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Strange Bedfellows: Human-Computer Interaction, Interface Design, and Composition Pedagogy

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Abstract

As digital interfaces increasingly mediate our access to information, the design of these interfaces becomes increasingly important. Designing digital interfaces requires writers to make rhetorical choices that are sometimes technical in nature and often correspond with principles taught in the computer science subfield of human-computer interaction. We propose that an HCI-informed writing pedagogy can complicate for both writing and computer science students the important role audience should play when designing traditional and digital interfaces. Although it is a subtle shift in many ways, this pedagogy seemed to complicate student understanding of the relationship between audience and the texts/interfaces they created: it was not just the "human" (beliefs, attitudes, values, demographics) or the "computer" (the software or hardware or other types of mediation) that mattered but rather the "interaction" between the two. First we explore some of the ways in which writing code and writing prose have merged and paved the way for an HCI-informed writing pedagogy. Next we examine some parallels between human-computer interaction principles and composition principles. Finally, we refer to assignments, student responses, and anecdotal evidence from our classes where an HCI-informed writing pedagogy drew—or could have drawn—student attention more acutely to various audience-related technical and rhetorical interface design choices.

Keywords: Composition pedagogy; Human-computer interaction; Interface design; Audience/user; Perceived affordance; Cognitive load; Usability testing; Iterative design

1. Introduction

With the proliferation of newer types of digital interfaces—Facebook and MySpace, blogs and wikis, cell phones and iPods—come new opportunities, new frustrations, and new rhetorical choices for writers and designers. For every time we have received a well-crafted email message from a colleague or had a search engine give us a relevant answer on the first try, we have received dozens of spam emails and clicked hundreds of irrelevant links. And, as many of us have probably experienced first-hand, it is frustrating when an interface is counter-intuitive or fails to respond in an expected way, for instance, when your effort to locate, on a web site, a local restaurant's hours of operation only leads you to information about making reservations, or when your attempt to add a contact into your cell phone's address book instead results in accidentally redialing the same user's number. Such frustrations remind us of Stephen Bernhardt's warning: "We need to constantly appraise the broad drifts in the shape of text—to anticipate what now constitutes and what will soon constitute a well-formed text. We need to think about how readers interact with text—what they do with

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it and how. We need to anticipate where text is going: the shape of text to come" (1993, p. 151). This reminder, which is just as relevant today as it was 16 years ago, for writers to study what readers do with texts and how they interact with them, mirrors the main tenant of the computer science subfield called Human-Computer Interaction (HCI), which studies how users interact with computers and digital devices of all kinds.

As stated in the Association for Computing Machinery Special Interest Group on Computer-Human Interaction's (ACM SIGCHI) *Curricula for Human-Computer Interaction,* "Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them" (Hewett et al., 1996). As such, the HCI field exists at the junction of the computing sciences (computer science, software engineering, and informatics), the design arts (graphic and industrial), and the behavioral and social sciences (cognitive psychology, sociology, and anthropology). One of the primary goals of the interaction design subfield within HCI is to improve the experience for humans at the exact time of direct interaction with the computer. However, there are many ways to define "improve" (e.g., accessibility, learnability, efficiency, ergonomics, safety), and there is a steady stream of new devices and new mechanisms that affect this interaction. In the face of this highly variable environment, one of the primary ways of defining the success or failure of an interaction design becomes dependent on the user's reaction to it. How will the user respond? Is the design user-centered? Is it usable?

We became interested in how closely our discussions of "design, implementation, and evaluation" of user-centered digital interfaces mirrored our concern in composition pedagogy for helping students design, implement, and evaluate reader-centered traditional and digital texts. We began to identify instances when designing digital interfaces required writers to make rhetorical choices that were technical in nature and often corresponded with principles taught in HCI or interaction design courses. As scholars and teachers in two disciplines that might seem distinct but in fact are increasingly related—composition and computer science—we found ourselves in a unique position to study collaboratively how HCI principles, and specifically principles of user-centered interface design, can be adapted for use in both composition and computing classrooms. Although there are several similarities between composition pedagogy and HCI ideas—similarities which will be discussed in this article and which make comparing these two disciplines plausible and fruitful—one major difference is that an HCI approach to design considers the user, or the audience, an active and integral component in the design process and assumes that the user will be served in some way. By contrast, some of the most influential ways composition pedagogy has dealt with audience—such as by creating fictional audiences, saying that the audience is "addressed," or even writing for real audiences or service-learning clients—still tend to frame users as passive or only involve them minimally, if at all, in the design process. These techniques sometimes fail to give us a clear picture about what role the audience should play in the composing process and even less of a clear picture about how exactly audience can be taught.

In short, we found that integrating HCI principles into our classrooms helped us complicate for students the important role audience can play in the process of composing digital texts and designing software interfaces. Though it is a subtle shift in many ways, it nonetheless made some big differences in how students seemed to perceive the relationship between audience and the texts/interfaces they created: it was not just the "human" (beliefs, attitudes, values, demographics) or the "computer" (the software or hardware or other types of mediation) that mattered but rather the "interaction" between the two that students came to view as central when considering audience. Thus, the audience/user always had to be involved in the composing and design process. In this article we examine three HCI principles that complicated how we taught audience in our composition and computer science courses. By studying these principles—that focus on understanding audience as an active element in the design process and that contribute to the effective design of digital interfaces—writing students can become savvier rhetoricians when composing in both traditional and digital media. Likewise, computer science students can become more effective interface designers as they increase their awareness of the rhetorical choices that impact their practice.

Our interest in interface design originated with our involvement in an innovative multimedia authoring minor at our medium-sized, liberal arts, primarily undergraduate institution. The goal of this minor was to merge the sciences with the liberal arts by training both writing and computer science students for newer types of digital writing, such as web site and multimedia design and basic database development. The following abbreviated description highlights the minor's goals:

> As more and more information is disseminated electronically for personal computers and via the Internet, the artistic design and narrative quality of this digital content become increasingly important. The Multimedia

> Authoring minor at Elon provides an interdisciplinary approach to the development of successful and persuasive digital content for all disciplines. . .. The minor will allow students to integrate the study of digital design and writing with a solid technical foundation through core courses in English, Art, and Computing Sciences. (Elon University Department of Computing Sciences, n.d.)

