Week 8: Website Optimization

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Overview

Last week, we learned about cookies and how they are used on web pages to store information about the user. This week, we will cover methods for optimizing our website in a few ways. By the end of this week, you should be able to look at a webpage and find ways to optimize it so that it performs better for users.

What's Due

- Optimization Challenge
- Usability/Accessibility Discussion (Two Posts)

Midterm

The Midterm due date has been moved to April 4th to provide all of you with a little more time to work on it. I know this semester has been stressful for some of you and I think extra time will result in higher quality work. If you need help with it, please come to office hours and I can walk you through creating layouts, features, and other things.

In total, you need to create 3 mostly done pages. The layouts for these pages should be complete. However, the content doesn't need to be finalized. You can use lorem ipsum for the text and image placeholders. For more details about requirements, please see the Final Project Description file on Blackboard→Course Materials→Final Project.

Website Optimization

It is important to optimize our websites so that our they can be found by search engines and perform well for users regardless of their screen size, browser, device, or personal abilities. In the next sections, we will go over various methods for improving our web pages so that they are more user-friendly and perform better across multiple browsers or devices.

Some of the methods have overlapping goals since a lot of the concepts are similar in terms of optimization. For example, making sure that images are optimized is good for performance and usability/accessibility. Large images will slow down the page load and users with low bandwidth will have a harder time accessing content.

Usability/Accessibility

These two concepts are different but have many overlapping ideas. We can add code or build features to aid users and prevent confusion with our content. These features sometimes require a bit more effort to create, but they are worth it. They go a long way in enhancing a user's experience and can result in positive outcomes from a business perspective.

Accessibility addresses discriminatory aspects related to equivalent user experience for people with disabilities. Web accessibility means that people with disabilities can equally perceive, understand, navigate, and interact with websites and tools. It also means that they can contribute equally without barriers.

Usability is about designing products to be effective, efficient, and satisfying. Usability includes *user experience design*. This may include general aspects that impact everyone and do not disproportionally impact people with disabilities. Usability practice and research often does not sufficiently address the needs of people with disabilities.

Look at the examples below which are based on an imaginary ball to gain a better understanding of these concepts. Red indicates that the situation is not fully usable or accessible while green means that it is both.

Usable but not accessible (bad): A ball in good condition but located on a high shelf where some people can't reach it. In this case, people could play with the ball, but some might not be able to get to it.

Accessible but not usable (bad): A ball on a table where everyone can reach it, but it has holes in it. In this case, everyone can reach the ball, but no one can play with it since it is broken.

Not usable or accessible (bad): A broken ball located on a roof. In this case, the ball can't be reached by anyone, and even if they could reach it, they couldn't use it since it is broken.

Usable and accessible (good): The ball is on a short table, and it is in good condition. Everyone can reach the ball it can be used as well.

It is important to build your website to be as accessible and usable as possible. The typical goal is to receive as much traffic to your website as possible. If your pages aren't easy to navigate or lack some of the accessibility and usability features included below, it will result in a lower rate of visitors to those pages.

Think about the times you've visited a page that loaded slowly, had intrusive popups, or used features which hindered your ability to use that page (sound playing automatically, paywalls, etc.). You may have left the page immediately or decided to not use the site again after that visit. Users coming to a website don't want to have their time wasted and be unable to locate something they are looking for.

There are many ways to incorporate usability and accessibility in your pages. I've included a few lists to get you started with thinking about the different ways a web page can be enhanced. This list isn't exhaustive, but it's useful for reviewing before publishing any pages.

