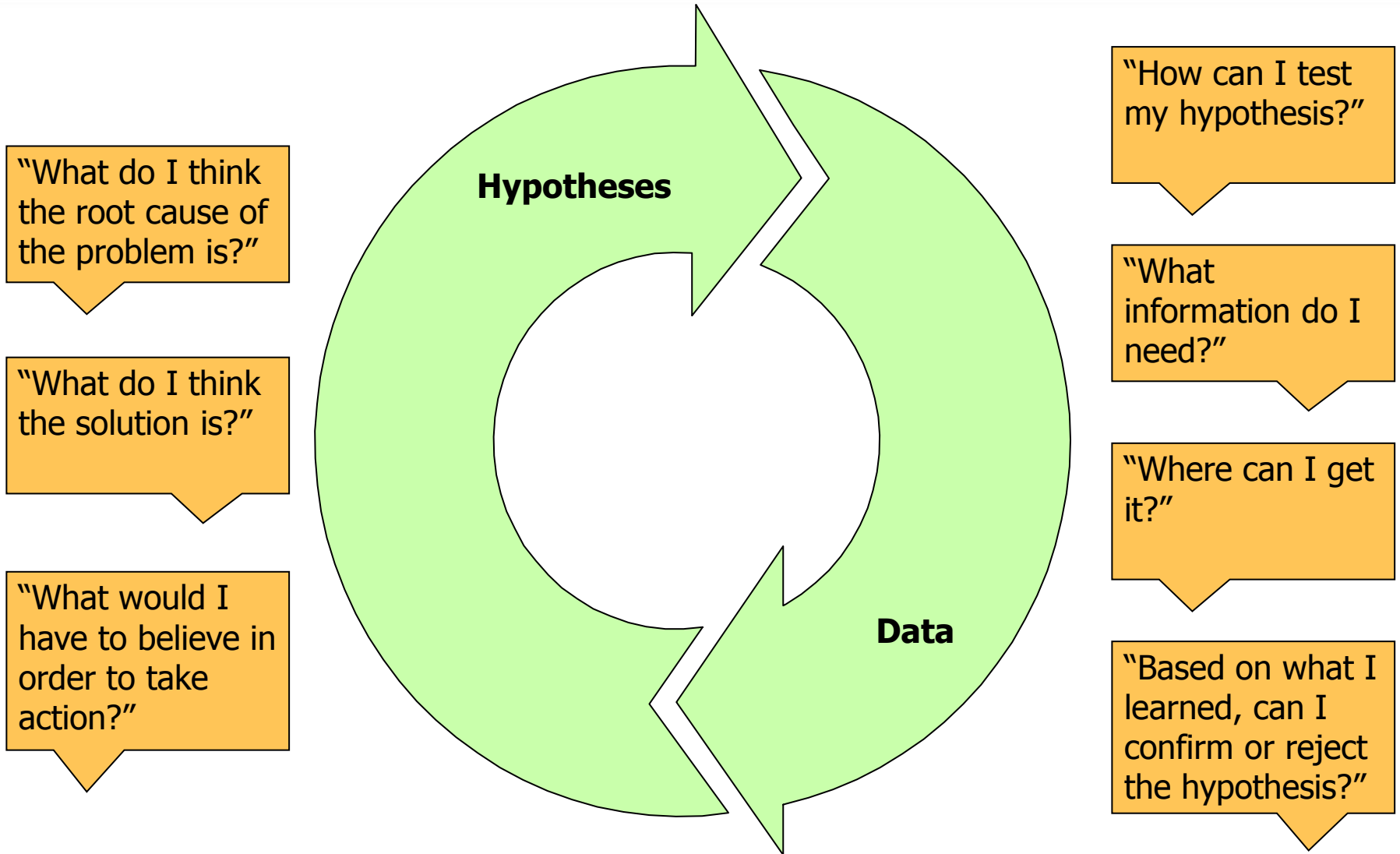




## Visualizing and storyboarding data

# Data analysis is fundamentally about asking good questions and using the best available information to seek out answers