Some of the major lessons we learned from teaching the writing and computing science courses that were a part of this minor were that designing digital interfaces requires attention to both writing and technical matters and that we needed a better way to conceive of the role audience should play in the composing of digital interfaces. In both of these cases, we found that traditional composition pedagogies were not up to the task, and our effort to develop a writing pedagogy based on HCI principles was meant to address these limitations.

We also acknowledge that pedagogies create subjectivities for students to inhabit (Faigley, 1993), if only temporarily, and we wanted to develop a pedagogy that invites students to become writers who think, behave, and act in ways that merge rhetorical and technical sophistication. Inviting students to occupy such rhetorical positions fits in especially well with the idea that texts and interfaces are "written information conveyance systems, little communication machines" that get unleashed in the world with the intention of achieving a particular end (Salvo & Rosinski, forthcoming). An HCI-informed writing pedagogy recognizes the social and cultural power of digital interfaces in that they can be transparent about the information they provide, or they can limit, hide, and distort that same information. As Steven Johnson has argued:

> How should we understand the cultural import of interface design in today's world? Put simply, the importance of interface design revolves around this apparent paradox: we live in a society that is increasingly shaped by events in cyberspace, and yet cyberspace remains, for all practical purposes, invisible, outside our perceptual grasp. Our only access to this parallel universe of zeros and ones runs through the conduit of the computer interface, which means that the most dynamic and innovative region of the modern world reveals itself to us only through the anonymous middlemen of interface design. (1997, p. 19)

Because all texts can be regarded as interfaces, a writing pedagogy based on the HCI principles of interface design helps us to envision texts as written information conveyance systems that carry social and cultural value and are meant to achieve some goal in the world and to serve the audience/reader in a very specific way.

By taking an HCI perspective, composition pedagogy can also better prepare students for writing both traditional and digital texts, and it can create rhetorically and technically sophisticated student subjectivities. This pedagogy has two related benefits: it can remind students about the rhetorical nature of their composing choices especially when working with newer composing technologies, and it can leverage the existing work done by the HCI field, especially in regard to understanding and involving audiences, to provide students with solid principles for the effective design of digital texts and interfaces. In this paper, we refer to anecdotal evidence from our own courses in writing, computing sciences, and multimedia authoring to begin to articulate a writing pedagogy based on HCI principles that could be used in both writing and computing sciences. We refer to assignments and student responses from our courses that did benefit—or could have benefited—from an HCI perspective, including anecdotal evidence from our classes where reference to HCI principles could have drawn student attention more acutely to various audience-related technical and rhetorical interface design choices.

2. Writing code and writing prose

There is precedent in composition scholarship for examining similarities between writing traditional texts and writing in the field of computer science. Earlier research tended to explore, somewhat defensively, whether writing code or web design were even appropriate activities for writing classes (Rea & White, 1999; Mauriello, Pagnucci, & Winner-White, 1999). As early as 1999, Nicholas Mauriello, Gian Pagnucci, and Tammy Winner-White called for a reevaluation of *who* teaches writing classes and argued that the newer demands of teaching students to write code might necessitate co-taught classes with both a writing and computer science faculty member. Robert E. Cummings (2006) also examined some of the similarities between writing code and writing prose, focusing on how the acts of computer programming and traditional composing both invoke an audience. He concluded that "the application of rhetoric to the art of programming is long overdue" and offered guidelines for teaching coding in the writing classroom (2006, p. 440). Other scholarship (Wysocki, Johnson-Eilola, Selfe, & Sirc, 2004) tended to assume that writing code, or other

types of digitally-enhanced writing, were indeed relevant activities that should be taught in writing classrooms, even as this scholarship still maintained an air of defensiveness about the changing nature of what constitutes writing and writing instruction. For example, Bill Hart-Davidson, Ellen Cushman, Jeff Grabill, Dànielle Nicole DeVoss and Jim Porter's 2005 *Kairos* article "Why Teach Digital Writing?" collected an array of arguments that can be used in different contexts (institutional, administrative, departmental, curricular) for *why* digital writing should be taught.

Most recently the scholarship has focused on defining new media, multimedia, or multimodal writing (Wysocki et al., 2004; Van Waes, Leijten, & Neuwirth, 2006), digital literacy (Selber, 2004; Jewitt, 2003) and developing corresponding digital pedagogies (Lunsford, 2006). Other scholarship has also argued that the very definition of writing has changed to include intellectual activities that previously belonged to the realm of computer science, such as creating interactive databases and dynamic web content, making decisions about which types of software or hardware to use, or identifying appropriate search terms that audiences would find meaningful and useful (Johnson-Eilola, 2004). This brief review of scholarship points out what has become a common tension in composition studies and an issue we confronted in our classes as well: should we teach the writing or the technology? The consensus seems to be to strive for a more balanced approach, one that recognizes that both writing and the technologies used to compose all texts are best taught from a rhetorical perspective. We were pleased to find that an HCI pedagogy helped us take such an approach in our classrooms.

The increase in scholarship on interface design in particular attests to its growing importance in writing studies. Some of this research examines ways to analyze and understand digital interfaces. For instance, Clay Spinuzzi (2001) questioned the efficacy of designing and analyzing interfaces based on the popular metaphor model because metaphors are static and fail to take into account user experience. He instead proposed a genre-ecology framework that views interfaces as "interlinked cultural-historical artifacts" (p. 51). Other scholarship examines interface design in specific discourse communities, such as in the online health industry (Kim, Young, Neimeyer, Baker, & Barfield, 2008). Although this scholarship has done much to expand our understanding of the communicative power of interfaces and how they function in particular discourse communities, our approach is more pedagogical in nature as we seek to establish how the interaction design subfield of HCI can be transformed into an audience-centered writing pedagogy.

