**Visualization for Exploration and Communication: A Truthful Art**

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# Text version of presentation for 2016 KT Conference: Communication Tools for Moving Research to Practice

Conference information: [https://ktdrr.org/conference2016](http://ktdrr.org/conference2016)

**Slide 0: Communication Tools for Moving Research to Practice**

Title slide template: Blue background with American Institutes for Research (AIR) logo in the background and a grey bar at the bottom.

Visualization for Exploration and Communication: A Truthful Art

Hosted by AIR’s Center on Knowledge Translation for Disability and Rehabilitation Research (KTDRR)

October 24, 26, and 28, 2016, from 1–5 PM Eastern

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Image of American Institutes for Research (AIR) logo

Image of National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) logo

**Slide template**: A mix of white background and black background slides. In both the white and black slides in the bottom left is the text: Alberto Cairo • University of Miami • www.thefunctionalart.com • Twitter: @albertocairo

**Slide 1: VISUALIZATION Exploration and communication: A truthful Art**

Alberto Cairo, School of Communication, University of Miami

Picture: Collage of slides depicting graphs and visualized data, such as data on whales, global and U.S. demographic maps, and neuro-system activity.

**Slide 2:** Screenshot of a Dropbox.com website depicting 7 folders.

1Part1

2Part2

3Part3

4Part4

4Part5

SCIENCECOMMUNICATION

STYLE\_GUIDES

<https://www.dropbox.com/sh/c0rg7lv90eg0bmm/AAB1gUGt9L9EYKWwSSla6_Pga?dl=0>

**Slide 3:** Why visualization?

**Slide 4:** A visualization is a graphical representation designed to enable exploration, analysis, or communication.

Pictures: Two covers of books written by Alberto Cairo.

The title of the first book at the top is The Functional Art: An Introduction to Information Graphics and Visualization, dated 2012. The tile of the second cover page is The Truthful Art: Data, Charts, and Maps for Communication, dated 2016.

**Slide 5:** Eightimages of data visualization books:

First cover: Exploratory Data Analysis by John W. Tukey

Second cover: Understanding Data by B. H. Erickson and T. A. Nosanchuk

Third cover: Introduction to the Practice of Statistics by David S. Moore and George B. McCabe

Fourth cover: Statistics and Computing: The Grammar of Graphics, Second Edition, by Leland Wilkinson

Fifth cover: The Elements of Graphing Data by William S. Cleveland

Sixth cover: Visualizing Data by William S. Cleveland

Seventh cover: Visualization Analysis and Design by Tamara Munzner

Eighth cover: The Visual Display of Quantitative Information by Edward R. Tufte

**Slide 6:** Two images of book covers:

The first cover displays a phone with graphed data on the display. The title is, “Information Dashboard Design: Displaying Data for at-a-glance Monitoring” by Stephen Few, Second Edition.

The second cover is on a blue background and is tilted, “The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios” by Steve Wexler, Jeffrey Shaffer, Andy Cotgreave

http://www.wiley.com/WileyCDA/WileyTitle/productCd-1119282713.html

**Slide 7:** Various methods for displaying data are depicted with data A, B, C, D, E:

Length or height: A horizontal bar graph, vertical bar graph, and horizontal line graph

Position: A horizontal dot plot

Area: Circular and rectangular graphs representing each data point

Angle/area: Pie charts

Line weight: Vertical Bar graph with varying widths

Hue and shade: Data displayed with varying colors or shades.

**Slide 8:** “The median score is 72 over 100”

Result: Unhappy students

Based on Richard Thaler’s “Misbehaving: The Making of Behavioral Economics”

**Slide 9:** “The median score is 72 over 100” Result: Unhappy students

“The median score is 96 over 137” Result: Happy students!

Based on Richard Thaler’s “Misbehaving: The Making of Behavioral Economics”

**Slide 10:** Depiction of two scales. Scale 1.The first exam’s scores ranging from 0 to 100 with an average score of 72 in red.

