Looks Matter: The Impact of Visual and Inclusive Design on Usability, Accessibility, and Online Learning

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Introduction

The recent expansion of digital scholarship has largely failed to take into account issues of accessibility and inclusive design. Likewise, the connection between accessibility and visual design is often overlooked in creating online learning tools. This gap is most often caused by an emphasis on delivering content rather than designing sites to be both visually appealing and effective in teaching concepts to students of all abilities and learning styles. In this chapter, we will argue that an emphasis on visual design in the creation of online learning objects enhances both accessibility *and* pedagogy.

As Jonathan Lazar and Paul Jaeger have pointed out, despite the fact that the U.S. "has the world's most comprehensive policy for Internet accessibility and that clear guidance for creating accessible technologies already exists," it is also the case that "designers and developers of Web software and hardware technologies in industry, academia, and government often exploit holes in existing policy to ignore the needs of people with disabilities."[1] Overlooking accessibility in web design does not just affect a small portion of users, either: the Center for Persons with Disabilities has concluded that, "though estimates vary, most studies find that about one fifth (20%) of the population has some kind of disability."[2] Though not all of these disabilities impact the ability to use the internet, it is clear that a significant number of users are likely affected by a failure to address accessibility in web design.

While significant gaps remain in meeting the need for accessible web design, many web designers concerned with usability have increasingly advocated for inclusive design, as opposed to designing for accessibility as an end in itself. One reason for this shift is the realization that a design element targeted toward a specific disability may be inaccessible or otherwise undesirable for others. Inclusive (or universal) design—and its goal of addressing the needs of the widest possible audience, including those with disabilities and those without—has benefits for a broad range of users, especially considering that disability represents a spectrum of needs and is a category that you can fall out of and into throughout life.[3] Ronald L. Mace et al. argue that "designers must consider the entire lifespan, including periods of temporary disability, of individuals who may wish to use the space or product being designed.[4] Inclusive design creates options for users, whether they are disabled or not. As the classic examples of the automatic garage door opener and the curb cut illustrate, users may have any number of reasons for preferring an inexpensive consumer product or structural element designed for accessibility, whether or not they are disabled.

Inclusive design's imperative to keep a range of preferences and needs in mind throughout the design process is equally relevant in web design, where it is desirable to give your users options so that they can navigate your site's content in multiple ways accord-

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ing to their needs, preferences, and learning styles. As George Williams has argued in the case of the digital humanities, "whether in a physical or a digital environment, designers are always making choices about accessibility. However, not all designers are aware of how their choices affect accessibility. Universal design is design that involves conscious decisions about accessibility for all, and it is a philosophy that should be adopted more widely by digital humanities scholars."[5] One frequently cited example of the absence of usability in web design is in university websites, a fact lampooned in a cartoon created by XKCD featuring a venn diagram of the information that visitors to university websites are looking for (application forms, department lists, campus maps) versus the information that they actually find (mission statement, letter from the president, listings of campus events).[6] According to Mark Greenfield, a web designer for SUNY Buffalo, "people who really practice the principles of user-centered design are still a minority."[7] In some cases, mobile versions of websites turn out to be more usable than the websites they are based on because they represent a streamlined, uncluttered design with an emphasis on crucial information. Overall, designing a website with inclusivity and usability in mind, both in terms of navigation and information retrieval, best meets the needs of most users.

Likewise, there is a connection between visual design and usability that is commonly overlooked, especially in library and university websites that are highly focused on delivering content and helping users navigate complex paths to information. In fact, designing a site with visual appeal, as opposed to focusing on including the largest possible amount of information, can support both usability and communication. Describing the "aesthetic-usability effect," William Lidwell, Kritina Holden, and JIll Butler explain that "aesthetic designs look easier to use and have a higher probability of being used, whether or not they actually are easier to use. More usable but less-aesthetic designs may suffer a lack of acceptance that renders issues of usability moot."[8] In other words, paying attention to visual design in creating online materials helps bolster usability.

While we know that both visual and inclusive web design helps a broad range of users (including those traditionally defined as disabled), we often don't think enough about the ways that visual and inclusive design enhances learning for students. In order to highlight the importance of visual and inclusive design elements in creating online learning materials, this chapter draws on the *Beyond Plagiarism* website, an online project aimed at teaching students about responsible source use at the University of Michigan.[9] In addition to creating content for the *Beyond Plagiarism* site, it was crucial to take inclusive design elements into account both for the visual aesthetics *and* to meet our learning goals. In designing the site, we drew on principles of inclusive design to achieve pedagogical and accessibility goals by breaking down a text-heavy, conceptually rich discussion of plagiarism and making it easy for students to understand and absorb. According to user testing, after the material was designed on the site, the modules were seen as both visually appealing and easy to navigate and comprehend. Likewise, the site scored a high accessibility rating from the WAVE accessibility toolbar extension for Firefox.

