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Summer 2020 iSchool Capstone

DSpace Accessibility Audit Summer 2020

Summary of work:

For my capstone experience, I performed a detailed assessment of the accessibility of Texas Digital Library hosted services, with an emphasis on DSpace repository hosting services. I also performed assessments of the accessibility of other TDL hosted services such as OJS Open Journal Systems, Dataverse, and Vireo Dissertation and Thesis management software. The focus of my study was on assessing the interfaces for each of these programs, and some preliminary assessments of the content hosted in each of these programs. This project of work will serve as a baseline analysis and plan of action guide for future development work in making Texas Digital Library's website and services more accessible to a broader audience, affecting all member institutions including major state Universities such as The University of Texas System and The Texas A&M University System.

Literature review summary:

During my project, I read literature surrounding general accessibility guidelines as well as contemporary accessibility challenges with institutional repositories. Despite there not being a whole lot of data surrounding institutional repository accessibility specifically, there were some trends notice in regards to accessibility within open access repository data. One study of institutional repository accessibility with universities in Nigeria "revealed that none of these academic institutions has put in place any strategy to ensure the long-term re-use or accessibilities of the contents of their Institutional Repository". They suggested implementing more object-based record keeping. The Conference on Inclusion and Diversity in Library and Information Science (CIDLIS) at the University of Maryland found "digital repositories overall lack consistency in how they make information and content accessible to users. Inconsistency in metadata does not promote interoperability or discoverability between repositories and within the repository itself".

It is important to note that there were 814 lawsuits regarding digital accessibility in 2017 alone. Though the 1991 Americans with Disabilities Act does not explicitly state adherence to WCAG guidelines as a necessity for institutional repositories, the ADA Title II prohibits disability-based discrimination on the part of state and local governments, and Title III prohibits disability-based discrimination for "places of public accommodations" like private businesses that are open to the public, such as restaurants, hotels, movie theaters, museums, and doctor's offices. Citations of these two titles result in the most lawsuits regarding accessibility.

One way institutions can better adhere to accessibility guidelines is through conducting a Voluntary Product Accessibility Template (VPAT) statement which outlines a website's compliance with 508 accessibility standards. In a study from a UNESCO comparison of 5 institutional repositories, only 2 of 5 common institutional repository software have released VPAT statements.

| Accessibility					
	Digital Commons	DSpace	EPrints	Fedora	Islandora
VPAT Statement	Yes	-	-	Yes	-
Section 508 Compliant	Yes	-	-	-	-
WCAG (Web Content Accessibility Guidelines)	Yes	-	-	-	-

Jean Gabriel Bankier and Kenneth Gleason, UNESCO (United Nations Educational, Scientific and Cultural Organization), 2014

DSpace, as a non-profit organization, has not gone on to release an accessibility statement, though it would be largely beneficial to institutions to perhaps perform their own assessment using a template such as the ITI (Information Technology Industry Council) template.

Tools & methodologies:
For my accessibility baseline assessment, I originally planned to use WorldSpace data but experienced issues with UT liaison to get eid access to the software. I ended up switching to Deque axe tools for data gathering instead. I also tried the Wave google extension but found the lack of exportable results limiting. The Wave tool did have a good webAIM powered contrast checker and it is good for seeing quick visuals and perhaps can be used at an individual level for institutions wishing to perform further assessments of their services, and a screenshot of this tool contrast checker report is found on the right.

Going through the DSpace system with WCAG - Perceivable, Operable, Understandable, and Robust guidelines in mind, I went forward and assigned tests to myself using a list of heavy use pages for DSpace as well as individual institutional DSpace instances and some other TDL service homepages.
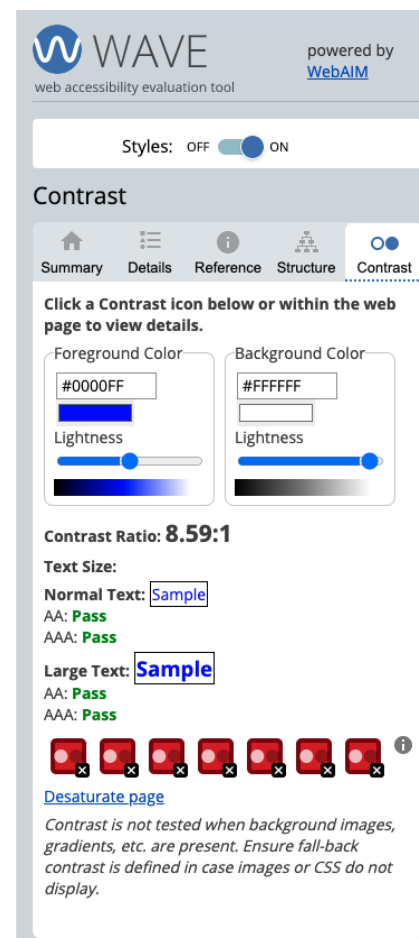
Process log for future development:

