

Supplementary Appendix 1

The 10 user-centered design (UCD) principles are listed below:

1. Involve users early.
2. Involve users often.
3. Design for use in context (the product will be used in the real world, so design accordingly).
4. Keep it simple.
5. Be polite.
6. Know your users.
7. Give users control.
8. Remember and design for emotion, people feel as much as they think.
9. Trust but verify, triangulation is the key.
10. Discover before designing and delivering, and know that discovery never ends even after delivery.

Supplementary Appendix 2

Briefly, the stepwise approach to constructing the Ohio Children's Opportunity Index (OCOI) included:

1. Standardizing and averaging: the 53 constituent measures of different units were standardized by converting to Z-scores. The standardized Z-scores were averaged across domains to form the untransformed domain scores across each census tract.
2. Ranking: the averaged Z-scores for every domain were ranked and scaled to a range between zero and one (with the least deprived tract having a 1/number of tracts score).
3. Exponential distribution: the ranks were transformed using the exponential distribution, making each domain's value range from 0 to 100. These domain scores were used to generate the overall area-level deprivation index.
4. Equally weighting the domains: once the final domain scores were generated, they were averaged with equal weighting to form the deprivation index. The resultant deprivation index scores for Ohio were reversed to create the OCOI for each census tract.

Supplementary Appendix 3 Sample Questions for Informal Focus Group Discussions

Content

1. How should race/ethnic distribution data be visualized?
 - a. If as quantiles, should it be visualized as tertiles, quartiles or septiles?
2. Using septiles to display the Ohio Children's Opportunity Index (OCOI) information with tertiles, quartiles or septiles of OCOI gives rise to several categories, how else can OCOI information be displayed?
3. Using quartiles to display race categories gives rise to very skewed groups, how else can race/ethnic distribution be meaningfully classified?

Function

1. Are additional filters required on the OCOI race dashboard?

Aesthetics:

- If not displaying OCOI information as septiles, should the color scheme to display OCOI information be changed?
- Should the shades of green and purple from the OCOI main dashboard be retained?

Supplementary Appendix 4

The training script will be broken into multiple videos. The longest video will be the "Illustrating the use of the dashboard for a use case" video at the bottom. There will be one video each explaining the Ohio Opportunity Index (OOI) dashboard and the Ohio Children's Opportunity Index (OCOI) dashboard, and several small videos using the OOI dashboard to learn specific tools like filters, map tools, sorting, and the Tableau toolbar.

The Ohio Opportunity Index Training Video Script

Introduction to the Ohio Opportunity Index

Screen Should Show the Ohio Opportunity Index Dashboard

Hello, my name is X, and I work with CATALYST at the Ohio State Wexner Medical Center. Today I'm going to show you how to use the Opportunity Index and Children's Opportunity Index Dashboards. These dashboards display community data for census tracts in Ohio in an interactive way so that users can perform actions that help them understand the data.

The Opportunity Index is a measure of opportunity for different census tracts in Ohio, where high scores indicate greater opportunity, and lower scores less opportunity and more deprivation. There are seven domains that include access, which means access to healthcare, food, schools, and the internet, crime, education, employment, health, housing, and transportation. Every census tract has an individual score for each domain, and an overall score for all the domains combined.

The Ohio Opportunity Index Demonstration

First, I will demonstrate how to use the Opportunity Index (OI) dashboard. I will explain what each part of the dashboard is, and then I will show some of the functions.

Screen Should Show the Ohio Opportunity Index Dashboard Again, Point at Map and Key

The first thing you will notice is the map of Ohio on the left. The key shows that the darkest purple represents tracts with

the lowest opportunity and as opportunity increases, the colors shift toward green, and the dark green reflects the highest opportunity. Right now, overall OI score is shown. If you hover over a census tract, a tooltip appears. The tooltip will tell you more information about that census tract. There is also a purple icon that explains more of the map functions.

Point at Table

In the upper right, you can see a table. This lists the county, census tract, and the domain score. The purple icon explains more of the functions of the table.

Point at Distribution Plot

The distribution plot shows the ranking of all of the census tracts, with the same color code as the map. The septiles, or seven categories, go in increasing order of rank with the highest opportunity tracts on the right.

