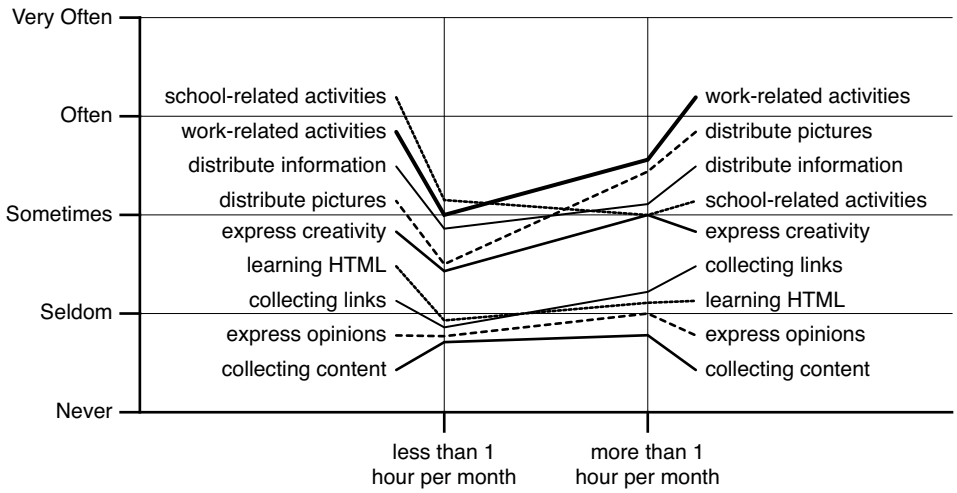

Figure 22: How frequently do users do different activities with their home pages?

A.1 The Current State of Personal Home Pages

How did these students use their home pages? Did they use them for school-related activities, to learn HTML, etc.? Participants were asked how often they used their home pages to do various activities, suggested by the prior literature (Erickson, 1996; Groth, 1998) and issues important to this research. For the sake of simplicity, the four groups were reduced to two groups in this analysis: 1) thirteen participants spending less than one hour per month and 2) nine students spending more than one hour per month on their home page. Figure 22 shows how participants responded to nine of these categories, based on these groupings. Two categories (using their site for commercial purposes and as a journal or blog) are not shown, because neither group used their sites significantly for those purposes.

As shown by the Figure 22, most of the different uses increased for the "more than one hour per month" group. The only use that decreased was the use of the home page for school-related activities. By examining the actual home pages of the participants in the "less than one hour per month" group, it was immediately obvious that the high rating of school-related activities is because those graduate students did not use their home pages much more than the original usage in their introductory class. So, almost all of their use can be characterized as part of a school-related activity. It is interesting that this group of

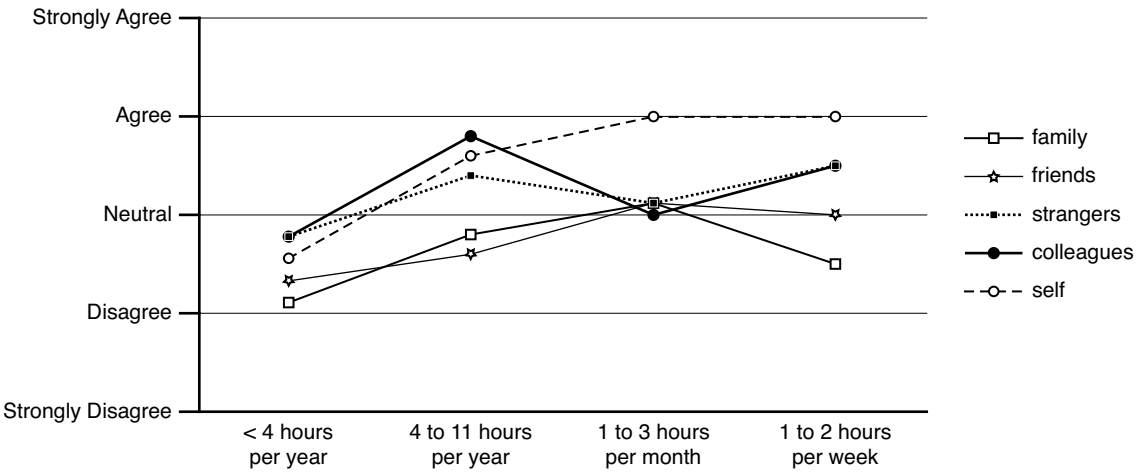

Figure 23: "Your home pages are useful to your. . ."