HTML/Text

- Use alternative text with images
- Identify page language using the lang attribute on the html tag
- Use HTML to convey meaning and structure
- Use labels with forms
- Include appropriate roles for elements (aria roles)
- Make all interactive elements keyboard accessible (tabindex attribute)
- Use easily identifiable and accurate links
- Don't use HTML tables for layout. Use semantic markup or divs instead.
- Use language appropriate for the reading level of your audience

General Styles

- Ensure color contrast is high (https://webaim.org/resources/contrastchecker/)
- Don't use flashing or blinking elements
- Use web safe fonts with appropriate backups
- Structure content appropriately (use enough white space with margin/padding)
- Use the line-height and font-size attributes to help your typography be legible
- Avoid using colors alone to convey meaning
- Use consistent colors across your website
- Break up long pieces of text content with headings/lists
- Avoid using excessive lists of links

Features

- Use a "skip to main" button
- Optimize content so pages load quickly
- Give users enough time to read content in slideshows or other interactive items
- Ability to enlarge font or switch text to dark mode (dark background/light text)

Responsive Design

- Keep the most important content on the screen, remove anything extra
- Make font readable on smaller screens
- Give tappable buttons/links enough space (padding and margin)
- Minimize your navigation menus
- Remove unnecessary images on smaller screens
- Use percentages and relative units such as em in your page

Online Resources

- https://www.w3.org/WAI/fundamentals/accessibility-usability-inclusion/
- https://www.usability.gov/what-and-why/user-experience.html
- https://www.usability.gov/how-to-and-tools/methods/writing-for-the-web.html

Search Engines

Search Engine Optimization (SEO) revolves around building your website in a way that allows for it to be found more easily by search engines when a user makes a query for information. For example, if a user does a search for "Cheetahs," a search engine will pull up relevant results from pages which have information about Cheetahs. The top results will typically have keywords, links, and other materials related to that topic which help them rank higher than other pages.

With the proper implementation of SEO, you can give your website a better chance of appearing on the first few pages of search results. Users typically don't go beyond a page or two in the search, so it's very important to get your page ranked as highly as possible.

There are a few methods for achieving quality SEO on your website. Some of them are related to the performance of the website while others are related to the content on the website. Websites that aren't responsive are generally ranked lower than those that work on multiple devices/screen sizes. As for content, using appropriate keywords and structuring your information well helps your page become more findable. If other websites link to your website, that generally will improve its SEO as well.

Here are some ways to address SEO on a website:

- Using appropriate keywords/phrases
- Having relevant content
- Including links to other related sources
- Having other pages link to your website
- Usage of title and meta tags
- Good performance on any device
- Usage of Metadata tags

Metatags

These tags are used to provide information about the HTML document that cannot be conveyed or represented by other HTML elements such as link, script, style, or title. The information in these tags is typically used by search engines, browsers, and screen readers.

Metatags almost always go inside of the <head> tag of an HTML document and do not have ending tags. The ones listed in the examples below are some that I have used in our assignment/examples files as well. This is not an exhaustive list, but these are the ones you should include in your pages for this course.

Examples

<meta charset="utf-8"> - This defines the character set for the HTML document.

<meta http-equiv="X-UA-Compatible" content="IE=edge"> - This is important to include if you plan on supporting earlier versions of Internet Explorer (IE). It will tell the browser to use the

latest version of IE available on that person's browser. It should be one of the first tags in your <head> tag.

<meta name="description" content=""> - This is used to describe the content that will be found in the HTML document.

<meta name="author" content=""> - This is used to mention the author of the document. It's useful for articles/blog posts.

<meta name="viewport" content="width=device-width, initial-scale=1"> - This is used to help your content scale to the user's device. It should always be included as leaving it out will result in your page displaying weirdly on smaller screen resolutions.

Online Resources

- https://developer.mozilla.org/en-US/docs/Web/HTML/Element/meta
- https://moz.com/blog/the-ultimate-guide-to-seo-meta-tags
- https://developers.google.com/search/docs/advanced/guidelines/webmaster-guidelines (This is specific to ranking well on Google – not required reading but interesting)

Cross-Browser and Device Compatibility

There are many different browsers and devices that users will use to access a website. It is impossible to build your website in a way that will work on all of them. However, if you test your web pages often, use responsive design, and include a few simple tools, your pages should work on most of them.