3. Human-computer interaction principles

Although no one absolute list of HCI principles exists, there are several principles that are generally supported by the HCI literature (Norman, 2002; Shneiderman & Plaisant, 2004), especially with respect to the design of digital interfaces (Sharp, Rogers, & Preece, 2007; McCracken et al., 2004; Lazar, 2006). Many of the HCI principles for user interface design easily correspond to the principles taught in composition courses. For instance, nearly every resource in the HCI or interaction design domain has a significant focus on user-oriented pre-design and post-design tasks such as *user requirements gathering*, *prototyping*, and *usability testing*. Though many people working in composition today are familiar with these tasks, we'll briefly note their definitions here for clarity's sake. Requirements gathering refers to the act of interviewing users about their expectations and limitations for the new system. Prototyping means creating a model of what the designer thinks the user might want (or showcasing features that the designer wonders if the user might want), but on a smaller or less expensive scale than it would take to create the actual software product. Usability testing is an important step in the design process in which the system is shown to users and designers to glean insights as to how the interface will actually be used. The emphasis on these user-oriented tasks comes from an understanding that the more testing and audience measurement we do throughout the design cycle, the closer the final product will be to something that the user actually wants and will find useful. Although the composition concepts of audience analysis, drafting, and peer-response correspond, respectively, with these HCI principles, the composition corollaries can be updated and enriched to include issues from the HCI domain, thereby becoming even more effective when applied to digital interface design.

Reducing cognitive load for users is another broad goal of effective interaction design. Donald Norman's (2002) principle of *perceived affordance* is a key concept; it states that the appearance of an interface should give clues to its use. Similarly, how a designer chooses to approach the navigational scheme and the visual organization of an interface are keys to its success as a user-centered experience. This HCI concept of perceived affordance corresponds roughly with composition's focus on tapping into audience expectations about a document's conventions and constrains—textually, visually, and organizationally—in an effort to enhance readability and comprehension.

To organize this comparison between HCI design guidelines and composition principles, we mix vocabulary from composition and from the HCI and interface design domains. We compare each of these guidelines or terms to the corresponding concept from the other field, pointing out similarities and differences as we go. Table 1 organizes these concepts around a streamlined systems development lifecycle that includes some of the key HCI principles that affect the design, implementation, and evaluation phases.

Table 1
HCI Principles & Corresponding Composition Principles.

	HCI Principles	Composition Principles
Design	Know Your User • Who is your user? (Demographics, diversity) • What does your user know already? (Expertise level) • What does your user need? (Requirements gathering) • What type of system will your user be able to handle? • What type of system is your user expecting?	Know Your Audience • Who is your reader? • What does your reader know already? • What does your reader need?
Implement	Reduce User's Cognitive Load • Design with perceived affordance in mind, including relying on known conventions/constraints for your type of discipline; consistency • Develop sensible navigation schemes • Organize information effectively for visual perception; Gestalt principles of design	Strive for Clarity, Make Arguments Obvious • Rely on known conventions and constraints for this type of document • Strive for readability through organization and structure of the document
Evaluate	Test and Iteratively Redesign • Prototyping • Usability Testing • Focus Groups	Peer-Response • Peer-Response workshops • Writing Center consultations • Reader Feedback

4. HCI principle 1: Know your user

Ben Shneiderman and Catherine Plaisant (2004) have argued that the first principle of good design is to be aware of the differences between users of a proposed computer interface, be it a piece of software, a web site, or an electronic gadget. They called on the much earlier work of Wilfred J. Hansen (1971), who called this principle "know thy user." Knowing the users includes gathering basic demographic information about them but also can involve dividing the user groups into their expertise level, categorizing them based on the kinds of tasks they want to complete using the system, and categorizing them by their preferred method of interacting with the system (refer to Table 1, row 1).

Composition also boasts a rich scholarly history on audience analysis as well as pedagogical work on teaching students to create readerly texts (Ede & Lunsford, 1984; Kirsch & Roen, 1990; Porter, 1992; Ede & Lunsford, 1996; Johnson, 1997a, b; Miller & Charney, 2008). Asking students to write for real audiences, such as their peers, university offices or departments, or real-world clients or community partnersis, is a common way to deepen student awareness of audience needs and expectations. Our exploration of the "Know Your User" HCI principle is meant to broaden this already rich composition history, especially in regard to designing digital texts. Engaging in audience analysis from an HCI user diversity perspective still requires designers to collect basic demographic information about their audience. But it also requires designers to ask questions that previously may have been ignored or considered only technical in nature, but which we argue are rhetorical as well. These include questions about user facility with the technology (e.g., novice, intermediate, expert), about what exactly the user needs to accomplish with the interface (e.g., locate information, submit a form, print an application), and about the user's preferred way of interacting with the system (e.g., text-based or image-based interface, text on the screen or in a Word or PDF document). It is also interesting to note that we have been using the language of our respective fields in this paper; digital interfaces have "users" but compositions have an "audience." Has "audience" come to denote passivity to students in writing classes? Does "user" imply a certain practicality or task orientation?

A writing pedagogy based on the HCI principle of "Know Your User" highlights that audience analysis should also consider technical concerns and decisions that can have a rhetorical impact on users. For a client project in a writing

course that was part of the multimedia authoring minor, students designed a web site for Helping Women to Excel, a non-profit organization that helps women gain technical expertise so they can join the workforce and earn a living wage. Despite interviewing the organization's director in person and on the phone at least three times, students still failed to sufficiently take into account the actual hardware and software the women had access to at home and at the training center. This resulted in a design optimized for high-end computers with up-to-date software. The students also only posted teaching materials in large PDF files, failing to consider that users had varying levels of expertise and expected to have access to documents that allowed them to jump easily between different education modules. Although the idea that students should have analyzed the audience's expertise level with technology or their expected means of interacting with material is not a new idea, what is unique is that by putting audience analysis into an HCI context, technical decisions and design choices are regarded as *rhetorical*—and it is this rhetorical perspective on audience-related technical decisions and design choices that is the value of an HCI writing pedagogy. By taking an HCI perspective, students could have been more likely to view their Helping Women to Excel interface as a "little machine" that was supposed to help users accomplish a specific task—in this case, to access easily particular education modules on low-end computers—and to recognize that an interface's success is judged based on whether the user's interaction with it is successful or unsuccessful.

On the flip side, for a newspaper project in the web design course, computer science students met numerous times with the editors from the paper to go over requirements at various times before and during the project semester. Students also worked directly with three staff members from the newspaper on developing adequate written materials for this site, on editing their text for readability, and on fact-checking their copy. These client-developer roundtables were essential to ensuring that the basic requirements of the project were being carried out effectively by the students. However, for the students, "Know Your User" occasionally extended only to knowing the requirements of the user but did not include considering the diversity of expertise inherent in the population that reads a local newspaper's online web site.