students also considered this usage to be a work-related activity, as that was a close second response. It is a good indication that the activities of the introductory class introduce students well to the concepts of informally publishing (an activity essential to their community of practice) their work, by posting it to their home page. Additionally, the top rating for work-related activities for the higher use group gives a good indication that personal home pages are actually being used primarily for engaging the academic community of practice.

To further investigate which communities of practice are actually being served by students' home pages, participants were asked how useful they felt their home pages were to various groups. The results, grouped by the four original groupings, are shown in Figure 23. Most students felt that their home page was more useful to their colleagues and strangers that shared their interests than to their friends or family. Students largely viewed their home pages as something important to their vocation, rather than their avocations or personal communications. In addition, personal home pages were found to be useful to the person creating them, increasingly so with use. Since, the student is the only one to contribute to them, it is an indication that the reflection of constructing their identity in their personal home page is actually useful to themselves, one of the key elements of making an identity construction environment work (Bers, 2001).

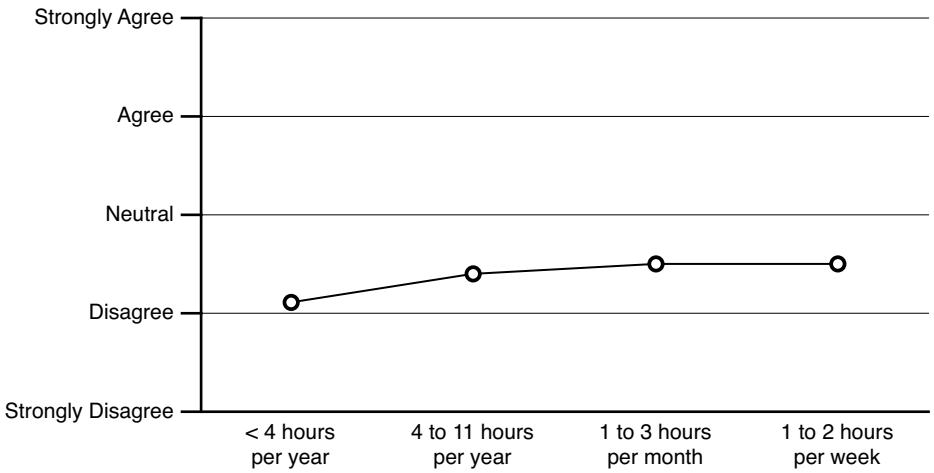

Figure 24: "You are fairly aware of who visits your home pages."

A.2 How to Improve the Current State

In the previous section, the analysis confirmed that students are using their personal home pages as part of their community of practice. As argued in Section 2.2.2, there are several limitations to static home pages. In this section, those limitations are explored.

Prior experience is frequently a barrier to entry for any advanced technology project. Because College of Computing graduate students have to be fairly computer literate, it seemed likely that this would not be a barrier to adoption of personal home pages. To confirm this assumption, students were surveyed about their experience with Internet technologies. In general, the students were highly familiar with Internet technologies. In addition, no noticeable trends were found between adoption of personal home pages and experience; for many of the questions, the less using groups were more Internet savvy than their counterparts.