CSS Reset

A commonly used and powerful tool for web developers is the CSS reset. Most browsers have different default styles for HTML elements and a web page will look different in each one. One way to solve this issue is by using styles to "reset" the CSS across all browsers. At the very top of a CSS file, you would include styles for common elements on the page to standardize them.

One of the most popular CSS Resets being used today is Eric Meyer's CSS Reset. I've provided the link in the examples section below. It targets many different HTML elements and sets their padding, margin, and other styles to baseline levels. The goal is to make all the elements have a standard style across all browsers.

The one downside to using the reset is that you must add back in styles that were reset by it. For example, paragraph tags typically have 16px of margin on top and bottom inside of browsers such as Google Chrome. However, the reset would set that to 0, and so you must add it back in or your content wouldn't have appropriate spacing.

Responsive Design

We've already covered responsive design in this course, so I won't go over it again in detail. However, it's important to use it for device compatibility. If your content has a consistent appearance across browsers, that is great. However, the content should work well at various screen sizes as well. As mentioned in prior lecture notes, you shouldn't base responsive styles on specific devices. You should examine your content at different screen sizes and adjust it accordingly. It should also be tested using emulators (Google Chrome responsive tool, BrowsterStack, etc.). This will ensure that it works on as many devices as possible.

Other Tools
Many tools exist to help you with cross-browser compatibility testing. I've listed two below along with an explanation as to what they do.

https://caniuse.com/
This website will let you know what browsers currently support or do not support a CSS property or feature. For example, Flexbox is supported in most browsers, but there are bugs with it in IE 10 and 11.

https://modernizr.com/docs
This is a JavaScript tool which detects a browser's capabilities and allows you to handle coding for them accordingly. For example, if a browser didn't support a given feature, the JS code would add a certain class to the html tag. With that class added to the HTML tag, you could reference it in a CSS declaration to provide specific styles in any situation.

Online Resources
- https://developer.mozilla.org/en-US/docs/Learn/Tools_and_testing/Cross_browser_testing/Introduction#development
- https://testsigma.com/blog/9-tips-to-avoid-cross-browser-compatibility-issues-from-the-start/
- https://meyerweb.com/eric/tools/css/reset/ **(Use this for the assignment)**

Performance
It is better to have your pages load quickly as users tend to be inpatient and will leave a page if content takes a long time to appear. You can only work on certain aspects of this as the user's connection or server speeds are outside of your control. In this section, I will provide some basic tips and tools to help you improve your page's performance

Page load is determined by a few things such as the user's connection speed, the speed of the server where the content being requested is stored, file size, and the size of resources attached to that file. Users typically have pretty good connection speeds, but you still want to try to reduce how long it takes for all your content to load. Here are a few basic tricks to try and achieve that goal:
- Reduce the size of images on the page
- Remove redundant or unused code
- Minify code/reduce page requests

Working with Images
It is very easy to force a large image to look small in a browser window using HTML or CSS. However, even if an image appears small on the screen, the full file must be downloaded. If it is one large image, that might not be so bad for a user. However, if there are several images with large file sizes, it would load the images very slowly for a user with low bandwidth.

To optimize an image, you must think about the type of image it is, and the size it needs to be on the screen. Images that need to scale upward such as logos should be used primarily as Scalable Vector Graphics (SVG). Otherwise, you can use image formats such as PNG, JPG, etc. on your page.

If you have a very large image on your website, all you need to do is open it with an image editor and resize it down to a point that is acceptable. Besides this, you should use the height/width attributes for the image in the HTML. If a browser doesn't know how big an image is, it won't reserve space on the screen for it and the view will change until it loads. However, if the image takes a while to load, but those attributes are used, the pages spacing will be correct.

You can use any image editor of your choosing for image optimization. Some free ones are: Paint.NET, GIMP, and Photopea. Your computer also might have one installed by default.