Scale 2. The second exam scale ranges from a minimum of 0 to a maximum of 137 with an average score of 96 in red.

Based on Richard Thaler’s “Misbehaving: The Making of Behavioral Economics”

**Slide 11:** N = 142 ; X mean = 54.2633 ; X SD = 16.7651 ; Y mean = 47.8323 ; Y SD = 26.9354 Pearson correlation = -0.0645

A listing of numerical values is depicted in two columns and 19 rows on the left side of the slide with values extending to the 4th decimal place.

**Slide 12:** N = 142 ; X mean = 54.2633 ; X SD = 16.7651 ; Y mean = 47.8323 ; Y SD = 26.9354 Pearson correlation = -0.0645

On a graph with the x-axis and y-axis labeled 1-100 a dinosaur is plotted according to the listed values on slide 11.

**Slide 13:** Depiction of two Excel spreadsheets filled with numerical data.

**Slide 14:** Michael E. Mann, Raymond S. Bradley, and Malcolm K. Hughes

Intergovernmental Panel on Climate Change (IPCC), Third Report, 2001

Image: A graph where the X-axis is the year ranging from 1000 to 2000, Y-axis is labeled Departures in temperature (degrees C) from the 1961-1990 average and ranges from -1.5 to 1.

Data from thermometers (red and from tree rings, corals, ice cores and historical records (blue).

**Slide 15:**

A visualization is a display intended to make the invisible visible

**Slide 16:**

A visualization is a display intended to make the invisible visible

Information shaped as a graphic functions as a cognitive aid

**Slide 17:**

A visualization is a display intended to make the invisible visible

Information shaped as a graphic functions as a cognitive aid

The nature of the information can guide you when choosing the most appropriate ways of telling the story

**Slide 18:**

A visualization is a display intended to make the invisible visible

Information shaped as a graphic functions as a cognitive aid

The nature of the information can guide you when choosing the most appropriate ways of telling the story

Visualization doesn’t simplify. It clarifies

**Slide 19:** Visualization is becoming mainstream

**Slide 20:** Four images are on the slide.

The top left image depicts the Adobe Illustrator logo

The top right image shows a screenshot of a software insight and reads, Easily explore data and discover trends without learning complex software.

The bottom left image shows the webpage for R and reads, The R Project for Statistical Computing.

The fourth image shows the software QGIS and reads, A Free and open Source Geographic Information System.

**Slide 21:** Screenshot of a website titled The Functional Art

Tutorials & Resources. Video tutorials

These videos will show you how I designed several of the graphs and maps showcased in the Truthful Art. This is the workflow I will outline:

GENERATING BASE GRAPHICS: insight, Quantum GIS, Adobe Illustrator

STYLING and COMPOSITION: Adobe Illustrator

PUBLISHING TO THE WEB (responsive design): ai2html

http://www.thefunctionalart.com/p/instructors-guide.html

**Slide 22:** In Global Health

Hans Rosling [www.gapminder.org](http://www.gapminder.org)

<http://www.gapminder.org/videos/200-years-that-changed-the-world-bbc/>

A screenshot of the Gap Minder website: GAPMINDER a Fact-Based Worldview.

On the website it reads, “Refresh your world – Pour the Sparkling fresh numbers into your eyes and upgrade your worldview”. Examples:

Wealth and Health Nations

CO2 emissions since 1820

Africa is not a country!

Is child mortality falling?

Where is HIV decreasing?

BUBBLE CHART

**Slide 23:** Image of a Pro Publica website titled A Disappearing Planet

MAMMALS

Image of a lion next to a bar graph that reads.

1,469 at risk (in red); 3,125 healthy (in gray); 835 unknown (in white).