In this article, we will highlight the most crucial elements of inclusive design for increasing accessibility and learning in online instructional materials that pay attention to different learning styles and needs. Additionally, we will draw on examples to demonstrate how using visual design techniques improves accessibility for all users. As we will argue, attentiveness to visual design can help achieve accessibility and pedagogical goals in a variety of online learning settings.

Project Development and Design

The idea for the *Beyond Plagiarism* website emerged from a series of conversations among librarians, writing program administrators, and campus IT staff after a publisher approached the university about campus-wide licensing of a grammar handbook. Although we did not ultimately decide to acquire the handbook under consideration, the vendor demonstration did

lead to a conversation about what kinds of gaps an online resource directed at the entire campus could fill. The University of Michigan is a large, decentralized campus, where writing classes are taught across multiple departments and schools. Although the writing program is overseen by a central unit, the Sweetland Center for Writing, it was seen as desirable to create an online resource that could be used across campus in order to ensure that all students had been taught about the responsible use of sources. Although many online anti-plagiarism tutorials exist, we wanted to focus on teaching students how to integrate sources into their writing in a way that was both responsible and effective, as opposed to focusing on ways to avoid or, as in the case of software like turnitin, catch plagiarism.

The initial group working on the *Beyond Plagiarism* project consisted of the Associate Director of the Sweetland Writing Center, the Librarian for English Language and Literature, the Director of Learning Programs and Initiatives at the undergraduate library, several graduate students in the Humanities, and graduate students from the School of Information. The site was conceptualized to contain four separate lessons, which could be followed sequentially or could be used independently. Each lesson would also contain quizzes for users to test their knowledge. Originally the quizzes were created in our Learning Management System (LMS), which allowed faculty to use the quizzes and grade the results in their courses. The content was largely written by the graduate students in the Humanities, while the graduate students from the School of Information created a framework for the site using WordPress. Once the first lesson was written, the group consulted a web content specialist and designer to talk about ways to make the content, which was primarily text, visually engaging.

The challenge in producing the content and designing the site was to translate the graduate students' expertise in teaching writing in an in-person context to an online medium. Because of the complexity of the topic, the materials as originally drafted included lengthy narrative sections that required sign-posting and other design elements to create a digestible and pleasing online learning environment. Considering that the web is a highly visual medium where it is difficult to engage with long texts, our initial design efforts were aimed at visually streamlining the material, thus making it easier to absorb and pedagogically effective. Our efforts toward visually streamlining the material were also in line with our visual and inclusive design goals.

Considering these challenges, as well as our pedagogical goals, we designed the site with the desired outcomes in mind. According to Jared Spool, "Design is the 'rendering of intent.' The designer imagines an outcome and puts forth activities to make that outcome real."[10] In the case of this project, we intended to create a website (with a target audience of undergraduate students) that would teach users how to incorporate source material into research projects. The website that we produced uses layout, color, navigation and hierarchy to create an engaging and visually clean website that is also user friendly. The site's design allows students to have the experience of learning about and focusing on the concepts without having to learn how to use the site, create an account, or click around looking for the section they need. It also creates a welcoming environment for a subject that is often anxiety-inducing for students and scholars alike. The following sections describe, in detail, those design decisions and how they contributed to pedagogical and visual design goals.

Design and Accessibility

Due to the text-centered nature of the content, some preliminary work needed to be done to prepare the material for the web. A visual and structural hierarchy and navigation were created, the text was chunked, a color palette was selected, and transcripts and captioning for text, video, and images were created. We adhered to universal design principles that made the website aesthetically appealing, accessible, and user-friendly. The design principles we used and their benefits to accessibility are discussed in detail below.