One limitation of the newspaper site became obvious quickly, and we suspect it could have been alleviated somewhat by additional attention paid to the type of audience analysis that is common in a composition course (demographics, experience level, etc.). In order to achieve a few of their visual design goals, the computer science students chose to design the web site using iframes, a technique that allows an outer box to hold an inner box. The result for long pages is that there are multiple scrollbars on the right-hand side of the page (see Fig. 1). A few of the editors reported that they found the multiple scrollbars confusing. As they navigated the site, they consistently used the outside scroll bar (in the browser) rather than the inside scrollbar (in the iframe, or inner window). Then they became frustrated when they realized they'd grabbed the wrong bar. The students did not anticipate this reaction from less experienced users, as they

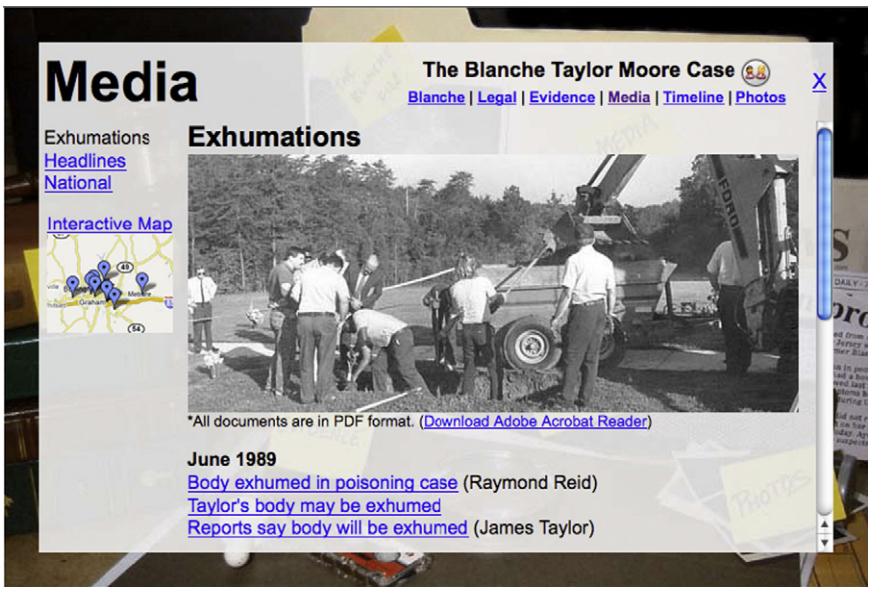


Fig. 1. Newspaper web site designed by computing science students.

were perfectly comfortable with multiple scrollbars themselves. A few of the editors also expressed mild frustration with the readability on the site. They found it difficult to read the font size the students had chosen for the large text blocks, and they did not like the transparent overlay feature (the iframe sits "on top" of an image below it with about 90% opacity). The lesson for the computer science students was that audience analysis extends beyond requirements gathering and that their own experiences with computing may not be the norm for all users. Although the computer science students were very familiar with the HCI requirement to determine the technical requirements of users (unlike the composition students described above, who created a high-end web site for users with low-end hardware), the effectiveness of their interface design could have been improved by collecting basic demographic information about their audience, particularly in regard to their experiences surfing the web.

In both composition and computer science, there is a strong tradition of "Know Your User," and both disciplines expect that the designer will take into account the diversity, experience, or expectations of the user or audience. However, we found that in both our writing and computer science classes, students sometimes made design decisions based on only a limited understanding of their audience or user. While an HCI-enhanced writing pedagogy could have reminded the writing students that technical choices can have a rhetorical impact on users, it could have also reminded the computer science students that attending to technical features, while ignoring basic user demographics, is insufficient as well.

5. HCI principle 2: Reduce user's cognition requirements

Much of the HCI and digital interface design literature deals with creating a system around the cognitive abilities of human beings. Understanding how humans perceive their environment—the senses involved, the mental maps and metaphors that they construct, the decomposition of complicated layouts into their component parts—is critical to good design (McCracken, Wolfe, & Spool, 2004). Although there are numerous guidelines for how the principles of cognitive psychology can be applied to digital interface design (Krug, 2000; McCracken et al., 2004; Sharp et al., 2007; Lazar, 2006; Norman, 2002), we focus on three of the HCI principles where we see the greatest benefits for both computer science and composition students: understanding perceived affordance, developing efficient navigational designs, and designing effective information organization (see row 2 of Table 1).

5.1. Perceived affordance

When discussing ways to make objects easier to approach for a first-time user, Norman (1988) introduced *perceived affordances* as an extension of earlier work by James Gibson (1977). Gibson introduced the term *affordance* to refer to the set of potential actions held by a physical object. We can explain this in terms of simple objects: for example, when a human sees a handle, she wants to grab it, and when she sees a ball, she wants to roll it. The perceived affordance of an interface therefore refers to the way a user can "tell" how to interact with the system upon first experiencing it. The sensory qualities that the user perceives in a system imply how to use it. Perceived affordances of an object, therefore, are subject to each user's ability to sense, as well as to their experiences, their backgrounds, their memories, etc. This is an important distinction; it is not solely the inherent qualities of the object itself that imply its use. These inherent qualities will always be complemented (and complicated) by the very powerful knowledge that exists in the user's own mind. As Norman explained:

> When we encounter a novel object, how can we tell what to do with it? Either we have dealt with something similar in the past and transfer old knowledge to the new object, or we obtain instruction. In these cases, the information we need is in the head. Another approach is to use information in the world, particularly if the design of the new object has presented us with information that can be interpreted. (2002, p. 82)

In addition to relying on perceived affordance as a way to figure out how an object will behave, Norman explained how users also rely heavily on *conventions* and *constraints* to guide them in how to use new objects within a system. Consider the example of a scroll bar: the bar has no inherent meaning as a device to humans (it is a made-up, digital construct), but our reaction to the scroll bar (we know it represents "more text than can fit on the screen," and we know that we can click it, pull it down, and expect to move along in the text) is learned and culturally dependent. We have not encountered scroll bars outside of digital interfaces, and if we encountered a scroll bar that suddenly acted differently, we would be surprised and confused.