Below is a view of the dashboard page of axe tools. Once you have identified pages you would like to test, click the test new webpage button in the top right corner of the screen.
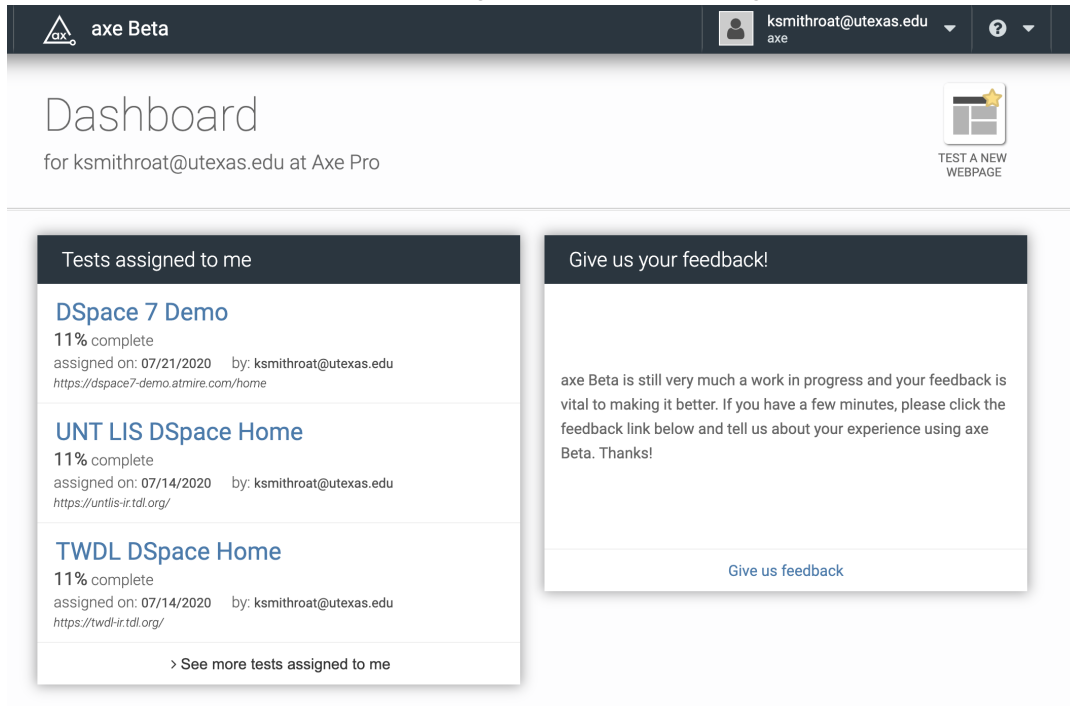
Once the testing frame has popped up, navigate to the webpage using the URL of the page you would like to test. Use the developer console in google chrome browser in order to select inspection elements and see which elements had major errors in the baseline scan. A screenshot of the console is shown below. The dotted outlines show which elements on your navigated page you are looking at for accessibility issues. You can toggle between HTML code view as well as an interface for testing the page through the console.
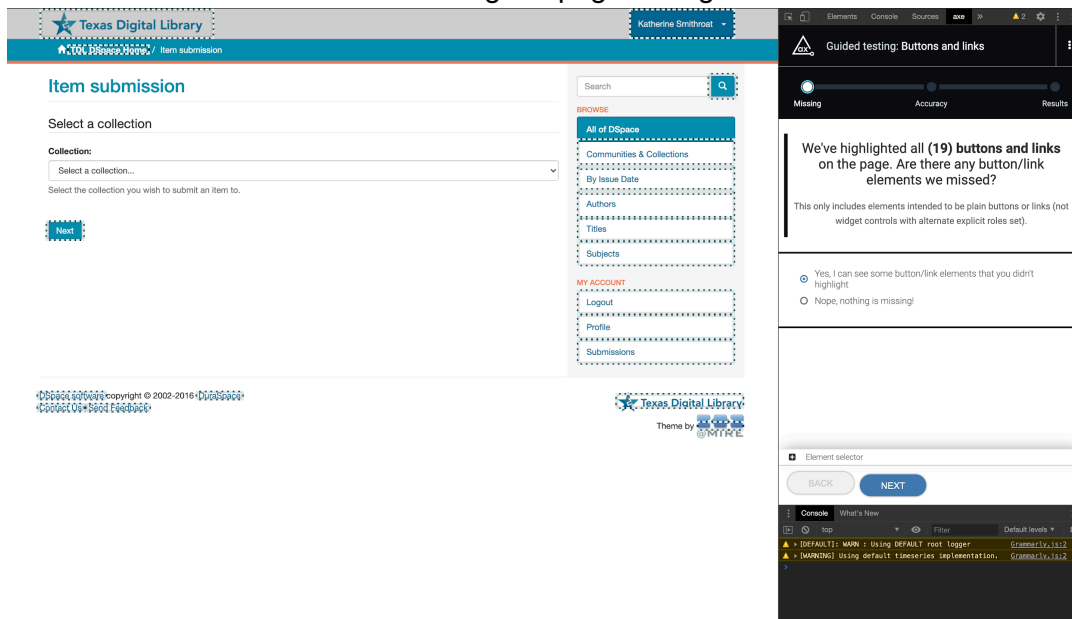
Tests assigned to me