## Definition

A hypothesis is a **tentative statement** about the relationship between two variables that **is verified or rejected through further investigation.**

## Purpose

Hypotheses are the **basis for the investigation process**, in the search for the new truth. They prevent 'blind research' in which data is gathered that is later deemed irrelevant. They serve as **the link between theory and investigation.**

Source: [http://www.sagepub.com/upm-data/41397\\_32.pdf](http://www.sagepub.com/upm-data/41397_32.pdf)

## To successfully focus further investigation, hypotheses must satisfy a number of criteria

### Clear and concise

- Stated in simplest possible terms
- Straightforward and easy to understand
- Specific concepts clearly defined

### Testable

- Empirical statement
- Can be observed and investigated

### General

- Explains a general phenomenon rather than a single occurrence

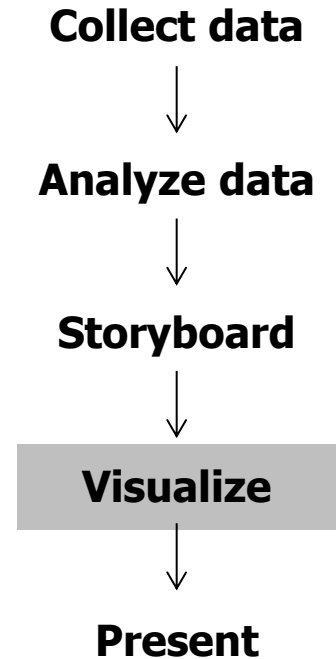
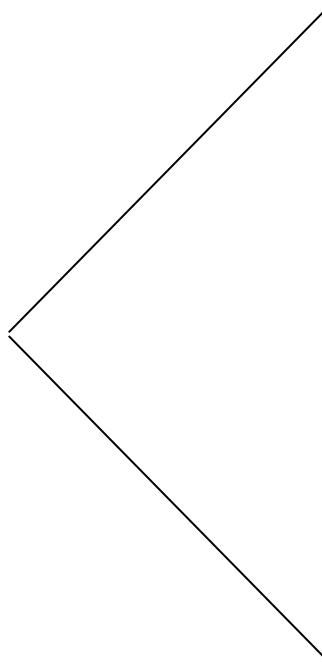
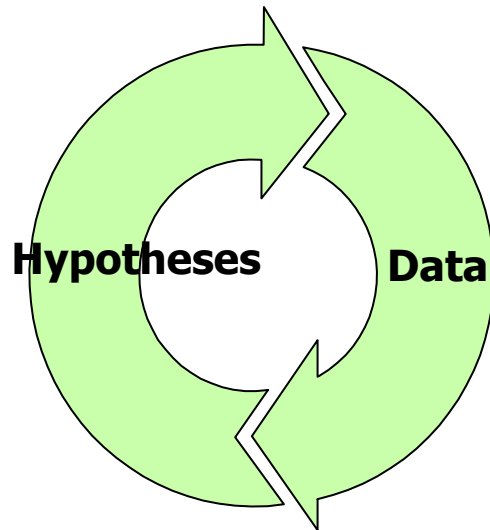
### Plausible

- Agrees with existing evidence and theory

### Relevant/ actionable

- Future actions depend on the verification or rejection of the hypothesis

# The data side of the data cycle breaks down into five steps – here we will focus on visualization



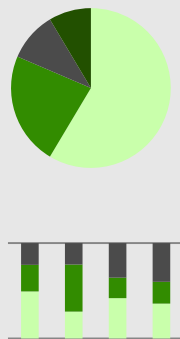
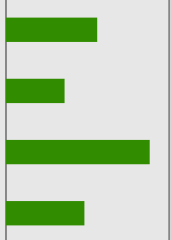
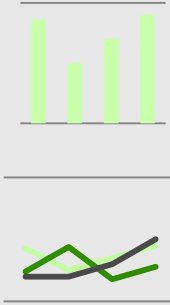

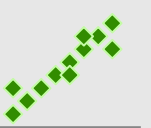
# Choosing the right quantitative chart requires defining the relationships between data points

Relationship:

Definition:

Basic charts:

Trigger words:

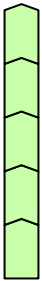
	<b>Component</b>	<b>Item</b>	<b>Time series</b>	<b>Frequency</b>	<b>Correlation</b>
	Percentage of total	Ranking items	Changes over time	Items within ranges	Between variables
	Pie, stacked column 	Bar 	Column, Line 	Column, Line 	Scatter plot 
	Share, percentage of total, accounted for X percent	Larger than, Smaller than, equal, most, least	Change, grow, rise, decline, increase, decrease, fluctuate	X to Y range, concentration, frequency	Related to, increases, decreases with, changes with, varies

# Concept visuals help highlight non-quantitative relationships

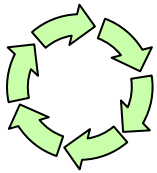
## Flow



Linear

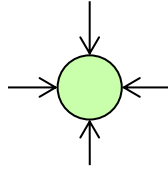


Vertical

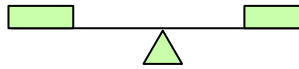


Circular/ continuous

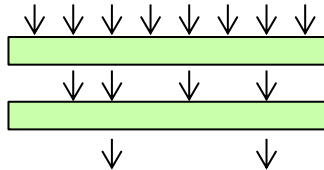
## Interaction



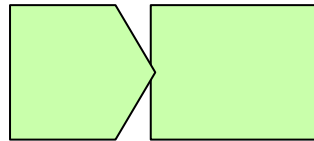
Forces at work



Balance

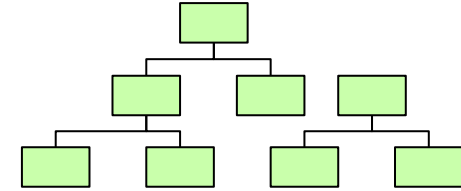


Screen/filter

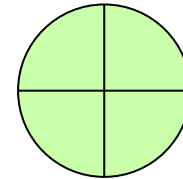


Implication/ result

