

Lecture #25: Human-Computer Interaction and Web Design

CS106E, Young

In this lecture we study the field of Human-Computer Interaction (HCI). We begin with a discussion of what HCI is and consider some past successes and current topics of research. We also consider fields of study related to HCI.

We then focus on the User-Interface Design Process, looking at the steps one might take and the techniques used. We apply the process to the development of an online bookstore.

We then turn toward some web design issues. We consider different font choices and how they are perceived. We look colors, learning a new color model—Hue, Saturation, and Brightness—and show how this model can be used to create a color wheel. We then look at some different color schemes that can be defined using a color wheel.

We end with a quick look at website layout, and a discussion of navigation issues which should be taken into account when designing a website.

Human-Computer Interaction (HCI)

HCI is an important field of study in computer science.¹ It focuses on how to improve interaction between humans and computers. This includes:

- Exploring new ways for humans and computers to interact with each other.
 - o Past successes include:
 - The Windows, Icons, Mouse, and Pointer (WIMP) interaction we now take for granted.
 - Widespread use of Graphical User Interfaces (GUI).
 - o Hot current topics in HCI include:
 - Virtual and Augmented Reality
 - Speech Commands
 - Gestures
 - even Brain Computer Interfaces are under study.
- Development of procedures and tools to build better user interfaces.

¹ The field is also sometimes referred to as Computer-Human Interaction (CHI) and, in fact, the most important conference for the field is called CHI. However, HCI is now generally preferred over CHI. HCI instead of CHI emphasizes the importance of the Human in the interface.

Related Fields

HCI is interdisciplinary. Related fields include:

- Psychology
 - o Better understanding of human cognition, such as how humans perceive colors or limitations of human memory, can create better computer applications.
 - o Some techniques used by psychologists to study and understand humans can be used to study how users interact with computer applications.
- Graphic Design
- Ergonomics
- Sociology / Ethnography
 - o As many modern applications involve multiple users, sociology has obvious benefits.
 - o In addition, sociology and ethnographic studies of a workplace can lead to development of appropriate, suitable applications.

User Interface Design Process

Let's take a look at some steps that might be used in developing a user-interface.

Needfinding – We need to start by considering what our user's needs are. This may involve going into a workplace and observing current processes as well as carrying out interviews with potential users.

Determining Tasks and Roles – We consider what sorts of tasks our user will need to carry out. We consider the different types of users that might be using our applications.

Prototyping, Testing, and Iteration – We determine what our interface should look like and develop prototypes to test our interface. Developing the correct interface is very difficult. We take an iterative approach—repeatedly testing, refining, and then retesting our interface with real users until we get it right.

Prototyping Techniques

Prototyping can be **low-fidelity (lo-fi)**, medium-fidelity, or **high-fidelity (hi-fi)**.

- At the lowest fidelity, we can simply have paper **sketches**. A user can tell us where they would click on the sketch and we can whip out a different paper sketch showing them what would appear on the computer screen next.
- We can increase fidelity by actually drawing out the interface on the computer. In a **wireframe** the UI designer draws out the different elements on the webpage, but doesn't bother worrying about the graphic details such as the font or the colors used.
- We can try to make our drawings appear just as the user would see them on a computer adding in typography, color, and shading. This is sometimes called a **mockup**.
- Prototypes may have some specific buttons on the interface hard-wired to carry transitions between screens.

While higher fidelity prototypes may give the user a more realistic feel for how the application will act, they take much more time to develop and will reduce the number of iterations we may be able to carry out. In addition, if too much energy is put into a prototype, the development team may be unwilling to discard it, even if testing proves it isn't the best interface.

Case Study: Bookstore Website

Suppose I decide that a smart investment is to build a new website to sell books. How might our user-interface design process play out?