Part of what makes collaboration useful is knowing you have an audience. So, participants were surveyed about who visits their home pages; the responses, organized by averages of the four groups, are shown in Figure 24. For all usage groups, owners tended to disagree that they knew who visited their home pages. There is little indication that higher adoption of static home pages actually increases the awareness of an audience. So,

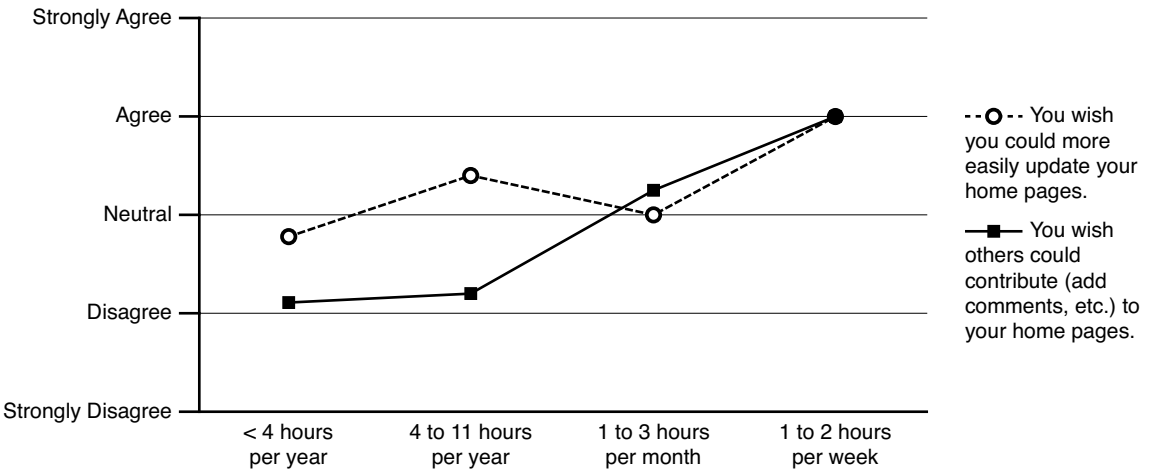

Figure 25: How can we improve on current home pages?

static home pages fail to serve audience awareness needs, even for those who adopt them.

To test how static pages could be improved, participants were asked if they wished they could more easily update their page and whether they would like for others to contribute to their home pages. The averaged responses by group for these two questions are shown in Figure 25. In general, those in the less-using groups did not find that they wanted others to contribute to their webpages, so it is doubtful that collaboration can be a method to entice them to increase their home-page use. Yet, there does appear to be a use for collaboration. There is an increase of those looking for others to contribute as usage increases. This indicates that collaboration is actually something that adopters of personal home pages would want as part of that medium.

Regarding the "publication is awkward" hypothesis, even non-adopting users find it to be a problem. Examining the data carefully, it was clear that for many respondents this was an important issue as several strongly agreed with the statement (wishing that it was easier). This was not as well reflected in the averages (as several also strongly disagreed), but it could be a strong influence on both adoption of personal home pages and using them to their full extent for several users.

APPENDIX B

STATIC HOME PAGES SURVEY

Please, take a few minutes to complete this survey. Your answers are confidential and will not be published with your name or other identifying characteristics (such as e-mail address).

B.1 General Demographics

Use the drop down lists to fill out this section. If no choice is correct or you would prefer not to answer that question, leave that field blank.

1. *Age*
   ◯ 18-20
   ◯ 21-25
   ◯ 26-30
   ◯ 31-40
   ◯ 41-50
   ◯ 51-60
   ◯ 61-70
   ◯ 71+

2. *Sex*
   ◯ female
   ◯ male

3. *Educational Attainment*
   Please indicate the highest level of education completed.
   ◯ Grammar School
   ◯ High School or equivalent
   ◯ Vocational / Technical School
   ◯ Some College
   ◯ College Graduate (4 year)
   ◯ Master's Degree (MS)
   ◯ Doctoral Degree (PhD)
   ◯ Professional Degree (MD, JD, etc.)

B.2 Internet Background

In this section, we want to find out about your background in using Internet technologies. Answer the questions to the best of your abilities. If no accurate answer is available, leave that question blank.