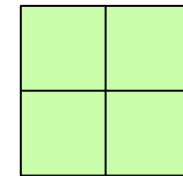
## Structure



Organization

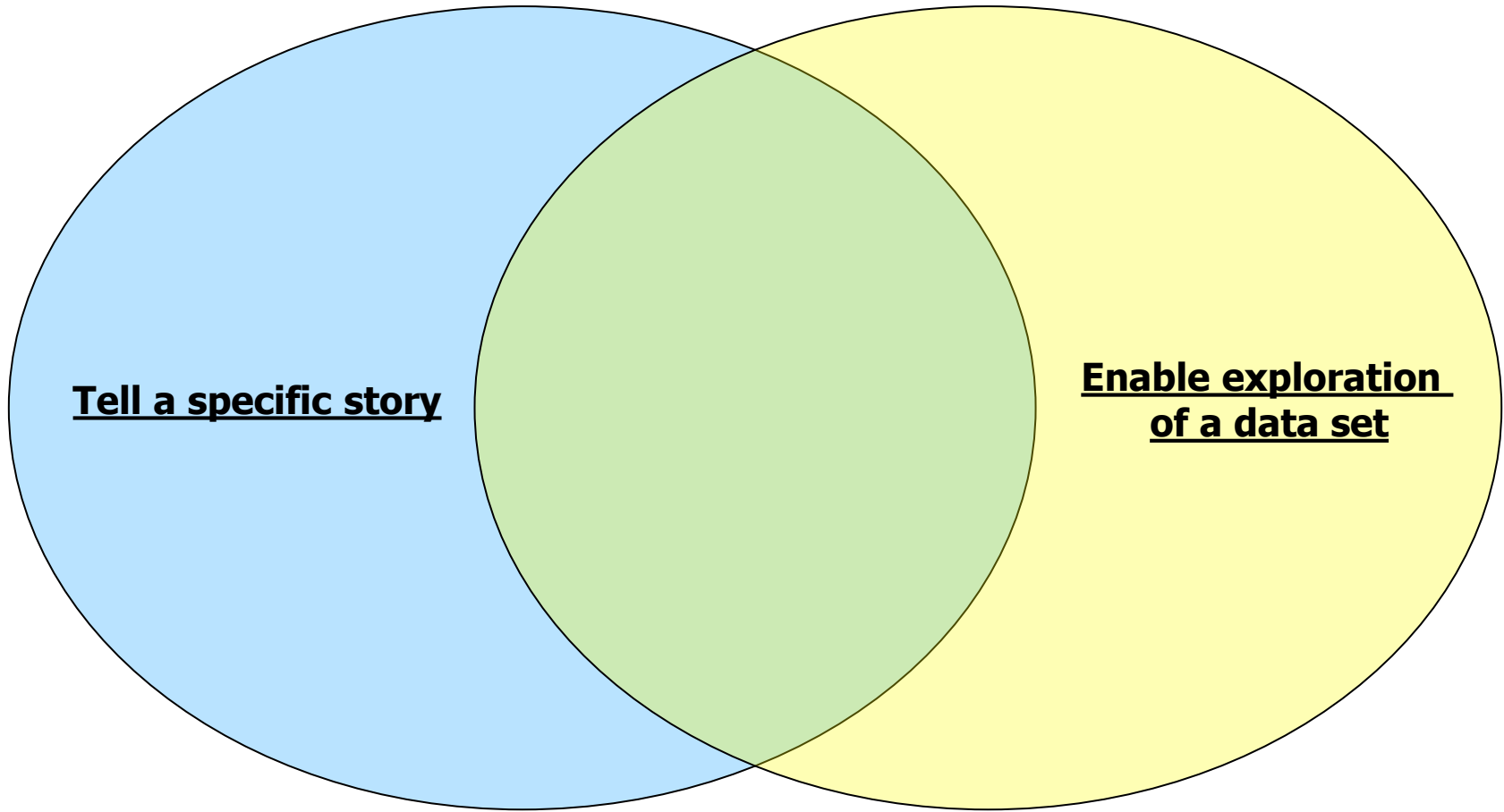


Parts of a whole



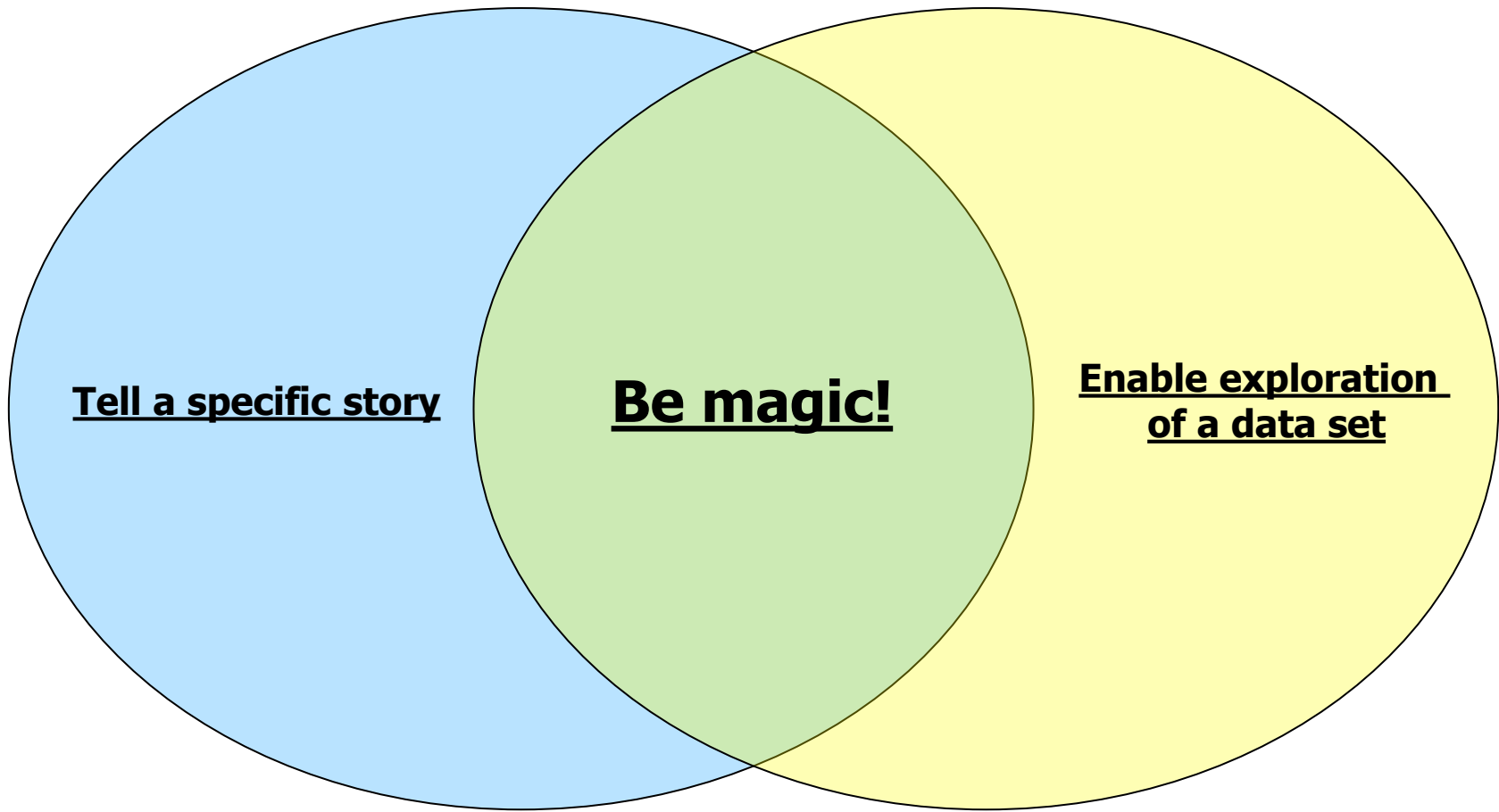
Segmentation

Visualizations can:



# Visualizations that tell a story and enable exploration create magic!

Visualizations can:



# This famous example tells a specific story and enables exploration

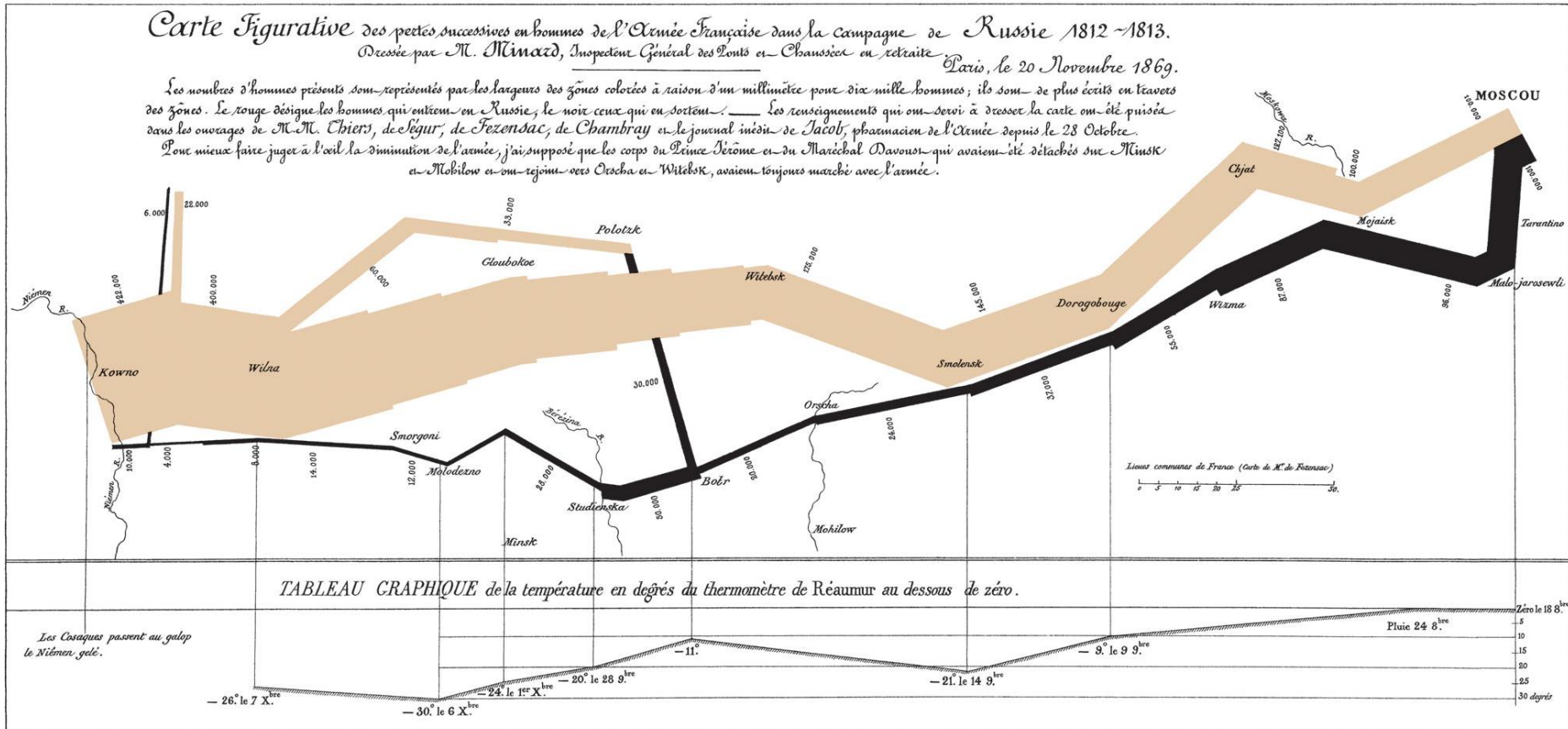
This map, published by Charles Joseph Minard in 1869, shows Napoleon's Russian Campaign