TWDL DSpace Home
11% complete
assigned on: 07/14/2020   by: ksmithroat@utexas.edu
https://twdl-ir.tdl.org/

Texas Digital Library OJS3 Demo Jo...
11% complete
assigned on: 07/14/2020   by: ksmithroat@utexas.edu
https://journals.tdl.org/ojs3-demo/index.php/ojs3-demo

Texas Data Repository Dataverse
11% complete
assigned on: 07/14/2020   by: ksmithroat@utexas.edu
https://dataverse.tdl.org/

Vireo Thesis and Dissertation Subm...
11% complete
assigned on: 07/14/2020   by: ksmithroat@utexas.edu
https://utexas-etd.tdl.org/

WTAMU Repository Home
11% complete

^ See fewer tests assigned to me

Once you have assigned tests to yourself you can revisit them in the Deque Axe homepage to see a brief description of major issues and export a CSV log that includes a detailed description of the elements and severity of the issue for web elements which do not adhere to WCAG guidelines.

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axe
v4.5.3 (*axe-core* 3.5.5)

What you're analyzing   ▼

https://dspace7-demo.atmire.com/home
Upgrade to axe beta to analyze an individual component

All issues found 35 ▾	⇄ Save results	↻ Run again

🚩 Elements must have sufficient color contrast	26
\<html\> element must have a lang attribute	1
Images must have alternate text	2
Form elements must have labels	1
Links must have discernible text	1

\<ul\> and \<ol\> must only directly contain \<li\>, \<script\> or \<template\> elements
\</\> Inspect Node   ⟳ Highlight

≪ ‹ 1 of 1 › ≫

Issue description
Ensures that lists are structured correctly

Impact: **serious**
⤢Learn more

Element location
`.mr-auto`

Element source
```
<ul _ngcontent-dspace-angular-c8="" class="navbar-nav mr-auto shadow-
none">
```

To solve this violation, you need to:

Fix the following:
List element has direct children that are not allowed inside \<li\> elements
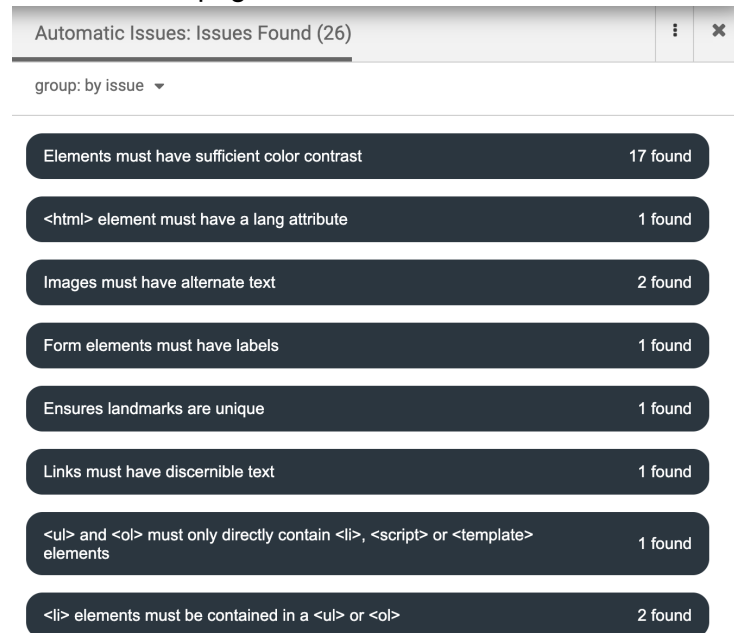
Related nodes:
\</\>Inspect (1)

`ds-expandable-navbar-section`

Issue tags: category: structure wcag2a wcag131	›

In the developer console view, as you are testing new web pages, you can see the element location of violations, as well as guidance to solve the violation.