Visual and Structural Hierarchy

Although the original text was divided into four modules teaching particular concepts, we needed to create an even more hierarchized structure in order to make the materials easy to navigate both within individual pages and when moving from section to section. Using headings to break up the text to create a structural and visual hierarchy is essential for all documents both print and online. When text is broken into headings on the web, it helps users to be able to scan and quickly understand the basics of the content they are viewing and it allows people with low vision using screen readers to navigate and scan the page using headings. Each lesson title on the site is coded as a Heading 1 and within each lesson the structure is revealed. Users can easily see how many sections are in a lesson and the location within the lesson. It is also important to number headings in consecutive order: Heading 1, Heading 2, Heading 3 etc., rather than skipping a level. Often the html formatting for Heading 1 or 2 is larger than most people would like and instead they select Heading 3 or 4, which is formatted in smaller text. Using the heading numbers in order is not simply for design, however, but it is also crucial for people using screen readers. If content jumps from Heading 1 to Heading 3, they may be wondering if they have missed content.

Chunking

Due to the length of each section (16 pages each), breaking content into headings and subheadings was not enough on its own to maximize readability of the material. The content also needed to be chunked into separate pages based on concept. Breaking the content into separate pages or chunks allowed each sub-concept to be isolated and therefore simple enough to be consumed directly and independently. Dividing the material in this way makes the concepts easier to understand, and users with reading and attention issues benefit from shorter sections. Lidwell, Holden, and Butler explain that "the maximum number of chunks that can be efficiently processed by short-term memory is four, plus or minus one."[11] We kept this concept in mind as we divided the material, and the overall design of the site as four modules reflects our efforts not to overload the reader. Chunking information makes it easier for people to recall and retain information, as well as simplifying design. Breaking the content into chunks provided the site with a structure many students are familiar with and allowed us to provide consistency throughout the site. We also made sure to include a fair amount of white space, which helps users focus on the content by not cluttering the design with non-essential information.

Color Palette

The color palette was selected based on the university's color palette and contains desaturated analagous colors on the color wheel. The desaturated colors selected are better for efficiency and performance.[12] They allow us to visually highlight elements on the page such as headings and important tips or information, but aren't distracting.

To accommodate users with color impairments, color isn't the only way the site conveys meaning. The use of shapes and text to draw attention to important tips and information means that users with and without color impairments can interact with the site in the same way.

Captions, Transcripts, and Audio Descriptions

Transcripts and synchronized captions were provided for all videos and text on the website. Providing these supplemental materials allows users with different types of learning styles to engage with the content in a variety of ways and aids those with audio and visual impairments. The Web Accessibility in Mind project explains that, "In many cases, the techniques for making web content accessible to people with cognitive disabilities are nothing more than techniques for effective communication."[13] This idea reaches beyond captions and transcripts and also includes concepts like chunking which increase site usability and learning for all types of users.