## Carte Figurative des pertes successives en hommes de l'Armée Française dans la Campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui ont été en Russie; le noir ceux qui en sont sortis. Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Fézensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.



# This is not just a map of the campaign route, the line also represents the size of Napoleon's forces along the way – you can explore both geography and data points all at once

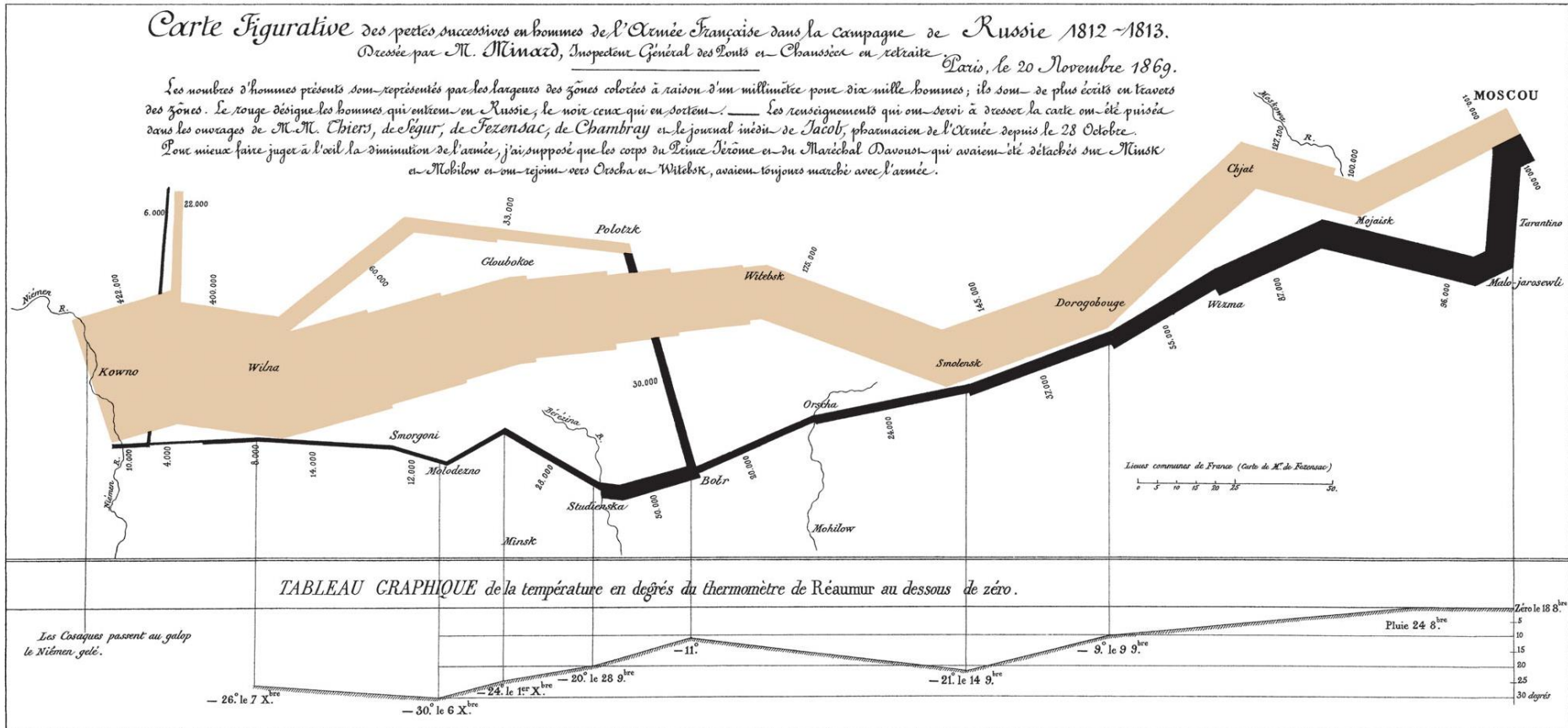
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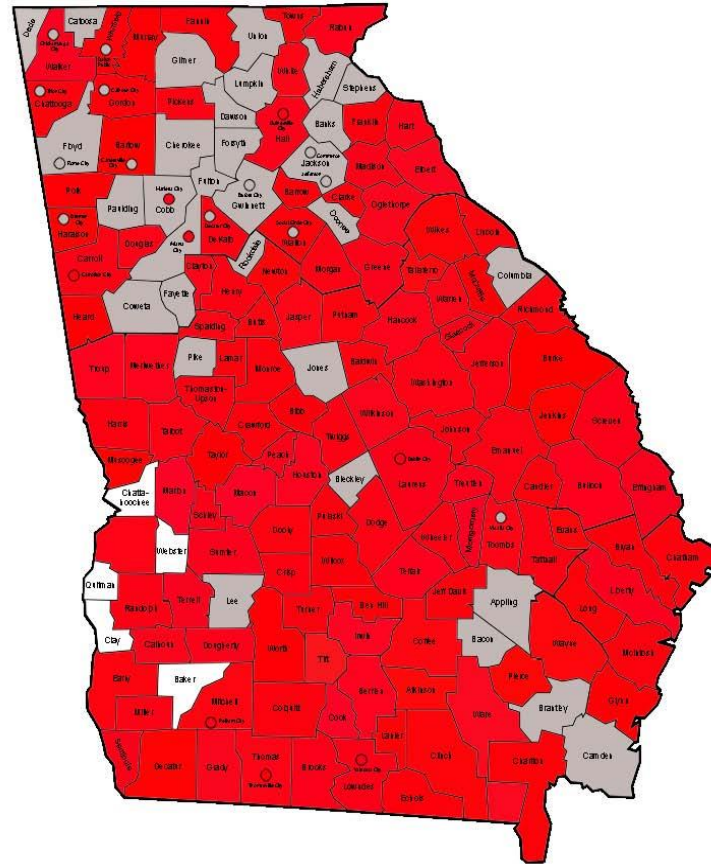


Autog. par Regnier, 8, Pas. 5<sup>ème</sup> Marie St<sup>é</sup> G<sup>é</sup> à Paris.

Imp. Lit. Regnier et Desroches.