- I need to spend some time considering who my website visitors are; why they are visiting my website; what level of technical expertise they have; what sort of devices they are using to visit my website; and what their Internet connection looks like.
- I make a list of potential tasks. Note that a website that works well for one of these tasks, may not work well for the other tasks. These might include:
 - o Visiting my website looking for a specific book.
 - o Visiting my website interested in a specific topic, but not having a specific book in mind. We might want to further consider how specific the topic is.
 - o Visiting my website because they're bored, and are just looking to waste time. We might further subdivide this, as someone glancing at the website while waiting for a coffee, might have different needs than someone with more time sitting down during a commute home via bus.
- I make a list of potential customers. I can create personas, which will make our future users feel more personal to the design team. We can speak about how a particular persona might do with specific features or tasks – for example: “how would ‘John’ handle this particular task.”
- Here are some sample personas:

Nicki is a young professional, who is very busy. She visits the website using her cell phone. She has moderate speed Internet, but her connection is sometimes spotty if she visits during her bus ride home.

Patrick is a senior citizen. He has low technical expertise and visits using an old Windows '95 desktop computer. He does, however, have a decent Internet connection.

Maddie is a junior high school student. She has moderate technical skills. She visits on a low-end tablet.
- For prototyping, we might develop actual webpages with HTML and CSS. However, rather than having them work completely, we can hardwire in results. For example, we might have a “search” text field and button, but regardless of what the user enters in the text field, we always give them the same results.
- I bring in testers who fit the user profiles that we developed. We then ask them to carry out specific tasks – “suppose you're looking for the new best seller by ‘Jane Cardinal,’ how would you do that?” or “suppose you're looking for a book on South American history, what would you do?” We watch how they carry out the tasks and evaluate how easily they can navigate our interface.

Website Design: Branding

- Developing a unique look and feel for your website is important.
 - o You want a user to remember your website.
 - o If your website looks just like every other website out there, they won't remember it.
- Creating a memorable and distinct look that users will remember is sometimes referred to as **branding**.
- Important elements that will help distinguish your website and develop your brand include:
 - o Logos
 - o Typography / Fonts
 - o Colors
 - o Layout

Typography

- Typography deals with how our text appears on the webpage.
- One key component of typography is the font family used for a website. There are several distinct font categories. These are:

Serif – Some fonts have *serifs* on their letters. Look at the following text:

SERIF

Note in particular the tick marks on the ends of the letters as highlighted below on the “F” on the right side. These are the serifs.



Sans-Serif – Other fonts do not have serifs. We call this *sans-serif*. Look at the following text which lacks serifs:

SANS-SERIF

Here I have an “F” on the left without serifs and an “F” on the right with serifs:



Monospace – Most fonts have variable spacing. In a variable-space font, letters can have different widths. Note how the text sequences below both contain five letters, but the second sequence is much wider than the first:

MIIM
MIWIM

In a *monospace* font all the letters are the same width. Here are the same text sequences written using a monospace font:

MIIM
MIWIM

- So, how do we choose when to use each type of font? In general, according to graphic artists:
 - o Serif fonts give a feeling of formality. Using them will make your website seem more authoritative.
 - o Sans-Serif fonts will make your website feel more contemporary.
 - o Monospace fonts are generally used to indicate computer input or output. They are particularly useful when writing computer code, as they help keep all your code lined up properly.

- Consider the following websites and decide what type of font they will use before visiting the website.
 - [The New York Times](#)
 - [Washington Post](#)
 - [MSNBC News](#)
 - [Apple Computer](#)
 - [IBM](#)
 - [Mandarin Oriental New York](#) (a 5-star hotel)

Color

Color is a very important element of website branding. Before we can discuss how to select website colors, though, we need to readdress how colors are defined and learn how to make a Color Wheel.

HSB / HSV

- As you will recall from our discussion much earlier in the quarter on how computers represent images, computers generally represent colors as Red, Green, and Blue (RGB) intensities.
- We also saw that printers use Cyan, Magenta, Yellow and Black (CMYK).
- There is another way to define a color. This method defines the Hue, the Saturation, and the Brightness of the color. The Brightness is sometimes referred to as Value. Thus, this color model is referred to as HSB or HSV.²

- Hue refers to the wavelength in the color spectrum



- Saturation controls the intensity of the color. Reducing Saturation leads to a more washed out look. Here are four samples of red, each with the same Hue, but with decreasing Saturation.