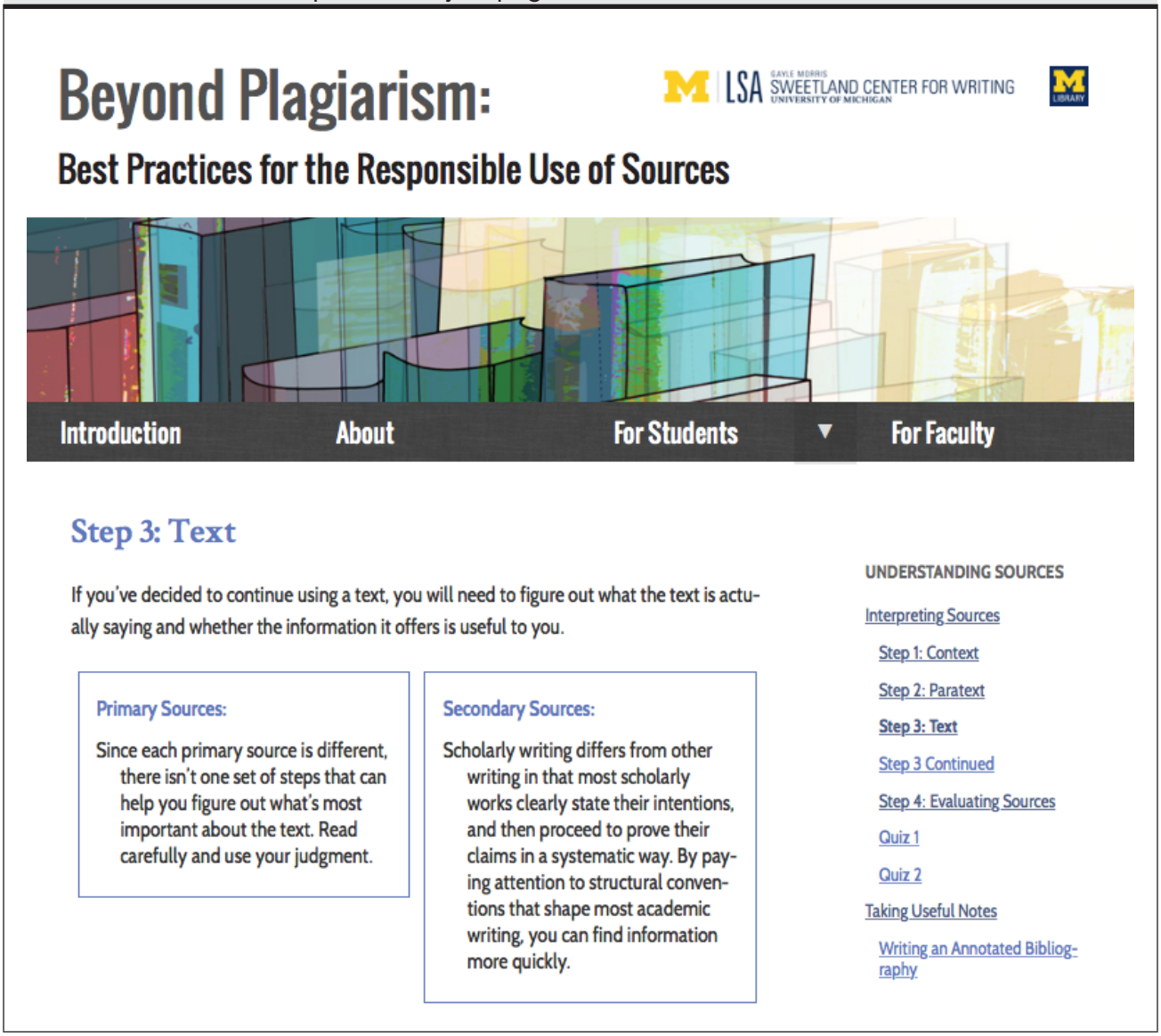
Navigation

In creating the *Beyond Plagiarism* site, we implemented a layered navigation scheme that only shows users 1–2 layers of navigation at a time. Initially, users only see the lessons or main sections of the site. Once a user has selected a lesson, the navigation menu for the lesson is fully revealed, showing all the sections, sub-sections, and the user's place within the lesson. Users with screen readers can use links in addition to headings to navigate websites. This type of navigation helps people to only see the information they need at that moment. The *Beyond Plagiarism* site has many pages, and to reveal everything at once would be overwhelming and potentially confusing.

Additionally, all of the links in the navigation and within the site consist of meaningful text rather than "Click Here." This allows people with and without screen readers to know where the link will lead them before they select it.

Overall we created a responsive website with simple, consistent navigation and consistently displayed hyperlink text. As we found in our usability testing,

FIGURE 1
Screen Capture of the Beyond Plagiarism Website
http://www.beyondplagiarism.sweetland.lsa.umich.edu/



our users are able to navigate the site without any instruction. Additionally, users familiar with online learning modules are accustomed to self-guided navigation through modules or sections.

Usability Testing

After adding the content to our site, we decided to conduct some usability tests to find out if our design and accessibility techniques actually created a usable site. We also wanted to test out the content of the site and discover if students found it useful and understandable. The following section describes the methodology and results of our usability tests.

Focus Group Description

Two focus groups were conducted with undergraduate students. Participants were asked to read a module and take the associated quizzes. Once they were finished, they were asked about their experiences and reactions. A moderator asked questions from a script with follow-up questions as appropriate.

- Methodology: The first focus group had six participants, and the second focus group had two participants.
- Method of participant recruitment: Distributed e-mail through library student supervisor group and Writing Center student group, as well as through undergraduate students in the English department.
- Recording methods: audio recorder and observers' notes.

Results

The eight undergraduates who participated in the focus groups ranged from sophomores to seniors, and their majors varied from the humanities to social sciences and health sciences. The main goals of the focus groups were to determine how long it would take students unfamiliar with the site to navigate and work through the modules and answer the quiz questions. Additionally, we wanted to determine their reactions to the content and how it was presented. In the first focus group, students were given 30 minutes to work through the module(s) and answer the questions. It took students on average a little over 12 minutes to finish reading the content in the first module. Several students had time to answer the quiz and begin the second module; however, the majority did not finish both in the 30 minutes.

Students in the second focus group were given an hour to go through one module and complete two accompanying quizzes in our LMS. It took the students approximately 50 minutes to complete the task.

The participants found the site and the content on the site visually pleasing and easy to navigate. Students specifically mentioned that the "Color palette made text easy to follow" and that the "Setup was good and generally easy to use."