You can also view individual element issues in the Deque homepage once you navigate to individual test pages.

Overall, I found the Deque Axe system to be very helpful in providing tactical data for quick resolutions to bring any webpage to VPAT AA compliance, which is the recommended level of rating for accessibility.

Results & discussion:
Overall, using the Deque Axe tool there were 33 Pages Tested: 10 DSpace Item retrieval/submission workflow pages, 20 Institutional Repositories, and 3 TDL services (Vireo, OJS, Dataverse).

For each of the tested pages, I aggregated the most critical errors found in the assessment.

To start below is a table of common DSpace workflow pages such as the Homepage and submitting and browsing for items page. I highlighted the pages with errors I found to be high in importance for immediate resolution through DSpace development.

Page	Wave Result	Axe Result	Critical Errors	Critical Issue Type
DSpace Homepage	7 Errors	50 Issues	1 Critical	search bar label
Communities and Collections	17 Errors	36 Issues	1 Critical	search bar label
Browse by Issue Date	15 Errors	72 Issues	3 Critical	alt text missing on logo, search bar label
Browse by Authors	14 Errors	27 Issues	2 Critical	alt text missing on logo, search bar label
Browse by Titles	15 Errors	79 Issues	2 Critical	alt text missing on logo, search bar label
Browse by Subjects	14 Errors	27 Issues	2 Critical	alt text missing on logo, search bar label
View Item	7 Errors	24 Issues	1 Critical	search bar label
Update Profile	7 Errors	17 Issues	1 Critical	search bar label
My Submissions	8 Errors	12 Issues	1 Critical	search bar label
Start a Submission	7 Errors	13 Issues	1 Critical	search bar label

I also went ahead and aggregated the collected test suite CSVs with an in-depth view of the common errors and which elements are associated with each as well as a severity ranking of moderate, serious, and critical issues with the page.

C	D	E	
Ensures the contrast between foreground and background colors meets WCAG 2 AA contrast ratio thresholds	serious	color-contrast	[".mt-4.mb-4[_ngcontent-dspace-angular-c25=\"\"]:n
Ensures the contrast between foreground and background colors meets WCAG 2 AA contrast ratio thresholds	serious	color-contrast	[".mt-4.mb-4[_ngcontent-dspace-angular-c25=\"\"]:n
Ensures the contrast between foreground and background colors meets WCAG 2 AA contrast ratio thresholds	serious	color-contrast	[".mt-4.mb-4[_ngcontent-dspace-angular-c25=\"\"]:n
Ensures the contrast between foreground and background colors meets WCAG 2 AA contrast ratio thresholds	serious	color-contrast	[".page-item:nth-child(11) > .page-link[href=\"\"]"]
Ensures the contrast between foreground and background colors meets WCAG 2 AA contrast ratio thresholds	serious	color-contrast	[".page-item:nth-child(13) > .page-link[href=\"\"]"]
Ensures the contrast between foreground and background colors meets WCAG 2 AA contrast ratio thresholds	serious	color-contrast	["a[href$=\"dspace\\.org\\/\\"]"]
Ensures the contrast between foreground and background colors meets WCAG 2 AA contrast ratio thresholds	serious	color-contrast	["a[href$=\"duraspace\\.org\\/\\"]"]
Ensures every HTML document has a lang attribute	serious	html-has-lang	["html"]
Ensures <img> elements have alternate text or a role of none or presentation	critical	image-alt	[".navbar-brand > img[src$=\"dspace-logo\\.svg\"]"]
Ensures <img> elements have alternate text or a role of none or presentation	critical	image-alt	["img[src$=\"dspace-logo\\.png\"]"]
Ensures every form element has a label	critical	label	["#query"]
Landmarks must have a unique role or role/label/title (i.e. accessible name) combination	moderate	landmark-unique	[".float-right"]
Ensures links have discernible text	serious	link-name	[".navbar-brand"]

Conditional Highlighting

Add a Rule   Done

Rule 1
text is
serious
Orange Fill

Rule 2
text is
critical
Red Fill

Rule 3
text is
moderate
Yellow Fill

Overall, the most common errors I noted during my inspection of all 33 of these pages were related to the following error types.