Point at Score Plot and Click on any Census Tract

In the lower right, you can see a set of bar graphs. These show the individual domain scores making up the opportunity index for the census tract selected. See how the map also highlights this census tract, the table shows only this tract, and the distribution plot shows where this tract ranks. These scores are from 1 to 100, where a higher score is better for that domain. The icon next to the score plot explains how these scores are weighted for the overall OI.

Whenever we click on a tract, we can click on it again to deselect it.

Filter Video

Point at Filters

Now we will start to show some of the functions. We can click on the filters in the toolbar to look at only a specific county or a specific domain.

Change Domain with Filter

When we choose an individual domain, the map is recolored by that domain. The purple colors still represent low score and green still represents high scores. The distribution plot will also now reflect how a census tract is ranked on that specific factor. The score plot shows the scores within that domain now, so you can see the components making up the domain score. These scores are z-scores, so they show how the tract compares to the mean for this domain.

Change Domain Back, Click on Septile Filter

With this filter, you can click on a specific septile color and it will show all of the tracts in that color.

Change Back to all, Change County with Filter

Now if we select a county, it shows only that county on the map and only those tracts in the table.

Map/Table Comparison Tools Video

Choose Two Census Tracts using Command or Control

Now I will talk about how to compare multiple tracts. If you have a Mac, you press and hold the command key on the keyboard, on a PC, you press and hold the control key, and then click multiple tracts that you want to compare. Let go of the key when you're finished selecting tracts. See these three tracts that all have different levels of opportunity. You can see where they rank in the distribution plot, and what the individual domain scores are in the score plot. In the score plot, they show the colors of the septile that tract is in. They are in order of census tract number.

There are other ways to select multiple tracts on the map tools.

Go to Map and Hover Over Tools while Explaining. Explain Scrolling in and out Using Mouse/Trackpad, and Using Shift and Moving to Reposition the Map

If you hover over the map with your mouse, tools will appear. There is a plus and a minus sign to zoom in and out of the map. You also can use a mouse or trackpad. If you use the scroll wheel on your mouse, one direction will zoom in and one will zoom out. On a trackpad, you pinch or widen your fingers to zoom.

The button that looks like a house returns the map to the original view. When you hover over the arrow, more options appear. The rectangle with a magnifying glass is a custom zoom where you can zoom in where you click.

The crossed arrows allow you to move the viewing area of the map and pan to the left and right. You can also press the shift key and move the map to do this when you have not selected this function.

The rectangle, circle, and lasso tool all allow you to select census tracts, which we will demonstrate.

If you use the square, all of the tracts that the square touches will be highlighted, and those census tracts will appear in the table, distribution plot, and score plot. The circle does the same thing. The lasso allows you to draw a freeform shape and highlight tracts within that shape. Try not to select too many, because it makes the distribution plot and score plots very cluttered.

Deselect Tracts, Use Home to Return the Map to Home

Go to Data Table and Select a Few Census Tracts in One County

The final way we can select tracts is using the data table. Use the control or command keys on your keyboard to select more than one. You can also shift and select a few in a row. You can also select a whole county. Right now, the data table is in alphabetical order by county and census tract.

Sorting Video

Now I will explain how to sort in the data table and in the visuals.

Hover Over County Name in Table, Sort Alphabetically, then Hover Over Arrow and Change the Sort to the Ohio Opportunity Index Score

As you see, we can sort alphabetically a to z or z to a. If we hover over the small arrow, we have other ways to sort, so we can choose minimum OOI score. Now the counties are sorted by the average OOI score for the whole county and the counties are ranked. Right now, it is ranked highest to lowest, so Putnam County has the highest average score. We can click on the sort icon again to change it to sort from low to high. Now Lucas county is at the top and has the lowest average OOI score. Ranking by reverse domain rank will rank in the opposite order, where the lowest ranked counties are at the top. The distribution plot selector will rank the counties by highest average rank, again putting Putnam County on the top. All of these sort options other than alphabetical essentially do the same thing and sort by OOI score or rank.

Hover over Census Tract in Table, Sort Alphabetically, then Change the Sort to Ohio Opportunity Index Score

We can also sort within a county, for individual tracts. Sorting tracts a to z puts them in numerical order, while sorting by score puts the tracts in score order within the county. See how the highest OOI score is at the top and the lowest is at the bottom. These represent the highest and lowest opportunity tracts in this county. Sorting by domain score does the same thing.