The HCI concept of perceived affordance, and especially the related notions of cultural and textual conventions and constraints, closely corresponds to the concept of designing for user expectations in composition. Both disciplinary fields rely on the ideas of conventions and constraints as a way to describe how features of a text or interface invite users to use that text or interface in certain ways, while discouraging other uses. Both fields also say it is important to ask what it is about user experience, background, memory, etc. that "tells" the user how to interact with a text or interface. Like "Know Your User," these are not entirely new concepts in composition; what perceived affordance offers is the forthright assumption that the audience will indeed actively use the text or interface. Learning about the HCI perspective on perceived affordance can encourage students to see the similarities between the way a reader interacts with a text and the way a user uses an interface. Such an approach can also encourage students to see texts as a kind of "system" and recognize that it is their responsibility as designers of the system to take into account user expectations about the interface.

In the newspaper case, the newspaper editors (clients) had a specific web site—designed by a competitor—that they wanted the students to emulate in their design. The target web site was designed by another regional newspaper and covered another famous legal case that also became a media sensation nationally. That web site had a very clean and professional design that relied on an extended visual metaphor of file folders, such as a crime detective might use. Each file folder for the "case" was labeled with a section heading for navigation purposes (see next section for more about navigation). The site design also relied on handwriting and typewriter fonts to lend further authenticity to the virtual "detective case folders." The students brainstormed various similar metaphors and ultimately decided on a "messy judge's desk." Their design for a judge's desk was to include various pieces of case evidence that would represent the navigational headings for the site, as shown in Table 2.

Table 2
Chart of navigational elements created by computer science students.

Desk Metaphor, Version One	Corresponding Section Heading	Indicated with Words?
Bottle of Ant Poison, Microcassette Tape	Evidence	No
Photo of Blanche	The Blanche File	No
Rolled-up Newspaper	Media Coverage	No
Stack of Black and White Photographs	Photos	No
Legal File Folders Labeled "Legal"	Court Documents	Yes
Sticky Note Reading "Timeline" Stuck to Computer Monitor	Timeline of Events	Yes

To set up the photograph, the students actually created a fake desk scene and shot footage using a digital camera and a tripod. They tried a variety of different layouts for the scene. The students then turned each item shown in the desk metaphor into a clickable hotspot for the corresponding section heading. Unfortunately for the students, during initial testing, they discovered that users of the site had no "cue" that they were supposed to click on the photograph of Blanche or the rolled-up newspaper. Some users did discover that those areas seemed to be clickable, but it was not obvious where they would lead, so the users shied away from clicking. In an ambiguous navigational situation, users preferred to click on word labels, such as the sticky note or the legal folders. Students decided to remake the desk metaphor using all sticky notes for cues. The resulting design is shown in Fig. 2.

Immediately, the students realized through their testing sessions that this was a much more effective design. Users were comfortable with clicking on a clearly labeled heading, and the designers were still pleased with the consistency and aesthetic of their visual metaphor. Afterwards, students did add one additional visual cue, which was to use a spotlight effect on the sticky notes as the user hovered over them with the mouse. They explained that this effect had an aesthetic rationale and a usability rationale: the spotlight put the user in the position of being a detective shining a flashlight on a crime scene, and was also an excellent visual cue for which sticky note was currently selected.

One of our writing students found herself in a design conundrum similar to the situation described above, and though she was initially resistant to altering her interface, the concept of perceived affordance and the need to reduce the user's cognitive load convinced her to rethink her design. After redesigning a series of poems and oral recordings written and recorded by residents of a homeless shelter into an online multimedia project, she included an opening page with a spanning image of garbage with hotspots to different poems and oral recordings (Fig. 3). Collecting just a minimal amount of user feedback informed this student that her interface design choice failed to capitalize on any

Fig. 2. Newspaper desktop metaphor designed by computer science students.

kind of perceived affordance whatsoever because the physical object of a garbage pile doesn't "tell" the user how to interact with it. There was little in the user's own mind about how to interact with this object, and garbage is usually the exact thing a person would not want to touch in real life.

Although this example may seem obvious or even humorous, what it showed us was that when designing digital interfaces, the concept of perceived affordance can quickly and effectively give students a reference point, a kind of meta-language even, for analyzing the effectiveness of their interfaces as a type of system. Significantly, such a reference point or meta-language also provides students with a way to separate their own personal attachment to a design and to instead consider its effectiveness. As the image in Fig. 3 indicates, in an effort to address the lack of sensory cues in the interface, the student added explanatory text and a site map as a way to "tell" her reader how to use the site.

Fig. 3. Garbage interface designed by composition student.

Another way that an HCI-informed writing pedagogy can capitalize on the idea of perceived affordance is by reminding students about the importance of *consistency* and *conventions* in interface design. When discussing digital interface design, Shneiderman and Plaisant (2004) stressed that the designer can reduce the user's cognitive requirements by applying consistent terminology, fonts, capitalization, and spellings. These are simple guidelines that are easy enough to implement throughout the target system. *Sequences* of actions should also be consistently applied. For

example, if you have "confirmation dialogue" messages that require an additional "are you sure?" response from a user before deleting data, this should be applied to all instances of deleted data. Shneiderman and Plaisant (2004) stressed that the designer should clearly follow conventions for the type of system she is developing. The field of composition also recommends that writers be consistent in regard to the use of terminology and the visual design of a text. Taking an HCI bent on this concept, however, makes consistency a more robust term with more serious implications for the usability of a text or system, especially in regard to helping a user locate the information he or she needs. The repercussions of inconsistency in a digital text might seem more obvious to students, thereby highlighting the importance of consistency in more traditional texts as well. Discussing conventions and consistency with students can be a straightforward exercise that gets the students on the right track as designers who think about their audiences' cognitive processing. Consider the now-commonplace conventions of underlining text as a way for readers to identify a hyperlink or the use of color to indicate whether or not readers have already followed a hyperlink. Consistently using these conventions reduces the user's cognitive load and is commonly relied upon in digital interface design.