Error Types:
Contrast errors
Missing links
Missing form labels
Alt text

For the institutional level, I also took into account these common error types noted as serious/critical issues and placed them into my running spreadsheet of error types. I highlighted institutions that had a high count of color contrast component issues, as this would be a straightforward CSS adjustment to resolve these errors.

| Repository	Color Contrast Errors	Critical Issues Homepage	Critical Issue Type
Angelo State	20 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
Baylor	13 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
SHSU	32 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
TAMIU	7 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
TAMU-CC	8 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
TAMU-G	20 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
TTU	13 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
TWU	18 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
UH	12 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
UH-CL	24 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
UNTHSC	10 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
UT Austin	11 Insufficient color contrast	1 Critical Issue	search bar label
UT Dallas	18 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
UT RGV	78 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
UT Southwestern Medical Center	17 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
UT Medical Branch at Galveston	50 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label
West Texas A&M	35 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label

|			
Texas Water Digital Library	10 Insufficient color contrast	1 Critical Issue	search bar label
UNT Library and Information SciencescRepository	24 Insufficient color contrast	2 Critical Issues	alt text missing on logo, search bar label

Once I had gathered baseline data for DSpace common workflow pages to see and add items as well as ran tests as the individual institution level, I expanded my test suite to include other TDL services such as Vireo, Dataverse, and Open Journal Systems.

TDL Service	Color Contrast Errors	Critical Issues Homepage	Critical Issue Type	Overall # Issues Homepage
Vireo	0 (for UT home)	0	0	4 moderate: 3 landmark, 1 heading
Dataverse	26 (Homepage)	2	alt text logo, search bar form label	67
Open Journal Systems	11 (TDL demo journal)	0	0	15

The following are examples of the primary errors I found while testing these pages:
One of the most common DSpace errors was the lack of alt text found in the upload of logos to the headers of the pages. Below is an example of the logo images. WCAG requires alt-text to be provided for screen reader accessibility.
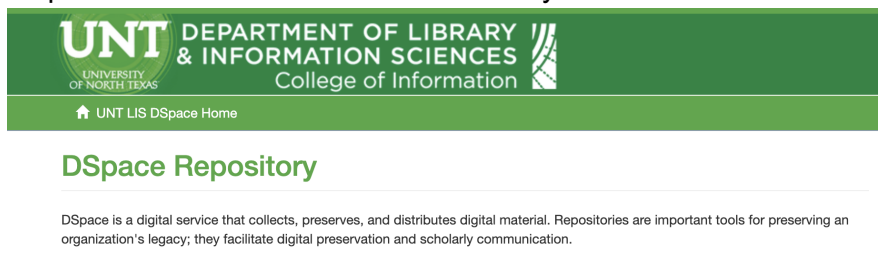
Another common error found during the course of my assessment was the lack of a form label on the search bar element. WCAG requires a label for any element that requires input for screen reader accessibility.
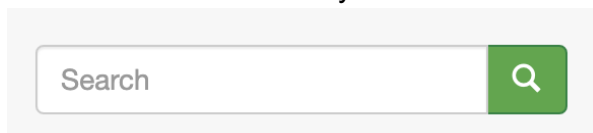
The most common color contrast errors were a result of inaccessible shades of school colors being used as accent text colors which when made small are no longer accessible because of the font size. A good way to resolve these issues is to either increase the font size or adjust to a shade of the color that passes the WEBAIM color contrast checker, which can be found at https://webaim.org/resources/contrastchecker/.

Other serious issues across many of the DSpace pages I checked were missing HTML language attributes and the misuse of list HTML elements to format content.

Next steps:
Now that there is a baseline assessment of these services, it would be beneficial to rerun the Deque Axe automated test suite as development changes are carried out.

There is a Google Drive of all CSV report data collected, but the priority of changes would likely be to add the search bar label, logo alt-text, and adjust color contrast CSS before doing deep-dives into changes for each sub-page tested.

For further accessibility enhancement, it would be interesting to use R-programming data analysis for trends across pages/institutions on all the CSV data collected. Due to time and resource constraints, more in-depth user testing of DSpace such as screen reader usability through task analysis would be immensely helpful to the increase of accessibility for these repositories. It would also be helpful to collect more data using other collection tools to cross-examine types of errors caught by these automated testing suites, though there may be duplicative data captured in the process.

Finally, as changes are implemented, conducting a formal VPAT review using the ITI (Information Technology Industry Council) template would be a great way to encourage VPAT adoption across DSpace instances beyond Texas and progress the academic repository accessibility at large.