You can also sort other components.

Change the Sort on the Distribution Plot, Then on the Score Plot

You can make the distribution plot sorted high to low. The score plot starts sorted by census tract id number but can be sorted low to high or high to low. When you sort the component scores, it sorts each individual score, so the tracts change the order they are in for each component score.

Explaining Tableau Toolbars Video

Now that we have covered the basic features, filters, map tools, and sorting, I will explain the toolbars at the top of the dashboard. On the left, you see revert, refresh, and pause.

Press Undo, Redo, Revert

Undo takes back your last action, while redo makes you do it over again. Revert makes everything go back to the starting screen. Refresh and pause do not do anything for a regular user, they apply to those adding in new data.

Zoom, Click on Some Tracts, go to "View:Original"

Now on the right side. The leftmost tool, the square with some bars in it, lets you save your current view for later. Maybe I want to look at these specific two tracts later and already be zoomed in to them. The next button, alert, is not used because the data are not updated continuously.

Click on Share, Talk, Click on Download, Talk

Next, share lets you make a link to email or send. Also you can get code to embed into a web site. Download allows you to get

either still images or data in different formats. Image, PDF, and Power Point will give you images, while data and cross-tab will give you underlying data.

Click on Comment, Talk, then Click on Full Screen, Talk Comment allows you to write things about the dashboard. If you would like to notify someone specific on the research team, you put @ and their name. Full screen makes the dashboard take up your whole screen. Click again in the top right to go back to the regular view.

You should now be ready to use the OOI dashboard. The OCOI dashboard is very similar, and I will now show you that one and the few differences.

The Ohio Children's Opportunity Index Demonstration

Screen Should Show The Ohio Children's Opportunity Index Dashboard

The Children's Opportunity index is a similar concept to the Opportunity Index but applied to children in Ohio. The domains in OCOI reflect family stability, infant health, children's health, access (which includes rurality, distance to schools, and distance from supermarkets), education, housing, environment (which includes air quality, tobacco availability, and vegetation), and criminal justice. Knowing the relative opportunity and deprivation in an area can help us understand how we can improve our communities.

Open up the Ohio Children's Opportunity Index Dashboard, Click on Domain Filter and Family Stability, Find Two Dissimilar Tracts

As you can see, this dashboard is extremely similar, but instead the underlying data applies to the opportunity or deprivation level of children. Some of the overall domains are different, and there are eight rather than seven domains. There are no longer transportation or employment domains, and there are two health domains, one for children and one for infants, an environment domain, and a family stability domain. Let's look at family stability.

As you can see, the zooming, tract selection, filters, and interactivity work much in the same way as the original Opportunity Index. We have the same features of a map, a data table, a distribution plot, and a score plot.

Revert, Click on Neighborhood Type Filters while Explaining, going through City, Neighborhood, Township, and Zip Code

One of the features of the OCOI that is new is a neighborhood type filter. You can now click the top filter, and for example, if you choose city or village, the filter below is all cities and villages in Ohio. Now, if I choose Akron, it zooms in to Akron Ohio. Next, a neighborhood filter, which limits to mainly urban areas, makes the lower filter show neighborhoods in cities. We can click on a part of Columbus, for example, Clintonville or German Village. Next, with the township filter, it is limited to governing areas, and we can click on a township. Finally, the zip code filter features all of the zip

codes in Ohio, and we can highlight only the census tracts in one zip code.

Revert, Click on Data Filters and Show Change

Another new filter is the data filter. In this dashboard, we have data from 2010 to 2014, and also data from 2013 to 2017. We can also look at the change. So we can see census tracts that have been improving, and ones that have been getting worse. When we click on a census tract, the score plot shows which factors have improved or diminished. The distribution plot has a different shape, because the ones with little change are close to zero in the middle.

Revert, Use New Map Tools, Like the Search and the Location

We can also search the map for specific cities and towns and it will zoom in. The compass allows us to zoom in on where we are currently using our computer's location services.

Those are all of the new features that are only in the OCOI dashboard. You should now be ready to use the OCOI dashboard.