5.2. Navigation design

Designing digital interfaces requires writers to attend to the rhetorical aspects of navigational systems as a way to reduce the cognitive load of a user in much the same way that a table of contents, chapters, and in-chapter headings guide the reader of a print-based text. The very choice of a navigational system and then the labeling of that navigation organize the content and therefore affect the user's interaction with this content. There are many different ways to categorize navigational schemes—global versus local navigation; drop-down menus versus button navigation; chronological, hierarchical, or task-oriented navigation—and each option appeals to different kinds of users and lends itself to different purposes (Farkas, Dragga, & Farkas, 2001; Rosenfeld & Morville, 2002; McCracken et al., 2004; Lazar, 2006; Kalbach, 2007). An HCI-informed writing pedagogy highlights that users will access the information for different purposes and that different navigational schemes will assist or hinder this effort accordingly. For example, a user's cognitive load can be greatly reduced when the primary navigation method feels "natural" and easy to use, so users will appreciate a web site with a navigation system that reduces the number of choices and clicks needed to navigate it. Similarly, it may be possible for a web site that serves multiple distinct audiences to include a variety of navigation options for these distinct audiences, so that the users can choose the navigation option that meets their own needs best (e.g., search versus browse, or sorting options such as "by date" or "by most relevant"). What Rosenfeld and Morville (2002) called Supplemental Navigation Systems, which can take the form of site maps, site indexes, guides or searching systems, are additional ways that a user's cognitive load can be reduced through navigational schemes.

Choice of navigation scheme is an important lesson for both computing sciences and composition students as they learn how to present material in the most navigable way. For a service-learning client project in a writing class, students were required to manage large amounts of printed materials that their clients needed digitized and organized for online delivery. The materials themselves were often diverse, as were the potential audiences. For example, The Boys & Girls Club had policy statements, permission forms, and training materials to share with volunteers, parents, and local managers, as well as images they wanted to make available to potential volunteers and community members as a way to raise money; the Turrentine Middle School Guidance Department had study guides for students, curriculum checklists for students and guidance counselors, and college application materials for students and parents; and Positive Attitude Youth Center had training and policy materials for volunteers and educational units for the students who attend the Center and their parents. In order to lessen the load on user cognition, students applied the concept of task-oriented navigation. Students determined how their users most likely expected to find various pieces of information based on the task that users wanted to perform, and designed the site around those tasks. So, for example, the Turrentine Middle School Guidance Department web site was designed around three distinct user profiles, each of whom would find different materials more valuable than others, so the primary navigation included an option for each of the three distinct groups of users, and the materials were listed in order of importance for each group. Some computer science students had a similar experience when designing a site for Open Door Clinic. These students chose to design the clinic web site around three distinct user profiles: patients, doctors, and donors. Users chose which profile was closest to their own profile, and they were shown a slightly different organization on subsequent pages. The students also chose to show a fourth choice, a site map, in case the user did not immediately identify with any of the three task-oriented profiles.

5.3. Visual & content organization

In *The Order of Things* (1970), Michel Foucault referred to a Jorge Luis Borges story, "Celestial Emporium of Benevolent Knowledge," which includes a warning about the power of organizational systems. Borges' story is about a Chinese emperor and his encyclopedia, and it includes a famous passage about a highly specialized but seemingly futile attempt to divide the animal kingdom. The divisions make perfect if idiosyncratic sense to the emperor but leave everyone else baffled. In his retelling of the story, Foucault reminded us about the fallibility of received knowledge systems and that while categories are arbitrary, they do carry meaning and power in their ability to divide, separate, and organize. Both Foucault and Borges were playfully critiquing the 17th-century assumption that there was some fundamental, stable order to the universe and the belief that this stability would become obvious once our language was revised to correspond to that order. When Foucault explained that "[t]his book first arose out of a passage in Borges, out of the laughter that shattered, as I read the passage, all the familiar landmarks of my thought—*our* thought, the thought that bears the stamp of our age and our geography—breaking up all the ordered surfaces and all the planes with which we are accustomed to tame the wild profusion of existing things," he reminded us that our faith in categories is comical because categories are simply a means to control the chaos of the proliferation of meaning (1070, p. xv). Such insight is akin to arguing for the value of applying HCI information architecture concepts to the composition classroom: although there is no fundamental order to the universe and no universal language, these concepts can remind students that how they choose to organize ideas in paper and digital interfaces, the way they choose to divide, separate, and organize information, affects both the meaning and the audience.

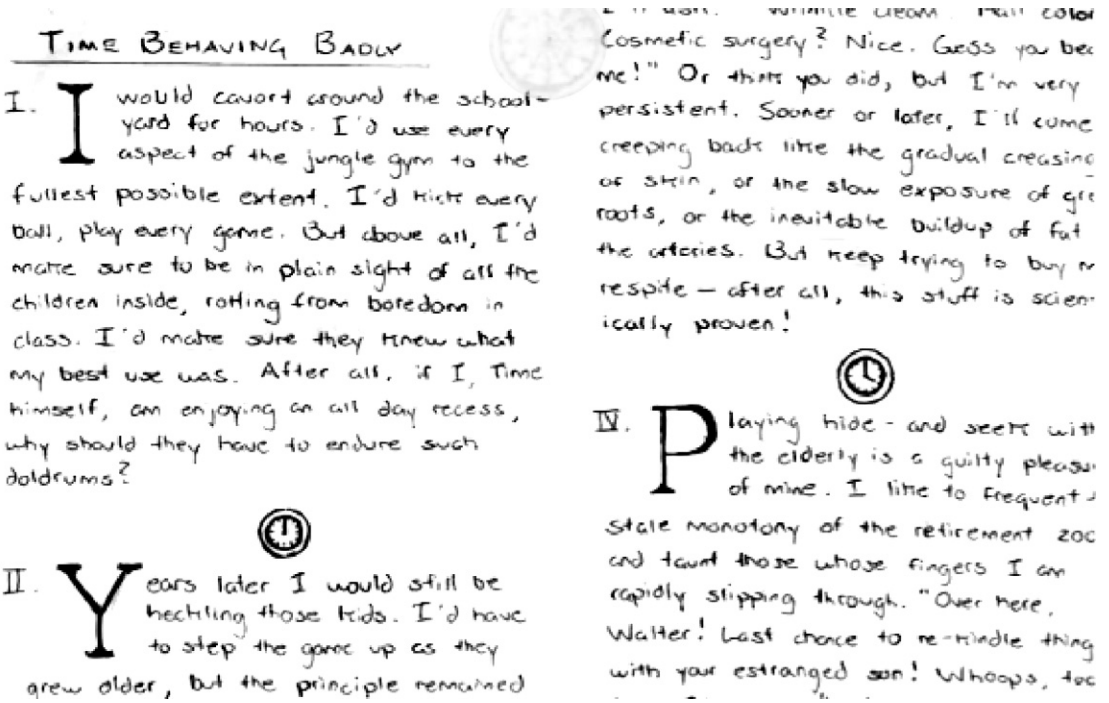
The computer science concept of information architecture is "the combination of organization, labeling, and navigation schemes within a [document]" (Rosenfeld & Morville, 2002). Grouping these activities together under a common platform and with a common purpose (usually design for the Web) gives us a richer way to teach composition and computer science students to organize and categorize information (Morrogh, 2003). A composition or web design pedagogy influenced by the HCI discipline of information architecture emphasizes the effective organization of content to reduce the cognitive load of the user and increase the usability of the interface.