Given the historical extinction rate, we would not expect more than one mammal species to go extinct each century. According to scientists, however, 1,469 are currently in danger of becoming extinct over the next 100 years. Note the red cluster at primates, especially lemurs. Rhinos, bears & big cats are also at risk.
Note: primates, lemurs, Rhinos, bears & big cats are in red text

A vertical bar graph is depicted in gray and red showing healthy and at risk species, the Panthera leo Lion Vulnerable.

http://projects.propublica.org/extinctions/

**Slide 24:**
Image: A vertical line graph with the X-axis ranging from 0% to 100% in 10% increments goes from blue to red, the Y-axis ranges from 2014 to 2004 in reverse chronological order in increments of one year. Data trends are spread out along the X-axis and converge as you increase along the Y-axis.

http://www.tampabay.com/projects/2015/investigations/pinellas-failure-factories/chart-failing-black-students/

**Slide 25:** Three images with three different graphs from the Pew Research Center are shown. The first image has the title: Many in Developing Nations Struggle to Afford Food and shows the countries in which people cannot afford food in percentages with a downward trend. The graph has the various countries plotted along a linear negatively sloped line.

The second image shows a coordinate grid with plotted cluster of various districts. The title is: Districts with Fewest Eligible Voters Have the Largest Hispanic Populations and Are Represented by Democrats.

The third image, titled 2014 Partisan Advantages Among Whites, by Year of Birth, shows a graph sorted by generations of Silent Generation with a high Republican Leaning, Baby Boomers with a light Republican Leaning, Generation X with a higher Republican Leaning than the Baby Boomer, and finally, the Millennial generation with a High Democratic Leaning.

**Slide 26:** Slide introducing Part 1 of the presentation: The Core Principles. It includes the same image described on slide 1.

**Slide 27:** A summary

**Slide 28:** A summary

Good graphics…

1. They are based on good data

**Slide 29:** A summary

Good graphics…

1. They are based on good data
2. They attract reader’s attention

**Slide 30:** A summary

Good graphics…

1. They are based on good data
2. They attract reader’s attention
3. They don’t frustrate readers

**Slide 31:** A summary

Good graphics…

1. They are based on good data
2. They attract reader’s attention
3. They don’t frustrate readers
4. They show the right amount of data

**Slide 32:** A summary

Good graphics…

1. They are based on good data
2. They attract reader’s attention
3. They don’t frustrate readers
4. They show the right amount of data

Note: Numbers 1. and 4. Are outlined.

**Slide 33:** A Bar graph is shown. The title is Less regulation = More Industry Investment

The first red bar graph is lower at $14 billion following 1992 Cable Regulation from 1993 to 1996

The second blue bar graph that is higher at $56 billion, after regulations were relaxed from 1999 to 2003.

Based on a chart by the National Cable & Telecommunications Association

**Slide 34:**

Two graphs are displayed; the top left is the graph depicted on slide 33. The top right graph is titled Cable Industry Infrastructure Expenditures in billions.

The X-axis is a date from 1990 to 2013 in two year increments.

The Y-axis starts at $16 then goes to $4, $8, $12, and $16.

In 1992 the investment with the Cable Television Consumer Protection and Competition Act (“Regulation”) was under 4 billion dollars whereas after the Telecommunications Act (“Deregulation”) passed, the investment increased to approximately $6 billion Dollars in 1996 with the trend increasing to $16 billion in 2001.

**Slide 35:** Line graph: Production Costs

*U.S. dollars per unit*

The X-axis ranges from 2008 to 2013. The Y-axis ranges from 350 to 550.

Two similar trend lines are labeled Product 1, and Product 2. There are three values on the right side of the graph, 150, 210, and 270 increasing along the Y-axis for Product 2.

**Slide 36:**

The graph from slide 35 is depicted next to another Production Costs graph where data lines for Product 1 and Product 2 do not intersect.

**Slide 37:** Line graph:

The X-axis is months starting in January and goes through December

The Y-axis has percentage values from 60% to 200% in increments of 20.

The title of the graph is Revenue and Units by Month as Percent of January Sales.

