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Hello. Welcome to Translating Maps and Geographic Data to Non-Visual Formats. My name is Elizabeth Pyatt. I'm an Accessibility IT Consultant at Penn State, and you can reach me at accessibility@psu.edu.

PYATT:

Just to share a little bit more about my history, I've been an accessibility consultant since 2001. I am the webmaster of accessibility.psu.edu, again, since 2001. In the past few years, we've worked with students with visual disabilities to prepare alt format content, and this includes maps for various courses, including political science, African ecology and geology. And also, I work with linguistics, which is my original degree, and this is why there is a picture of the upside down E or the schwa in different fonts on this page.

So where am I from? Right now I'm in central Pennsylvania. I'm in Center County, this triangular county in the center of the state of Pennsylvania, in State College, which is the town of Penn State University. However, I'm not on campus. But if I am on campus, I will say that Old Main is one of our lovelier buildings.

For this presentation, we'll start by showing some educational map examples, and hopefully you think about what you've seen along with what I've seen. We'll talk about different alt document techniques. This includes alt text, long description, tables and lists, tactile graphics, signification, and some other techniques. We'll review some case studies, at least four, and we'll provide some design guidance, some tips throughout the presentation, and a summary on the last slide.

For academic content, geosciences, obviously, comes to mind, from geography to geology to crater mapping on the Moon and beyond. Maps are notable for being able to simultaneously show different layers, such as roadways, cities, bodies of water, and geological features, such as in this map of Pennsylvania.

Sociology, political science, and other social sciences rely heavily on maps. The map here is from the 2010 US census and shows median age by metropolitan region in Pennsylvania, some of which are actually very small villages. We are in a state with the quote "an aging population", but note that there is a relatively young median age pocket right New York State College.

Maps are very common in history courses, of course, including a history of maps. This map is

one of the earliest maps in North America made by Europeans. Note the relatively squat shade of Florida and the prominence of Cuba. They might not yet have discovered Cape Cod either.

This French and Indian War map was used in an English course about 19th century American literature in relation to the novel *The Last of the Mohicans*. In this case, we focused particularly on the location of the forts on the Hudson River since that's where the novel took place. But we did include some information about Pennsylvania. We also described a map of the Missouri Compromise regarding the status of slavery in Western territories, again, for another novel, *Uncle Tom's Cabin*.

Maps aren't just for educational use, of course. In the next few slides, we'll discuss some common uses outside of academia. One of the most common non-academic uses is to determine where you are and what else is around you. This is the map of Old Main on Penn State campus, the building we saw at sunset. It's close to the large Schwab auditorium. One of the ongoing discussions in our Office of Accessibility is how to translate this information of a campus map to an alternate format which could be read out on an iPhone app.

Another common use is to find nearby items of interest, such as local restaurants selling fried chicken. Although the pins on this Google map are clickable, there is a text based list on the left with similar information that a user can click on. We have both commercial options like KFC and Chick-fil-A, and local options like Korean chicken and one from Gigi's Southern Table in this area. The second one I'm going to have to check out.

Weather maps, particularly in regions prone to one or more forms of precipitation, are another popular use of maps in the non-educational sector. We'll discuss this use in later slides.

We've reviewed some different types of maps, but not necessarily all the possible alt tech strategies. When thinking about your map, it's important to remember that the goal is not to make this an accessible map, but rather provide key information in the map in one or more formats so that all audiences can access the data.

Here are some of the approaches we have or could take to make a map accessible-- alt text, long description, long description with lists and tables, a tactile or 3D graphic, or location based text output, such as in a mobile app, being able to enter a state or zip code or sonification. They each have their advantages but some limitations also.

And by the way, the image above is a tactile version of our congressional district, District 12. This was converted to an embossed graphic with raised lines, and the dots are texture indicating where the district is.

A lot of your choices involve determining what's most important for the context of the map. The same image might only need a simple description in an introductory course but a more detailed description in another course.

It's important to think about why the map is being used. That is, why is this map here? Some questions to ask are-- is it there to show a location? Is it there to show the shapes of a region, points where cities might be, lines where rivers or roads are? Is it there to show geographic patterns, or guide people to location information? Is it there to add visual interest? Or is it a mix? Can it be quickly described? Your solution may be a judgment call.