1. How frequently do you *order* a product/service from a business, government or educational entity by filling out a form on the web?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

2. How frequently do you make a purchase online for more than $100?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

3. Have you changed your browser's "startup" or "home" page?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

4. Have you changed your "cookie" preferences?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

5. How frequently do you participate in online chats (such as instant messaging, but not including e-mail)?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

6. How frequently do you participate in online discussions (such as usenet, but not including e-mail)?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

7. How frequently do you participate on a Wiki, Swiki, or CoWeb?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

8. How frequently do you listen to a radio broadcast online?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

9. How frequently do you participate on a daily journal, weblog, or blog?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

10. Do you have a personal (one about yourself) daily journal, weblog, or blog?
    ◯ Yes ◯ No

11. How frequently do you make telephone calls online?
    ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

12. How frequently do you use a nationwide online directory to find an address or telephone number?
    ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

13. Have you taken a seminar or class about the Web or Internet?
    ◯ Yes ◯ No

14. Have you bought a book to learn more about the Web or Internet?
    ◯ Yes ◯ No

15. Have you customized a webpage for yourself (e.g. MyYahoo, CNN Custom News, but not your home page)?
    ◯ Yes ◯ No

16. How frequently do you work on your home pages?
    ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

17. How frequently do you work on webpages other than your home pages?
    ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

18. Have you written/read raw HTML (the mark-up language used for most webpages) files?
    ◯ Yes ◯ No

B.3 Home Pages

In this section, we want to find out how you feel about your current home pages; this includes the front page and other pages on your home site. If you use a weblog (or Blog), consider that a part of your home page as well. If you do not have home pages, leave this section blank and turn in the survey.

1. How much time did you spend on your home pages within the last year?
   (choose the one that most closely matches)
   ◯ less than 4 hours this year
   ◯ between 4 and 11 hours this year
   ◯ between 1 and 3 hours *per month*
   ◯ between 1 and 2 hours *per week*
   ◯ more than 2 hours per week

What follows are questions about how you use your home page. If you are unable to answer a question, leave that question blank.

1. How frequently do you use your home pages to express your creativity?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

2. How frequently do you use your home pages to express your opinions on issues you feel are important?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

3. How frequently do you use your home pages for work-related activities (i.e. professional site)?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

4. How frequently do you use your home pages for school-related activities?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

5. How frequently do you use your home pages for collecting links to fun and/or useful sites?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

6. How frequently do you use your home pages for collecting interesting and/or useful things that others have created?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

7. How frequently do you use your home pages to learn website design and/or HTML?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

8. How frequently do you use your home pages for commercial purposes (selling, profit making)?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

9. How frequently do you use your home pages to distribute pictures?
   ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

10. How frequently do you use your home pages to distribute information (phone number, directions, contact information)?
    ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

11. How frequently do you use your home pages as a daily journal or weblog?
    ◯ Very Often ◯ Often ◯ Sometimes ◯ Seldom ◯ Never

What follows are statements about your home page. Choose how much you agree with each statement.

1. Your home pages have a good design.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

2. Your home pages are interesting to yourself.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

3. Your home pages are useful to yourself.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

4. Your home pages are interesting to your family.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

5. Your home pages are useful to your family.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

6. Your home pages are interesting to your friends.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

7. Your home pages are useful to your friends.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

8. Your home pages are interesting to your colleagues / fellow students.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

9. Your home pages are useful to your colleagues / fellow students.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

10. Your home pages are interesting to strangers who share your interests.
    ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

11. Your home pages are useful to strangers who share your interests.
    ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

12. You are fairly aware of who visits your home pages.
    ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

13. You wish others could contribute (add comments, etc.) to your home pages.
    ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

14. You wish you could spend more time updating your home pages.
    ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

15. You wish you could more easily update your home pages.
    ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

16. You spend too much time updating your home pages.
    ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

B.4 Community Awareness

What follows are statements about your general awareness and impressions of the College of Computing community.