Removing Unnecessary Code/Reducing File Requests

This involves removing extra code that isn't necessary or can be replaced with a shorthand version. Additionally, combining external resources into one file is helpful. Instead of having a CSS stylesheet for every page, you can have one larger CSS file which results in less external requests for documents. For example, imagine you had the following styles:

```
body {font-size: 16px;}
p {
  font-size: 16px;
  margin-top: 1.5em;
  margin-right: 1em;
  margin-bottom: 1.5em;
  margin-left: 1em;
  text-decoration: none;
}
h2 {font-weight: bold}
```

The p tag doesn't need a font-size of 16px since the body tag is being styled the exact same way. The p tag inherits that size, and that line of code wouldn't be necessary. Besides this, we have 4 lines of code to set the margin to 1em for the p tag. We could alter that code to look like the following line while achieving the same result. The first value is for the top/bottom margin, and the second value is for the left/right margin.

```
p {margin: 1.5em 1em;}
```

More examples above are the text-decoration and font-weight styles. P tags by default don't have a text-decoration on them. For the h2 tag, they are bold by default, and so the font-weight: bold style is unnecessary.

Minifying Code

This is straightforward and entails taking your code and decreasing its size. Minified code will have things such as white spaces, hard returns, comments, and other things removed. The result would be code that isn't very readable for users, but the file size would be decreased and allow the file to load more quickly. I've included links to tools below that you can use to minimize your CSS and JS files. However, you can use any tools you'd like as long as they decrease the overall file size.

CSS: https://www.cleancss.com/css-minify/
CSS & JS: https://www.minifier.org/
JS: https://www.toptal.com/developers/javascript-minifier/ (They also have a CSS minifier)

Testing Methods
Like other concepts covered in this lesson, there are free tools out there to assist you with testing your page. I've listed some good tools below along with an explanation of what they do.

https://pagespeed.web.dev/ - PageSpeed Insights – Provides detailed information on various parts of the page and how they are loading. It offers some recommendations for improving your pages speed/rendering.

https://tools.pingdom.com/ - Pingdom Speed Test – Provides you with a grade for your page's speed performance. Different servers from around the world can be chosen with this tool. It also gives you recommendations for how to improve the speed.

Google Chrome Lighthouse Tab – Similar to the other tabs we have seen so far (Console and Application), this tab is a powerful tool for understanding your website and how it is performing. Right-click a page and inspect it. From there, go to the Lighthouse tab and choose as many options as you'd like. You can check Performance, Accessibility, SEO, and other cool things. The report it produces is very thorough.

Examples
A new video will be released on Monday afternoon. This video will cover Optimization in the context of this week's assignment. When it is available, the link will be added to the assignment description.

A PowerPoint document and PDF have also been released under Blackboard → Course Materials → Resources → Usability & Accessibility.

Here's a link to all course examples:
https://www.albany.edu/~cv762525/cinf362/examples/ (coded examples)
https://www.albany.edu/~cv762525/cinf362/videos/ (videos)

Before completing the assignment(s) for this week, please read the "Viewing Your Web Pages.docx" file on Blackboard. You will not be able to submit anything for the assignment without completing that portion first. It is located directly in the Lecture Notes folder.

Optimization Challenge

Due Sunday, March 27th at midnight
Download the "Optimization-Challenge.zip" folder from Blackboard under this week's Lecture Notes or the Assignment folder. Inside of the zip folder will be HTML, CSS, JS, and image files to use for this assignment.

Optimization Tasks
Inside of the HTML, CSS, and JS files, I have placed comments explaining actions to take, or code to add. Your task is to add code to optimize the page as much as possible. I've provided a list of things to do below, but feel free to try additional things as well.

In some portions, I ask you to change the titles or content. For the content inside of the "main" area, you should have all of it be related in some way. The goal is to pretend that the web page is an informational blog/conspiracy theory blog about some random topic. For example, if I chose to make the page about how Turtles are secretly taking over the world, my content might look like the content below. The tag is on the left with the content that would go inside of it on the right. For the h1, you are only replacing a portion of it.