The Revenue line is green and starts at 100% in January and increases to 180% by December. The Units Sold line is brown and starts at 100% in January and decreases to 80% in May but ends up at 120% by December

This gives us a way to compare the data sets’ patterns of change in a single graph along a common scale, so magnitude comparisons are appropriate and the intersections of lines are meaningful.

I certainly cannot conclude, once and for all, that graphs with dual-scaled axes are never useful; only that I cannot think of a situation that warrants them in light of other, better solutions. I invite you to propose viable exceptions, which I will welcome with open arms.

https://www.perceptualedge.com/articles/visual\_business\_intelligence/dual-scaled\_axes.pdf

**Slide 38:** A summary

Good graphics...

1. They are based on good data

2. They attract readers’ attention

3. They don’t frustrate readers

4. They show the right amount of data

Note: Numbers 2 and 3 are outlined.

**Slide 39:** Original

Image of 30 small circles with triangular graphs of different colors and numbers. Above each circle are the names of famous authors. On the left of the page it reads:
From first published to masterpieces

Visualized are the authors of the 100 best English novels of 1900 according to the Modern library ranking. Authors are represented through circles showing their life span where their debut novel, their masterpiece(s) according to the ranking are positioned. Authors’ order points out the time-gap between the debut novel and the first published novel selected from the Modern Library ranking (masterpiece). Debut novel and first masterpiece correspond for the first 22 authors. Information about authors’ hometown and novels’ ranking are reported as well.

Sources: biograph.com, Britannica.com, modernlibrary.com

http://www.thefunctionalar t.com/2014/11/redesigning-visualizations.html

**Slide 40:** Original Quick Redesign

The image depicted on slide 39 is on the left. A redesigned representation of the data from slide 39 is on the right. Authors are listed vertically with their age across the X-axis.

http://www.thefunctionalar t.com/2014/11/redesigning-visualizations.html

**Slide 41:** Part 2 – Choosing graphic forms

Image described on slide 1.

**Slide 42:** Image from slide 7 reproduced here.

**Slide 43:** A data visualization catalogue is shown with 30 round blue and white icons.

<http://www.datavizcatalogue.com/>

Another image shows similar graph icons by Ann Emery, data analysis + visualization

<http://annkemery.com/essentials/>

**Slide 44:** Title: What graphic forms are more appropriate to represent your data?

Three aspects to consider:

1. Think about the audience and the publication

2. Think of the questions your graphic should help readers answer

3. Can you understand it without reading every single figure?

**Slide 45:** Based on Cleveland and Robert McGill (1984)

Image: A vertical arrow along the left is labeled at the top, “Enable accurate estimates” and at the bottom “May enable general estimates”. To the right of the arrow are 9 boxes. From top to bottom they are labeled and show examples of each type of graph/figure:

Position along a common scale

Position along identical, nonaligned scales

Length

Direction/slope; Angle

Area

Volume

Shading and saturation

Color hue.

**Slide 46:** Based on Cleveland and Robert McGill (1984)

The same image as in Slide 45 with a red box around Position along a common scale.

**Slide 47:** Great for accurate judgments: Comparisons, relationships, etc.

An image with 6 different charts are depicted.

The first is a bar chart with blue bars with countries of Spain, US, France and UK on the X-axis and numbers from 0 to 60 on the Y-axis.

The second is a Lollipop chart with the same values but has vertical lines and a dot at the top of each line.

The third is a dot chart or dot plot with values represented in two colors.

The fourth is a scatter chart or scatter plot with values from 0 to 80 on the X-axis and 0 to 60 on the Y-axis.

The fifth is a line chart (or time series chart) where the X-axis represents years between 1995 and 1998.

The sixth is a slope chart with countries color coded and lines trend up or down between 2000 and 2010 on the X-axis.

**Slide 48:** The image described on slide 45 is repeated with a red square around Area, Volume, Shading and saturation, and Color hue.

**Slide 49:** Title:Great for general patterns, trends, etc.

There are four images with a geographic maps of Spain.