1. You are familiar with the CoC research-oriented events that are being scheduled (e.g. faculty recruiting talks, CoC distinguished lecture series lectures, etc.).
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

2. During the academic year, you regularly attend the CoC research-oriented events.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

3. You are familiar with the CoC social events that are being scheduled (e.g. picnic, grad. teas, happy hour, etc.).
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

4. During the academic year, you regularly attend the CoC social events.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

5. You are familiar with CoC research in your own group. *Here group refers to the smallest recognized people entity (for example, the animation group fits our definition of group better than, say, the GVU Center).*
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

6. You are familiar with CoC research work in groups other than your own.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

7. During the academic year, you regularly discuss school / research activities with fellow students.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

8. The College of Computing has a good sense of community.
   ◯ Strongly Agree ◯ Agree ◯ Neutral ◯ Disagree ◯ Strongly Disagree

APPENDIX C

GUIDE FOR STUDENT INTERVIEWS

This appendix contains a loose set of questions / topics to guide the student interviews. This is not a chronological, verbatim account of the questions asked. Rather, these questions represent the topics covered. The interviews were conducted as open-ended clinical-style interviews. At the end of the interview, all of the following questions / topics in this appendix were covered, either implicitly or explicitly.

At the beginning of the interview, participants were told, "as you know, I designed AniAniWeb. But, that is not the reason that I am interviewing you today. I want to find out about your home pages."

1. Tell me about your personal home pages. By personal home pages, I mean your web presence, whether that be on one website or several, on a weblog, AniAniWeb, static webpages, etc.

    (a) For what purpose do you use your personal home pages?

        i. Who might be interested in them?

    (b) What activities do you use them for? Can you give me any specific examples of these activities.

        i. What made you want to do this?

        ii. Why did you do it this way?

    (c) Do you ever interact with anyone using your personal home pages? If so, how and why?

2. Tell me about how you created your home pages?

    (a) Chronologically, how did you create them?

    (b) What strategies did you use and how did you feel about those strategies? What would you advise others about creating personal home pages?

    (c) What tensions do you perceive? When I say tension, I am referring to conflicting needs that need to be balanced. So, for instance, when buying a house with a fixed amount of money, there is often a tension between quality of the house and quality of the neighborhood.

    (d) How do you deal with them? What are the compromises that you make?

3. Do you ever look at other people's home pages? If so, can you tell me more about that.

    (a) Who's home pages do you look at?

(b) Why do you look at them?

4. Is AniAniWeb serving your needs?

   (a) What do you like, dislike, etc.?

   (b) How does it compare to other home pages you've had?

   (c) Have you ever had an activity that you would have liked to do, but AniAniWeb did not allow you to do it? If so, can you give me specific examples.

   (d) Are there any other features you can think of that might be helpful for AniAniWeb? Why would they help?

   (e) (only for Blog users) Can you tell me about what you use your weblog for?

APPENDIX D

GUIDE FOR FACULTY INTERVIEWS

This appendix contains a loose set of questions / topics to guide the faculty interviews. This is not a chronological, verbatim account of the questions asked. Rather, these questions represent the topics covered. The interviews were conducted as open-ended clinical-style interviews. At the end of the interview, all of the following questions / topics in this appendix were covered, either implicitly or explicitly.

1. Tell me about your personal home pages. By personal home pages, I mean your web presence, whether that be on one website or several.

    (a) For what purpose do you use your personal home pages?

        i. Who might be interested in them?

    (b) What activities do you use them for? Can you give me any specific examples of these activities.

        i. What made you want to do this?

        ii. Why did you do it this way?

2. Do you ever look at other people's home pages? If so, can you tell me more about that.

    (a) Who's home pages do you look at?

    (b) Why do you look at them?

APPENDIX E

GUIDE FOR STUDENT FOLLOW-UP INTERVIEWS

This appendix contains a set of questions asked of students in follow-up interviews about AniAniWeb.

1. Can you show me how you use AniAniWeb?
    (a) How do you normally use it?
    (b) What features do you use?
    (c) How do the security features work?
2. What is useful about the software?
    (a) What makes it useful?
3. What would you like to see in the future?
    (a) What features would you like to see?

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VITA

Jochen “Jeff” Rick was born in Munich, Germany, in 1976. In 1984, his family moved from Germany to Birmingham, Alabama. He graduated from Vestavia Hills High School in 1993. All of his post-secondary education was conducted at the Georgia Institute of Technology. He received a B.E.E. in 1997. He received a M.S. in electrical engineering in 1999. He received a Ph.D. in computer science in 2007. His research focuses on how innovative media can support active (often collaborative) learning. His hobbies include improvisational theatre and staged theatre at DramaTech.