H1: Welcome Stranger, Enjoy My Blog About **the Rise of Turtles**
H2: **Turtle Overlords: How did it all begin?**
H2: **Turtle Origins: A Case Study**
H2: **Eating Habits of Turtles**
H2: **How to Defend Against Turtle Mind Control Techniques**

First Span in ".about" section: "tell the world that **Turtles are going to take over.**"
Second span in ".about" section: "know the truth about **the Turtle invasion.**"

As you can see above, all my main headings/span tags are related to the same topic (Turtles). It doesn't have to be real or serious, so feel free to be as creative as you want.

For the headings in the aside section, you should alter them, so they are related to the images above them. The images are of pineapple pizza and Godzilla respectively. You can use different images in the aside section, but they should still be optimized and sized correctly. An example of something you might include:

H4: Pineapple Pizza: A Culinary Masterpiece
H4: Our Savior Godzilla

SEO & Usability/Accessibility

- Add missing title and doctype tags
- Add lang attribute to the html tag
- Add missing metatags (viewport, description, charset, author, and http-equiv)
- Change headings/text to contain relevant keywords
    - Change "ADD YOUR FAKE TOPIC HERE" inside of the h1 tag (1 total)
    - Change "ADD YOUR FAKE TOPIC HERE" inside of the span tags in the .about section (2 total)
    - Change "ADD A BLOG TITLE" inside of h2 tags (4 total)
    - Change "ENTER TITLE HERE" inside of h4 tags (2 total)
- Add appropriate alt, height, and width attributes to the images (don't say "an image of")
    - The height/width attributes should have the exact dimensions of the image (if it doesn't look perfect on the page, no worries)
- Add a title attribute to the iframe tag
- Add labels to the form for the name/email inputs

Cross-Browser and Device Compatibility

- Add CSS Reset code by Eric Meyer to the CSS file: (https://meyerweb.com/eric/tools/css/reset/)
- Add styles to the "Responsive Styles" section so the page is responsive down to 400px (I have provided 3 media query breakpoints for you to use)

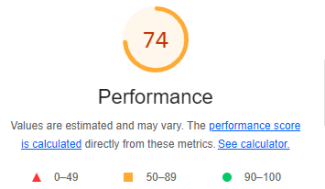
Performance

- Resize the images so they aren't so large (actual size and file size), but still look good on the screen
    - I resized both images to 350px in terms of width.
- Remove redundant lines of code in the CSS (margin, padding, border, and background color)
    - These areas are labeled with "/* Redundant Style */" and you will either change them to shorthand or remove them entirely (4 total locations)
- Minify the CSS and JS files

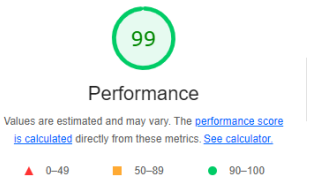
All external resources have already been linked for you. You should not move any of the external CSS or JS into the HTML file. When you upload your work to FileZilla to create a live link, make sure you upload all files for the assignment (including images).

You will know you are done when you use a Google Lighthouse Audit for Performance, Accessibility, and SEO, and your page has scores of 95 or higher for each item. These audits should be done for Mobile and Desktop. You should try to get 100 for each if possible, but it can be difficult to do.

Original Lighthouse Scores:



Lighthouse Score After Assignment is Done:



Your webpage is **due on Sunday, March 27th at midnight.** To submit the work for this exercise, visit Blackboard → Course Materials → Lectures Notes for this week's class. You can also go into the "Assignments" folder and the submission area will be titled "Optimization Challenge." You should be submitting a live link to me; it can be through the UAlbany server or 000webhost. The work submitted will be evaluated based on the rubric explained below.