In one of the elective writing courses in the multimedia authoring minor, students experimented with the concept of organization as information architecture through a Tell-A-Story project. Students selected a general theme or experience in human life (such as love, hate, beauty, happiness, joy, or fear) and rewrote one "story" based on this theme in five different composing technologies (clay, pen and paper, a Word document, animation, and multimedia). While the general theme or experience remained the same, the audience and context could change. After designing each interface, the students wrote a reflection explaining their interface design choices in general and their information architectures in particular.

One of the most striking outcomes of this project was that students became extremely cognizant of how all texts and documents are kinds of interfaces and that the visual or structural organization of their interfaces could substantially alter the effectiveness of the message, the audiences they could reach, and the purposes they could serve. One student, working with the theme of "time passes," created this pen and paper interface (Fig. 4):

By dividing this paper into different sections with Roman numerals, drawings of a clock with its hands set at different times, and larger and different fonts for the first letter of each section, this writer has drawn on long-accepted conventions for organizing paper interfaces. But when it came time to tell his story in a digital interface, he found that transferring his paper information architecture to a web site information architecture was far too complicated for the time he had available and his expertise with web design. This project succeeded in driving home to students that the information architecture of an interface does not automatically transfer between different types of media and that different organizations can drastically alter the message being conveyed. Just as content impacts design, design impacts content (McCracken et al., 2004).

In terms of visual organization, most schemes for digital media rely heavily on the principles of visual perception (McCracken et al., 2004), such as proximity, similarity, and continuity, the same Gestalt principles that are commonly used in document design (Schriver, 1996) and web design (Williams & Tollett, 2006). This set of principles stresses that humans have a strong tendency toward holistic visual perception rather than understanding objects atomistically. For interface design, this means that we should create a visual interface (a page) in such a way that the elements of the page (such as images, text blocks, white spaces) are appealing and sensible as an integrated whole, not just as separate parts. For instance, using the Gestalt principle of *proximity* in the visual organization of an interface means visually grouping "conceptually alike" objects together on the page or screen. *Similarity* states that users will perceive


TIME BEHAVING BADLY

I. I would cavort around the schoolyard for hours. I'd use every aspect of the jungle gym to the fullest possible extent. I'd kick every ball, play every game. But above all, I'd make sure to be in plain sight of all the children inside, rotting from boredom in class. I'd make sure they knew what my best use was. After all, if I, Time himself, am enjoying an all day recess, why should they have to endure such doldrums?

II. Years later I would still be heckling those kids. I'd have to step the game up as they grew older, but the principle remained

Cosmetic surgery? Nice. Guess you bec me!" Or that you did, but I'm very persistent. Sooner or later, I'll come creeping back like the gradual creasing of skin, or the slow exposure of gre roots, or the inevitable buildup of fat the arteries. But keep trying to buy m respite — after all, this stuff is scien ically proven!

IV. Playing hide-and seek with the elderly is a guilty pleasu of mine. I like to frequent stale monotony of the retirement zoo and taunt those whose fingers I am rapidly slipping through. "Over here, Walter! Last chance to re-kindle thing with your estranged son! Whoops, too

Fig. 4. Paper interface designed by composition student.

objects that are the same size, color, etc. to be conceptually related to one another. *Continuity* means that a user will perceive the items on a page as being conceptually related to each other if the items are aligned with one another. Each of these visual organization schemes is part of a very powerful "cueing" system that can help the user understand the underlying conceptual organization of an interface while minimizing cognitive load.

For both the writing and computer science students, there is a reciprocal dynamic between what the designer/writer "knows" and what the user/reader "sees." To the user (or reader), understanding the organization of content within a print or digital/web interface is dependent on the cues she is given (usually visual), but to the designer, the visual organization of the site will depend largely on the content. As Daniel McCracken, Rosalee Wolfe, and Jared Spool explained, "Content organization drives visual organization. . .. Good visual organization makes it easy to locate content" (2004, p.82). This means that during the design process, it is useful for writers to consider and re-consider the visual organization of their interface both from the perspective of the user and from their own perspective as the information organizer.

6. HCI principle 3: test and iteratively redesign

One lesson that is taught in nearly every computer science software development course is about how to conduct tests of the system that the student has designed. There are two main types of tests: usability testing and defect testing (sometimes called simply "software testing"). Typically, interface design or HCI courses are more concerned with usability testing ("Can the user operate the software I have developed?"), whereas software engineering courses are more concerned with the defect testing ("Does this particular module or piece of code operate properly? Does it function as designed?"). Our focus here will be on usability testing as it applies to interface design and composition pedagogy.

When a designer conducts usability tests, she is most often interested in watching the user interact with the system in a realistic and natural setting. Is the user experiencing the interface in ways that the designer expected, or differently? How does the user react to dialogue boxes? Are there enough opportunities for feedback or interaction between the user and the system via the interface? Are these interaction opportunities frustrating or pleasant for the user? As these questions themselves are varied, and the answers will be detailed, the procedures for usability testing are also highly variable. The testing can be either formative (conducted during design phase) or summative (conducted after major

design milestones have been completed). The testing can be done by experts or by novices, depending on the particular attributes of the interface being tested. Testing can employ many different techniques, including thorough face-to-face interviews, paper prototypes, or scripted problem-based test scenarios. In professional software design firms, interface design teams will conduct these kinds of tests using a special testing station or room. These testing stations allow easier viewing of the user as she interacts with the system. Special software can capture mouse movements, keyboard taps, and any delays in using the system, while video recordings can capture facial expressions and verbal comments made by the user.