The Choropleth Map displays percentage of people who ate at least one serving of boiled octopus last year using different shaded areas by quartile percentages.

The second image is a Dot Map. Every dot represents a restaurant that served boiled octopus at least once last year.

The Proportional Symbol Map displays people who ate at least one serving of boiled octopus last year using circles of 1,000,000 or 250,000.

The Isopleth Map displays the most common temperature in which octopuses are boiled. With four options in different shades of green, 116-120 degrees C, 111-115 degrees C, 106-110 degrees C, and 100-105 degrees C.

**Slide 50:** The image described on slide 45 is repeated with a red square around Direction/slope, Angle, and Area.

**Slide 51:** How Music Preferences Have Changed in Two Decades

Music styles preferred by University of Miami students. Survey based on interviews with 1,000 students.

SOURCE: WishfulThinkingData Inc.

Two 3 D pie charts are shown. The first pie chart is dated 1994 and the second pie chart is dated 2014.

The first chart is divided up by music genre: Classic (5%), Hard Rock (35%), Samba (25%), Hip-Hop (20%), Reggae (10%), and Country (5%).

The second pie chart has the same categories with no percentages displayed.

**Slide 52:** Title: How Music Preferences Have Changed in Two Decades - Music styles preferred by University of Miami students. Survey based on interviews with 1,000 students.

SOURCE: WishfulThinkingData Inc.

The same data as slide 51 is depicted using a slope chart with horizontal lines for each music genre depicting a change of either increase or decrease in music genre preference from year 1994 to year 2014.

**Slide 53:** Choosing graphic forms is largely dependent on the messages you wish to convey, or the insights you want to get.

**Slide 54:** An image of Polio infection rates is shown using a grid style chart. Each section has a color representing a high (red shades) or low (blue shades) number of polio infections across individual states, with a declining trend after vaccine introduction.

<http://graphics.wsj.com/infectious-diseases-and-vaccines/>

**Slide 55:** Repeated image of the graph on slide 54 with purple and yellow colors.

Color blindness simulator: <http://www.color-blindness.com/coblis-color-blindness-simulator/>

Randy Olson: <http://www.randalolson.com/2016/03/04/revisiting-the-vaccine-visualizations/>

**Slide 56:** From the CVD color blindness website,four screenshots of the map of Brazil are shown with different colors and shades in each image.

Color blindness simulator: <http://www.color-blindness.com/coblis-color-blindness-simulator/>

**Slide 57:** The same screenshots of Brazil from slide 56 are shown with additional links for color-blindness resources.

Resources about color:

http://mkweb.bcgsc.ca/colorblind/

http://earthobservatory.nasa.gov/blogs/elegantfigures/2013/08/05/subtletiesof-

color-part-1-of-6/

http://colorbrewer2.org/

**Slide 58:** Another chart of polio cases in the US is shown using red shades from light red to dark red.

Randy Olson: <http://www.randalolson.com/2016/03/04/revisiting-the-vaccine-visualizations/>

**Slide 59:** A line chart depicting Polio cases in the United States.

The Y-axis is the number cases per 100,000 people, the X-axis is the year from 1930 to 1965 in 5-year intervals. The data trend is bell shaped and increases from 1930 to 1955 where vaccines were introduced. After 1955 the data trends downwards.

Randy Olson: <http://www.randalolson.com/2016/03/04/revisiting-the-vaccine-visualizations/>

**Slide 60:**

The chart described on slide 59 is reproduced with Y-axis values ranging from 0 to 160 and additional individual value lines are drawn in grey.

Randy Olson: <http://www.randalolson.com/2016/03/04/revisiting-the-vaccine-visualizations/>

**Slide 61:** Polio cases per 100,000 residents across the United States

(vertical line = Polio vaccine introduced)

Each state has a small chart depicting data on polio ranging from 1930 to 1970.