Optimization Challenge Rubric – 10pts

- Live link submitted – 1pt
- The page has been optimized – 9pts
    - Images resized (1pt)
    - CSS Reset code added to CSS (1pt)
    - SEO (2pt)
        - Metatags were added
        - Heading/span tags were changed
    - CSS and JS minified (1pts)
    - Usability/Accessibility was improved (2pts)
        - Alt tags on images
        - Html lang attribute used
        - Title tag added
        - Labels added to form
        - Title added to iframe
        - Doctype tag added
        - HTML validates
    - Responsive styles added, and redundant CSS was removed (2pts)
        - Responsive down to 400px

Usability/Accessibility Evaluation (Two Posts)

Initial Post due Thursday, March 24th at midnight

Visit the Web Accessibility Perspectives page and watch all 10 of the videos (very short): https://www.w3.org/WAI/perspective-videos/

After reviewing those videos, visit https://webaim.org/ and a website of your choice (try not to pick websites you previously used for discussion posts). While visiting those websites, navigate through a few pages normally, and then perform some of the activities below on each one. The more things you try, the more perspective you will gain in terms of understanding how others use the web.

- Turn off images in your browser
- If you have access to a screen reader, turn it on and try to navigate through the websites or your computer in general (maybe turn off monitor or blindfold yourself)
    - Windows 10 – Microsoft Narrator (https://support.microsoft.com/en-us/help/22798/windows-10-complete-guide-to-narrator)
    - Mac OS X – VoiceOver (https://www.apple.com/voiceover/info/guide/_1121.html)
    - Some other operating systems come with their own
- Try to navigate a page without your mouse (keyboard)
- Watch a video with the sound muted and no captions
- View the website on your phone, desktop, or other devices

After trying those activities, write whether you think those websites are accessible/usable or not, and discuss your general experience in an initial post. You don't have to answer every question here, they are meant to guide you so that you have somewhere to start.

- Is the website usable/accessible overall?

- If you used a screen reader, what was your experience like?
- Is the site easy to use?
- How is the information architecture?
    - Does a clearly established hierarchy exist?
    - Can you tell where the main navigation is?
        - How do they handle their navigation on smaller screens?
- Can you use your keyboard to navigate the website? (Try to press tab)
- Does the website work well on a mobile device?
    - Are the buttons and links easy to tap? What about input boxes?
- Is the color contrast high enough?
- Does it let you accomplish the tasks it says it will?
- Can you identify the website's purpose from the homepage?

Use various web tools to aid your evaluation

- https://webaim.org/resources/contrastchecker/ (plug in color values)
- https://wave.webaim.org/ (copy and paste link)
- Google has a built-in accessibility audit (inspect the page, go to the "Audits" tab all the way to the right. Uncheck everything except "Accessibility" and then click "Generate Report"

The initial post is **due Thursday, March 24th at midnight**. To submit, go to Blackboard → Course Materials → Lecture Notes for this week's class. There will be a discussion area called "Usability/Accessibility Evaluation" where you can post your initial post. You can also visit the Discussion Board area directly from the Course Materials folder.

Response Post due Monday, March 27th at midnight
In your response post, compare a different website mentioned by another student to the one you evaluated (not including webaim). Do you agree with their overall assessment? Was their website more or less usable/accessible than your own? Were there features that your websites also had or lacked? Did you notice anything that could be improved for the website? These aren't required questions but just some to give you an idea of what I'd like to see in your posts.

The response post is **due Sunday, March 27th at midnight**. To submit, go to Blackboard → Course Materials → Lecture Notes for this week's class. There will be a discussion area called "Usability/Accessibility Evaluation" where you can post your response post. You can also visit the Discussion Board area directly from the Course Materials folder.

Usability/Accessibility Evaluation Rubric – 2pts
The initial post is worth 1.5pts and the response post is worth .5pt for a total of 2 points. I will be evaluating your posts based on the following criteria:

- Did you mention the websites you evaluated?
- Were specific items about the websites mentioned?
- Did your response post contribute to the original post?
    - Avoid summarizing the other person's post or simply saying that it was a good post.

Next Week

Next week we will start learning about server-side technologies such as PHP which allow us to add more features to our websites. The best resource for PHP is php.net but other websites have good tutorials as well. PHP, like JS, is a programming language but it's useful for manipulating HTML and working with forms and databases.

- https://www.php.net/manual/en/intro-whatis.php
- https://www.php.net/manual/en/intro-whatcando.php
- https://www.w3schools.com/php/ (more of a reference)