As you may or may not know, Penn State has over 20 locations throughout the state. And here's a map of all of them. Below are some questions a viewer might be asking, such as, I know, there is a location in York, Pennsylvania, but how do I get there? Or which are the campuses close to Philadelphia or the Pittsburgh region? Even, where exactly are all the campuses? This last was important during one of the state legislature budget cycles. Penn State studied all its operations and sent a report indicating they were active somehow in every county in the state, even those without a campus.

On the page with the map is a set of text links for each campus. Note that they are sorted roughly by geography east versus west. An alphabetical list could also be maintained, but it's important to be mindful of double maintenance. Sometimes campuses do get new names.

Is a map ever decorative? Sometimes, yes. Given the paragraph above, this paragraph "with 24 campuses throughout Pennsylvania, Penn State represents a strong economic engine. It is, among other things, a major employer and a source of students, faculty, and staff who keep local economies going by spending money to live in communities and support nonprofits to benefit those in need." It's clear that the map is mostly there to support the point of view of how important the campuses are to the state of Pennsylvania.

A simple alt text such as map of 24 campus locations across all regions of Pennsylvania would probably be sufficient, especially if there's a link pointing to the campus location page. This is a more abstract version of the campus map, and it's actually a link to the campus location page. Since it is a link, the Alt text should describe where it's going and not the image itself. The Alt

text here is list of Penn State campuses.

Switching gears, this scenario, which happened twice in the same semester, is from a course which had a map quiz on the countries of Africa. The map here is a color map from CIA.gov, with information on capitals and major bodies of water, as well as the outlines of the countries.

The solution was definitely a tactile graphic. These are black and white line images printed on special paper which are run under a heat lamp device. The heat causes the black ink to swell and become embossed. But there are limits. Given the size of some African countries, it would be difficult to determine which ones they were with touch alone. Therefore, we decide to split the map into the different regions identified by the UN.

One of the limits is text labeling. Most maps have text 12 points or smaller, but Braille works best when it's 24 point text, and more like 45 to 60 points for English letters. We can use textures such as dots or dashes to simulate colors, but only about 5 maximum. Therefore, we usually have to provide a long annotation of what is in the tactile, including any splits and abbreviations used.

The solution is still not perfect. In the first map of the west bulge of Africa, there are lots of smaller countries where Braille labels would not fit. We have a profusion of arrows pointing to names and abbreviations, including one dotted arrow that crosses the continent and almost into the Mediterranean.

In the second, the countries are larger, but the shape itself of the region is hard to recognize. That area is also West Africa, with the Atlantic Ocean on the west and right about the southernmost tip and below the bulge. The map on the previous slide shows the whole continent split, but the student using these must work to put the pieces together mentally.

Some of you may be wondering about 3D printing. And there is definitely a use case. The model above is from Thingiverse user Thecapsi, T-H-E-C-A-P-S-I, and it shows how the mountains of central Pennsylvania, particularly the Appalachians, are laid out. In this region, the Appalachians curve from a north-south orientation found in Virginia, Maryland, to an east-west orientation found in eastern Pennsylvania. State College is located on the outer edge of this curve.

There are limitations, too. 3D prints may need to be of a higher quality in order to eliminate ridges from the deposit of plastics. Designs also need to include curves instead of sharp

edges. Some points, such as those used for Braille, could be sharp.

Finally, it's important to add some indication, perhaps a notch, or a tab, or even a stick on Braille label, to indicate which direction is north. We'll switch gears again to a language data map. Here, a color coded map of where Arabic is spoken as an official language, mostly in countries of North Africa and the Middle East.

This is a case where I might provide a table or a list, but there are several ways to structure that list. What's the focus of the map? Is it just a way to identify countries where Arabic is spoken? In that case, a simple list might do. Alternatively, if it is for a sociolinguistics course, you might want a table with additional fields. Note if this map were on a page where lists of countries was already in the text, such as in an Arabic I course, the image could be considered decorative. Finally, I would add that lists and tables are great art forms for charts and graphs as well.

Here's an alphabetical list of countries which includes columns for Arabic status and percentage of Arabic speakers. Note that it doesn't really indicate whether the country is in Africa or somewhere else. Additional columns could be added to indicate that. Unless it was in a course where students would be expected to know this information already, or where that information is not relevant.

This is another presentation and a hierarchical list by Arabic status. The green labels, official language, and co-official language could be a heading level in a Word or HTML document. Note that in the second column, an order list with different numbering schemes at each level is used. This provides additional cues on semantic structure and hierarchy.

Here is the map again in black and white with all the color information removed. The key is much more difficult to use if a viewer doesn't have color vision. Some of the alt text strategies mentioned here can be used by multiple audiences.