Randy Olson: <http://www.randalolson.com/2016/03/04/revisiting-the-vaccine-visualizations/>

**Slide 62:** Which one is “better”? It depends!

Four graphs from slides 59, 59, 60, and 61 are shown.

Randy Olson: <http://www.randalolson.com/2016/03/04/revisiting-the-vaccine-visualizations/>

**Slide 63:** Part III – Visual Design

Image described on slide 1.

**Slide 64:** Graphics style guides

A chart has 13 words listed vertically, a color next to each word, and four numerical values to the right with column labels C, M, Y, K. The first five words are grouped under the category Maps: These colors can be converted to black and white automatically. But always double check automatic conversions.

The last 6 words are grouped under “Charts”.

Words listed (and colors) are as follows:

Land (light grey), water (light blue), neighbor (medium grey), park (greenish grey), country (brown), pink (pink), silver (silver), red (red), blue (blue) beige (beige), ocre (burnt orange), green (green), orange (orange.

Why does it matter?

Color palette is not just a rule. Colors are essential to build a family structure to the graphics at the DMN. Use these colors as a starting point for every graphic you do.

Creating variations:

On Illustrator, go to Filter, Colors, Saturate.

Always double-check automatic conversions to grayscale.

**Slide 65:** The key to any visual design is the presentation of a *cohesive*, *structured*, readable, and understandable composition.

**Slide 66:** Simplicity is about subtracting the obvious and adding the meaningful.

*John Maeda, The Laws of Simplicity*

**Slide 67:** Unemployment in the countries that participated in the survey

Chart with the X-axis is thousands of people ranging from 0 to 500 in increments of 50.
The Y-axis is labeled Countries and includes numerical values labels: Spain (125), Singapore (435), South Korea (240), Venezuela (135), Ecuador (323), and Somalia (453).

Below the chart is a table with the same data represented.

**Slide 68:** Data from slide 67 is represented in a horizontal bar graph instead of triangular bars. The X-axis is now in increments of 100.

**Slide 69:** Data from slide 67 is represented in a horizontal bar graph, the X-axis values ranging from 0 to 500 in increments of 50.

**Slide 70:** Data from slide 67 is represented in a horizontal bar graph with dotted lines instead of solid, and a white background instead of grey.

**Slide 71:** Data from slide 67 is represented in a horizontal bar graph with shades of green for each country. Darker shades represent higher unemployment rates.

**Slide 72:** Data from slide 71 is displayed with the table next to the graph, and ordered from highest value to lowest.

Title:Somalia leads the countries that participated in the survey

Thousands of unemployed people.

An arrow pointing to Somalia reads:

The economic crisis caused by a sudden drop in exports has led Somalia to an unsustainable situation.

Source: CompletelyFakeData Inc. Graphic by ACME

**Slide 73:** Multi-scale Modeling and Assessment of Malaria Risk in Northern South America.

Image of a poster presentation by Alimi, T. O.; Fuller, D. O. and Beier, J.C. from the Abess Center for Ecosystem Science and Policy; Department of Geography and Regional Studies; Department of Epidemiology and Public Health, University of Miami.

Poster sections include: Introduction, significance, specific aims, materials and methods, preliminary results, conclusions and references.

There are two images of Africa, a bar chart, and flow chart in the poster.

**Slide 74:**

Image of the poster described on slide 73 redesigned. The poster now has an orange color scheme highlighting each section of the poster. One of the maps of Africa has been recolored to better highlight the areas being discussed. The flow chart now includes an image of a mosquito for the term “malaria”, and the bar chart is now horizontal with new colors.

**Slide 75:** The golden rule for using *type* and *color* effectively: Elements that have the same nature must look alike

Note: “type” and “color” are red.

**Slide 76:** Choosing colors: Begin with just one color (plus black and white.) and play with its shades. Increase the variety of colors only if it’s necessary.

A color chart is depicted with less saturated hues on top with the description, “Use neutral colors for most objects and brighter colors” on the right-hand side the description reads, “Use accent colors to highlight the most important information” for red, blue, green, and orange.