Illustrating the Use of the Dashboard for a Use Case

Now that we know how to navigate these tools, I will demonstrate how we can use this tool for analysis and policy making. Let's pretend we are a manager of a program that tries to improve maternal and infant health. We only have enough resources to target mothers in some of the worst performing areas of the city. I will use parts of Columbus to demonstrate, and find neighborhoods that we could target.

First, Narrow Down the City/Village to Columbus. Rank the Census Tracts by Infant Health Score, Low to High, and Look where the Low Ones are

The lowest scoring tract for infant health in Franklin County scores, especially bad for infant injury, neonatal intensive care unit (NICU) stays, and maternal morbidity. However, it is not actually significantly worse than average in infant mortality, because it does not have a z-score of -1 or lower for that variable on the score plot. These are spread in a few parts of the city, some in the east side, in the Linden area, South of German Village, and some on the west side of the city south of the river.

Click on Infant Mortality in Score Plot, Change to "Keep Only." Highlight Eight Worst Tracts

We can keep only one of the things making up the infant health score, infant mortality. We can now find which of these tracts have the worst scores just for infant mortality. It may not be the one with the worst infant health score. The ones with the seventh and fourth worst infant health score have the worst infant mortality. Let's click on those.

Narrow Down to the Two Worst at Infant Mortality on the Map. Then Examine Their Other Scores

These are both in South Linden area, just east and northeast of the Ohio State University campus. These two worst tracts (049001400, and 049007511) also score badly for preterm

birth. Now let's look at some of their other scores. Their overall OCOI is in the bottom septile. For access, their lowest scores are for food access. For children's health, they score low for asthma. Low scores for most of the crime and education domains. Air quality and tobacco exposure for environment. Paternal involvement and poverty for family stability. Crowding and evictions for housing. Now let's look at the whole neighborhood.

Narrow Down the Ohio Children's Opportunity Index to South Linden. Change to Infant Health and Highlight the Top-3 Tracts

If we are serving women in South Linden, we can see which parts of South Linden have the worst infant health ratings, and see what our program should target. Let's click on the three tracts in the north part of the neighborhood. We can see that two are in the lowest septile and one of them is in the second lowest. In these three tracts, infant injury, infant mortality, and maternal morbidity are not far from average, as they are close to zero on the score plot. These tracts do score badly for Neonatal Abstinence Syndrome (NAS) and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), NICU stays, preterm birth, and attendance at well-child visits. Our program should work on ensuring there are resources available to help connect people to rehab, support groups, and drug treatment. Our program could also try to highlight the importance of well-child care, help connect women to care, and ensure they schedule these visits. Also, as we learned earlier, paternal involvement is low, so if there are not fatherhood programs in the area we could encourage existing programs to target that area. Let's look at change.

While Focused on South Linden Still, Change the Filter to Change. Start Looking at Infant Health, then Look at Other Changes in those Tracts

Now we can see that three census tracts in this area have changed in a negative way for infant health. Also, two of these three tracts were in the bottom two for infant mortality. Programs and resources can specifically try to target these areas so that they can improve like some of the other parts of the neighborhood. In other domains, there has been improvement in children's health, crime, and environment for this area. Access, education, family involvement, and housing have mixed changes. Programs should be prepared to continue providing referrals for help in access to care, educational resources, social services, and housing.

Now let's look at the two tracts with the highest infant mortality in the regular OOI.

Change to the Ohio Opportunity Index Dashboard, Find Tracts 049001400 and 049007511. Go Through Each Domain

We can see that these tracts are in the lowest septile for the adult Opportunity Index scores too. For access, they are fine for the distance to care and schools, but they lack healthy food and internet access. We may need to ensure we refer people to food banks, WIC, and food stamps, and provide

information that is offline. These tracts struggle with crime and poor education, as most scores in these domains are low. We may need to help these participants in these areas. For employment, they all have high unemployment but access to training and low wage jobs are average to good. For health, they have a lot of cardiovascular disease, diabetes, drug addiction, and preventable emergency department admissions and a high poverty rate. For housing, they have low home value. Finally, their transportation is mixed, with low

vehicle access but good public transit access. Bus passes and rideshare services may need to be provided to program participants from these areas.

The use of both tools allows us to paint a thorough picture of high-risk census tracts. For any social programs, these tools could be used to see what specific geographic areas need improvement, and which domains need the most work.

That concludes this training video. I hope you have found this useful and are excited to use these dashboards.