- Brightness controls the intensity of the light. Here we have the same value of Red and four different brightnesses.

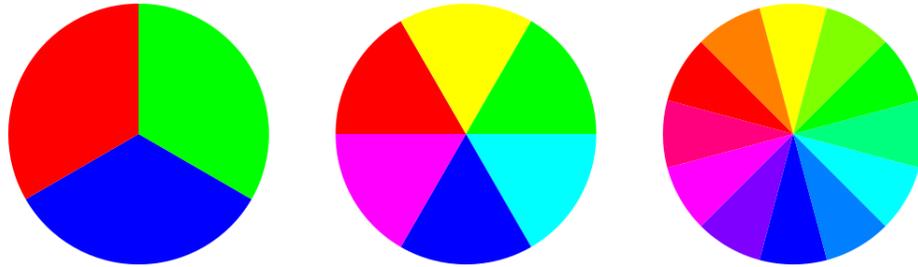


- There is a mathematical formula to translate between RGB and HSB/HSV.
- Internally the computer uses RGB, however, when choosing colors, the HSB/HSV model may be preferred.

² You may also run into HSL (Hue Saturation Lightness), this is similar to HSB/HSV and the Hues are the same between the two models but the SB/V and SL components are a bit different.

The Color Wheel

- A color wheel is a tool for choosing colors.
- We can create a 3-color Color Wheel by taking our three primary colors and spreading them onto a wheel. We can mix each color with its nearest neighbor creating a 6-color Color Wheel, and mix neighbors again to create a 12-color Color Wheel. This process can continue, but we'll stop at 12 colors.
- As we discussed in the Computer Representation of Images lecture painting uses different primary colors than computer monitors, so if you go to an art store, you'll discover one set of color wheels for painting, and another for computer work. We of course will be concerned with the computer, so here are 3-color, 6-color, and 12-color Color Wheels based on Red, Green, and Blue primary colors:



- The colors in the Color Wheel represent the Hues in the HSB/HSV model.

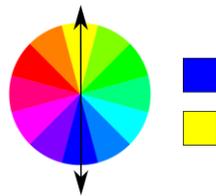
Color Schemes

With the HSB/HSV model and our Color Wheel we're now ready to make some Color Schemes.

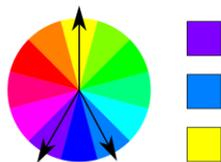
- One simple scheme is to choose a single hue and just vary the saturation or brightness. This is called a **Monochromatic Color Scheme**. This leads to color choices like this:



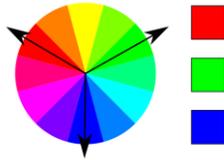
- Using the Color Wheel, one scheme is to choose colors on opposite sides of the color wheel. This is called **Complementary Colors**.



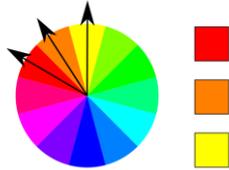
- Another scheme takes a color on one side of the wheel and then two colors on each side of the complementary color. This is called **Split Complementary Colors**.



- A **Triad Color Scheme** uses three colors equidistant from each other.



- An **Analogous Color Scheme** uses colors next to each other on the Color Wheel.



Layout and Navigation Issues

- Your overall layout can contribute to your website branding, if you have a unique look.
 - However, make sure your layout is usable. Trading off usability for artistic freedom is probably not a good way to increase your website traffic.
- Make sure users have a clear sense of what is on the website.
 - Remember a webpage that the user doesn't know about and can't easily reach is close to useless.
- Have a consistent means of navigation throughout your website – don't use a left-hand sidebar on some pages and then a top-navigation scheme on other pages.
- Remember, users won't necessarily come in through the main homepage.
 - If your website is useful, visitors may send friends links to the inner pages on your website (this is sometimes referred to as *deep linking*).
 - If someone arrives at the website via a deep link, you'll need to show them where they are in the context of the wider website, and provide them a way to the rest of your content.
- Don't lead visitors into a dead-end with no way out. I continually see student websites which include webpages where a visitor has no means of getting back to the wider website without hitting the web browser's back button. This is poor design.