(We can make exceptions to this rule when we do need to have many different colors, just to identify elements in the visualization).

**Slide 77:** Screenshot of an infographic titled Diagram news in Perspective.

An image of a mega telescope is shown. On the left side of the mega telescope is text stating 400 years after Gallileo, mega-telescopes rule space exploration. On the right side is a description of How the European Extremely Large Telescope (E-ELT) gathers high-resolution images. There are smaller images around the image of the mega telescope depicting parts of the telescope with specific descriptions underneath.

**Slide 78:** The Importance of Text.

How the Tax Burden Has Changed

Dates range from 1980 to 2010.

Two charts beneath.

First chart: Tax rates have fallen for most Americans, especially high earners.

Share of yearly income paid in federal, state and local taxes, by income bracket.

Below the first chart reads:

Average tax rates were lower for every income group in 2010 compared with 1980, but rates fluctuated during the intervening decades. Savings from federal income tax cuts in 1981 and 1986, under President Ronald Reagan, eroded as other taxes increased. New federal cuts in 2001 and 2003, under president George W. Bush, again reduced the total tax burden. Tax revenues rose in 2010 as the economy recovered from the recession.

Second chart: What’s driven the changes? Federal income tax rates have declined…

Share of income paid in federal income taxes.

Below the second chart reads:

Federal income tax rates fell in the 1980’s after decades of relative stability. The cuts were partly reversed in 1993 under President Bill Clinton, before rates fell again in the early 2000s. For households earning less than $25,000, the tax rate in recent years has been negative because the expansion of government payments like the earned income tax credit exceeded the amount of taxes paid.

<http://www.nytimes.com/interactive/2012/11/30/us/tax-burden.html>

**Slide 79:** Sequencing and layering

An image of an article on Brazil’s Demographic Opportunity includes a map of brazil color coded with a data table. Below that is a graph where each line represents a country or continent long the course of history (X-axis) and number of children per woman (Y-axis).

**Slide 80:** The slide shows excerpts from the article on sequencing andlayering on slide 79.The excerpts show parts of the article. Underneath each image, from left to right, are arrows. On the left under the first image is “Sequencing The upper layer”.

**Slide 81:** Slide 80 is duplicated. In addition, below each image is an arrow pointing down to the corresponding map, graph or text. Next to the first arrow is Layering “Drilling down”.

**Slide 82**: Louisiana is drowning, quickly.

An article is displayed next to a map of Louisiana in 1992. The introduction to the article reads:

In just 80 years, some 2,000 square miles of its costal landscape have turned to open water, wiping places off maps, bringing the Gulf of Mexico to the back door of New Orleans and posing a lethal threat to an energy and shipping corridor vital to the nation’s economy.

http://projects.propublica.org/louisiana/

**Slide 83:** exercise

**Slide 84:** Life Expectancy at Birth (Years).

Three bar graphs depict High income economies, upper middle income economies, and lower middle income economies for countries around the world in relation to life expectancy at birth.

<http://www.brookings.edu/~/media/press/books/2013/affordableexcellence/affordableexcellencepdf.pdf>

**Slide 85:** Life expectancy at birth in 1990, 2000, and 2010

Data from slide 84 represented in one table with orange lines representing women, men in blue, and both sexes in grey. On top of each column are names countries including USA, UK, Australia, Canada, France Japan, Hong Kong, Singapore, China, Malaysia, Thailand, India, Philippines and Vietnam.

The Y axis is life expectancy and ranges from 54 to 84.

**Slide 86:** Disclaimer

The author(s) developed and presented the contents of this file at an online conference sponsored by the Center on KTDRR. The online conference was developed under a grant from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR grant number

90DP0027). NIDILRR is a Center within the Administration for Community Living (ACL), Department of Health and Human Services (HHS). The contents of this presentation do not necessarily represent the policy of NIDILRR, ACL, HHS, and you should not assume endorsement by the Federal Government.