The number and diversity of the testing procedures used in computer science, and the extent to which the user is involved, emphasizes the limited ways peer-response is sometimes approached in writing courses. Typical ways of collecting audience feedback in composition classrooms, like visiting the writing center or participating in peer response, are of course valuable. But they do tend to frame the user/audience as passive, as generic readers who give feedback usually near the end of the writing process, and the decision to revise a text based on this feedback is usually left to the writer's discretion. In contrast, we found that the HCI concept of testing and iterative design can be used in the composition classroom as a way to highlight for students the value of developing user studies, collecting user feedback throughout the design/writing process, and deciding to make certain revisions because they will cause the user to have a more satisfactory interaction with the interface.

It was often fascinating to watch the writing and computer science students arrive at a more nuanced understanding of the role audience plays in composing traditional and digital texts by working together on usability tests. Early in their coursework for the minor, the computer science students tended to take for granted the HCI idea that it was necessary to watch a user interact, throughout the design process, with a content-management system or respond to an instructional video, but they saw little or no need to watch a user interact with written content. Early in their coursework, the writing students assumed exactly the reverse: they recognized the need to collect user feedback on their written text, typically near the end of the writing process, but failed to appreciate the useful feedback users could provide them in regard to the architecture of the content management system or the menu of an instructional video. What was especially interesting was not just that each group of students learned from the other group about the value of collecting user feedback (computer science students in regard to traditional texts and writing students in regard to menus or navigations), but rather that both groups of students were also able to extend the kind of testing with which they were initially more familiar.

We observed that, in general, the writing students became less resistant and were reinvigorated with the idea of peer-response when they considered it from an HCI perspective. What had become in many ways a lackluster activity which they engaged in only because they were required to, at the very beginning (by collecting demographic data) or at the very end (through workshops or writing center visits) of composing, became instead a worthwhile activity that gleaned valuable data about the extent to which their "system" was succeeding and about how to proceed with composing their texts. Writing students began using the language of HCI to develop formative testing for both traditional texts and digital interfaces and to consult the computer science students on HCI strategies. For example, one group of writing students composing a procedural manual, a web site navigational scheme, and a training video for The Boys & Girls Club designed several mid-point testing procedures, including face-to-face interviews and talk-aloud protocols, with the volunteers who would be using the materials.

We also observed that the computer science students expanded their concept of HCI testing to include written text. For example, one of the ways that computer science students are taught to design page layouts is by "greeking," or using blocks of a foreign text as "placeholder" text. The standard text that is used is a Latin passage from Cicero called "lorem ipsum." Since the 1500s, typesetters have reasoned that using text that has to be translated will stop the designer from being distracted by actually reading the text, and instead the designer will focus on the page layout. Students understand the greeking process, and using this technique can make it easier to teach document design concepts. Unfortunately for the computer science students, this technique often exacerbates their existing habit of marginalizing the text or treating it as an afterthought. This is especially problematic if there are students acting as "writers" and different students acting as "designers," a practice which often occurs when students divide up the work in mixed classes ("Let's divide into work groups by our talent areas!"). In the newspaper project for the CIS 450 course, students performed the page layout design task by first greeking the text areas for internal testing of the page layout and navigation scheme. They then performed four rounds of informal (non-client) testing on this greeked page layout and navigation design. They then added a first draft of "real" text and invited the client to view their prototype. The problem with this methodology was obvious as soon as the clients, a group of seasoned newspaper editors, sat down to view the prototype web site. The editors were completely unable to focus on the page layout and navigation details and were unable to give any useful

feedback even about photos, colors, or look and feel. They were consumed by the urge to correct and react to the text. The editors spent the entire 100-minute testing period correcting phone numbers, subject-verb agreement, and facts of the case. The students were dumbfounded. The editors were invited back after a second round of text correction (much of the corrected text provided by the editors themselves) and the students were able to get a moderate amount of feedback on the look and feel.

We brainstormed many fixes for this pendulum swing between primacy of text and primacy of interface in the two groups of students. We wondered if having students perform identical tests on their layouts or their more technical aspects and on their written words (in other words, not letting computer science students focus all their testing on greeked text) would be effective. We wanted the writing students to embrace the validity of involving users in the design of a text throughout its design process, and not just at the very beginning or very end, whereas we wanted the computer science students to understand that written text also needs intentional "testing" for clarity and meaning, not just for its layout on the page. Students majoring in what might seem like two very different disciplines can learn from the HCI approach that treating the audience/user as an active part of the entire composing process, for all features of their given text or interface, could be beneficial. In fact, we found that in our classes where writing students and computer science students worked together, usability testing subtly complicated traditional notions of peer-response by encouraging writers to view texts as kinds of "systems" that readers respond to in some way, for example, by altering their content knowledge or deciding to act in some particular way (Salvo & Rosinski, forthcoming). Encouraging students to approach texts as "systems" to which readers will respond highlighted the necessity of testing the system and of including the user in the design process to determine if it achieves its intended purpose. Again, these concepts are not foreign to traditional notions of peer-response, but couched in the language of HCI they take on new relevance and urgency in regard to both traditional and digital interfaces.

7. Conclusion

It was our experience teaching courses for our institution's multimedia authoring minor that convinced us it would be useful to develop a pedagogy drawing upon the disciplines of both composition and computer science. As more and more of the information available to readers is mediated through digital interfaces, it becomes increasingly necessary for writing students to understand how an "audience" becomes a "user." How does the audience interact with the interfaces the writer creates? How is it that these "little machines" that translate human-readable programming code into zeroes and ones can also serve up faithful visual and auditory representations of a writer's ideas? How will our audience react to the interface that we design to express our ideas, and how will we know if our choices were successful? Designing digital interfaces requires writers to make technical choices that are also rhetorical in nature and to engage in activities that parallel the design, implementation, and evaluation cycles typical in software development. With its focus on knowing the user, reducing the user's cognitive load, and testing and iteratively redesigning, we find that software development may serve as a model for a newer type of writing pedagogy. This pedagogy leverages the research being done in HCI on user-centered design and offers strategies and approaches that could be used when composing digital as well as traditional paper-based interfaces. In addition, we find that an HCI-influenced writing pedagogy can be used in computer science classrooms as a way to remind students that the design of digital interfaces demands attention to rhetorical choices that impact their practice as well.

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