Here is another language map from South Africa, which has very fuzzy boundaries defining the areas where 11 language used in South Africa are dominant. It should be noted that not all the 11 languages are equally dominant. Again, this is a case where it's important to know what information is needed and why.

It is possible to create a tactile or some long description listing the approximate locations of each language, but it would take time. It might be that such a map has been created,

particularly for a student in South Africa. So looking in a repository or asking around could be useful. However, I will assume that some other strategy could be used.

Here, again, we might use Alt text based on the surrounding paragraph. In the first paragraph, the text focuses on the indigenous languages, including Zulu, Tosa, Songa, Swazi, Sesotho, and others, being in the eastern half versus Afrikaans in the west in English in one city, Cape Town. And the second, where the eastern half is already specified, the map might be considered decorative or need only a short Alt text. In both cases, a list of the 11 languages could be included in their text, and this would benefit anyone not able to easily read the map key.

But sometimes a map is included as part of assignment. In this case, it's important to provide the information but not give away the answer. Here are some sample questions that could be asked. Which language is the most widespread geographically? Why is English only dominant in one small area, Cape Town? Which indigenous languages are the most widespread?

Alt text may be used for one question. But again, it could give away the answer. A table with relevant information, such as relative size, area, location, and other information could provide what the student needs in the right way.

This map shows differences in pronunciation of the words pen, P-E-N, and pin, P-I-N, within the US. Different colored dots indicate whether the speaker rhymes or doesn't rhyme these words. I'm including this to show what happens when the original creator of the map provides only an image. If an assignment were to ask to explain the distribution where in the US the words pin in pen rhyme, or don't rhyme as in my dialect, an [? alt doc ?] team might need to spend time counting the different colored dots in each state.

The last case is probably one of the more challenging ones-- a weather map, specifically, a weather radar map. A tactile map would be difficult to produce with current technology. It would not be able to be quickly updated. At some point, a system to dynamically create tactile graphics, perhaps on a grid of raised Braille dots could provide some good solution. For now though, we probably need to find something else.

Again, it's good to ask questions about what information people would like to know. Is it raining now? Will it rain soon? Is it anything frozen? Or what's happening somewhere else? Note that some of the answers might rely on an animated loop sequence. In this case, I will ask, what would a mobile app do? Phone apps are designed to provide information on a small screen.

This app here provides current temperature, wind direction, whether it's rainy, cloudy, or Sunday, and other information. What this might not capture is data from another location or how the weather system is moving.

By the way, I think this is a useful app, but I did want to mention there are some places where the text background contrast is not accessible, such as where the white text is on a dark gray cloud. You should always test color contrast if you use multiple backgrounds.

This page is a standard winter weather advisory issued by the Weather Service calling for 2 to 4 inches of snow. It gives information about what, where, when, and other details, including snowfall rates and where there will be slippery conditions. Sometimes it can be useful to borrow an old format, but make sure that users can access the advisory outside of a map interface, such as with a zip code or address search. Most weather apps do this already.

This is another scream from WeatherUnderground.com, which has an hourly forecast and an accessible table. It provides information on time, projected conditions, temperature, precipitation forecast, cloud cover, dew point pressure, and wind speed-- very useful if you're a weather fanatic. I was happy to see that the site was taking initiative to add aria attributes to the page.

I'll end this session with some links to sonification demos posted online. Like 3D printing, sonification could be very useful but must be designed to provide all information to all viewers. The first demo is from NASA. It shows the density of galaxies in a star map. They have a very good description on their website.

The second is income inequality on a subway line. It's posted on [? Vimeo ?] by Brian Foo. I actually think the audio portion is very effective. Unfortunately, what it doesn't do is provide an indication of what stop you're at when the sound is happening. I will say that if you play the audio, that there is a huge change from when you cross from Brooklyn into Manhattan and when you leave lower Manhattan.

So here is a summary of some potential guidelines. For instance, if you know you need to know the shape, you might want to consider a tactile map. But you may need to adjust the original design to make it usable by a user using only touch. Is the map for navigation? You could add text-based instructions. And this actually benefits sighted users who don't-- who prefer text-based instructions over using a map.

If you're trying to extract data, usually an alt text, or a long alt text or list or table are good strategies. If you're adding interactivity making a clickable map, you might also want to think about making sure you have text links or the ability to search by zip code.

Thank you for viewing this. I hope some of this is helpful in useful projects.