Each lesson has a metaphor to help illustrate a strategy and/or technique for using sources in writing. Students had varied reactions to the metaphors, including being unsure as to the purpose of that content and simply not liking the illustrations that accompany the metaphor. Other students seemed to enjoy this part of the lessons, saying that "it just gave you something to relate to in really simplistic terms."

Students in both groups found the content on the site easy to navigate while the quizzes in the LMS were found to be challenging to navigate across the board. The quizzes often introduced new and complex examples rather than incorporating examples from the lessons, thus requiring students to read and comprehend new passages. The multiple choice questions presented another point of confusion and difficulty, especially ones in which more there was more than one potentially correct response. The quiz questions were seen as challenging, which would be expected if they were being used for a grade, but the students didn't expect this from a supplemental website. Overall, the focus groups revealed that the quizzing interface in the LMS was cumbersome and clunky and looking at the often lengthy question text and the multiple choice options simultaneously was impossible.

Recommendations

It became obvious after these focus groups that, de-

spite the mixed response to our illustrations, our site and content were working in the intended ways, but the quizzes were in need of revision. To address the clunky and cumbersome LMS quizzing interface, we found a way to include the quizzes directly in the website. After redesigning this portion of the site, students can now test their knowledge in the site at the point of need and receive immediate feedback. Faculty and instructors can receive information on how to incorporate the quiz content into their LMS if they wish to assign it for a grade in their courses.

Faculty Survey

In addition to finding out what undergraduate students thought about the site, we wanted to gauge faculty interest in this project. As mentioned above, we are a large, decentralized research institution, and we therefore decided to target upper level writing and first-year writing faculty in order to focus on instructors who have contact with the broadest spectrum of students across the university. A survey was distributed to the selected faculty via email. They were asked to look at the *Beyond Plagiarism* site and answer questions about the content, site, and course needs. Our goal was to determine if faculty found the content useful and if they would consider using the lessons in their courses.

Results

We had five faculty respond to the survey across the social sciences and sciences. They ranged in teaching experience from fairly new to very experienced. All five of the participants require the use of primary and secondary sources in their courses. The survey respondents found the content in the lessons useful, ranging from somewhat to extremely useful. As one respondent put it, "I think if a student will take the time to use the module it could be very useful… [However,] unless this was part of the curriculum I'm not sure many would visit voluntarily." A couple of the respondents found the illustrations distracting: "I think your content is useful, but your graphics are clunky and this might turn off students." The faculty also found that the content doesn't always speak to their specific discipline and/or sources, explaining that "Intended audience is crucial to understanding primary sources." Others focused on the importance of teaching students to consider who produced the sources or data they are relying on: "Who produced the data? Who made the measurements?"

Recommendations

The results from the faculty survey indicate that the overall concept of the lessons is perceived as being useful, although it is not clear whether or not all faculty would assign something like this in their courses. The content is predominantly geared toward the humanities and more effort will need to be made to incorporate social sciences and science resources. At the same time, adding more social sciences and science material would add a large amount of content to the site, which may not scale up well. Additionally, it would take extra time and energy to tailor lessons to additional disciplines. The content was created to fill a perceived gap on campus, but without faculty assigning the lessons to their students the site will not be utilized to its fullest extent. We will need a marketing plan and faculty commitment to reach our intended audience.

Future Considerations

This project was a learning opportunity for everyone involved, especially in terms of the importance of good project management to a project's success. This project was designed by committee without the oversight a designated project manager, which has ultimately slowed down the process. Likewise, the size of the core project team, and its division into writers and coders, has made it difficult to implement a cohesive strategy for decision-making and feedback. Overall, the translation from text to design could have been more efficient had the content writers been in conversation with the designers from the beginning. Designers and web content experts should be consulted at the beginning stages of a web-based project to help shape the project with an eye for web writing, design,

and accessibility. This will save time and energy reshaping content in order to meet web requirements.

In addition to the importance of strong project management and collaboration between designers and content producers from the outset, this project also highlighted the sheer amount of work that goes into creating effective and accessible online learning materials. As many educators who have taught online courses have come to understand, teaching online is not the same as turning a lesson plan into a narrative for students to read, nor is it enough to post even the most thoughtfully crafted materials without considering medium, design, and accessibility. Even when content and design line up perfectly, it is crucial to have clearly delegated project management to insure that the project continues moving forward. Although there may be a sense among some administrators that online learning can be done more cheaply and with less labor than in-person teaching, our experience with this project has amply demonstrated that designing effective online learning tools requires expertise and considerable time commitment.

Notes

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