# Visualizing a problem can draw a stark comparison and help reenergize the conversation - this map shows the challenge of science implementation in Georgia

Example: Georgia science pass rates by district, 2005

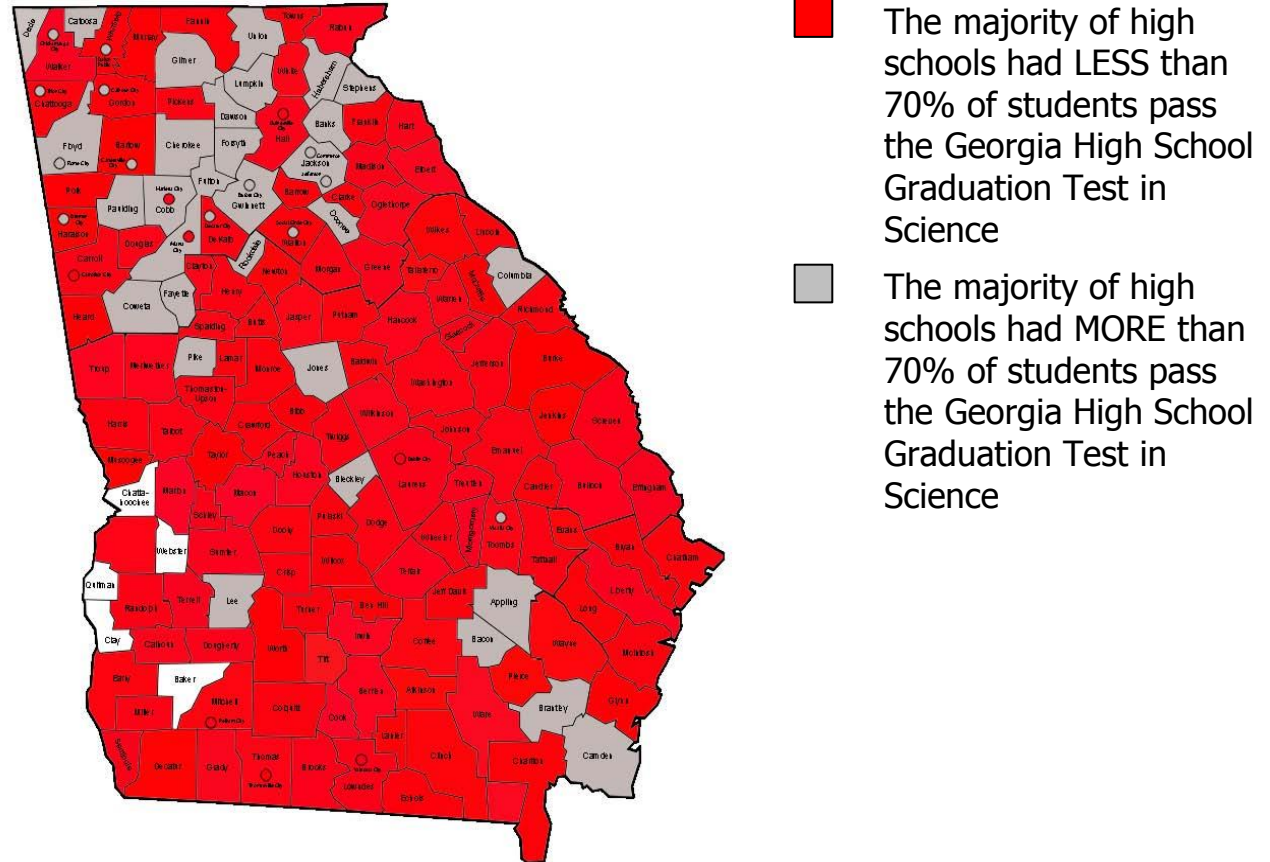


- The majority of high schools had LESS than 70% of students pass the Georgia High School Graduation Test in Science
- The majority of high schools had MORE than 70% of students pass the Georgia High School Graduation Test in Science

Reprinted with permission from Kathy Cox, former School Superintendent, Georgia

# After the Superintendent used the map to convince legislators of needed interventions, the Science Implementation Specialists started work in 2005

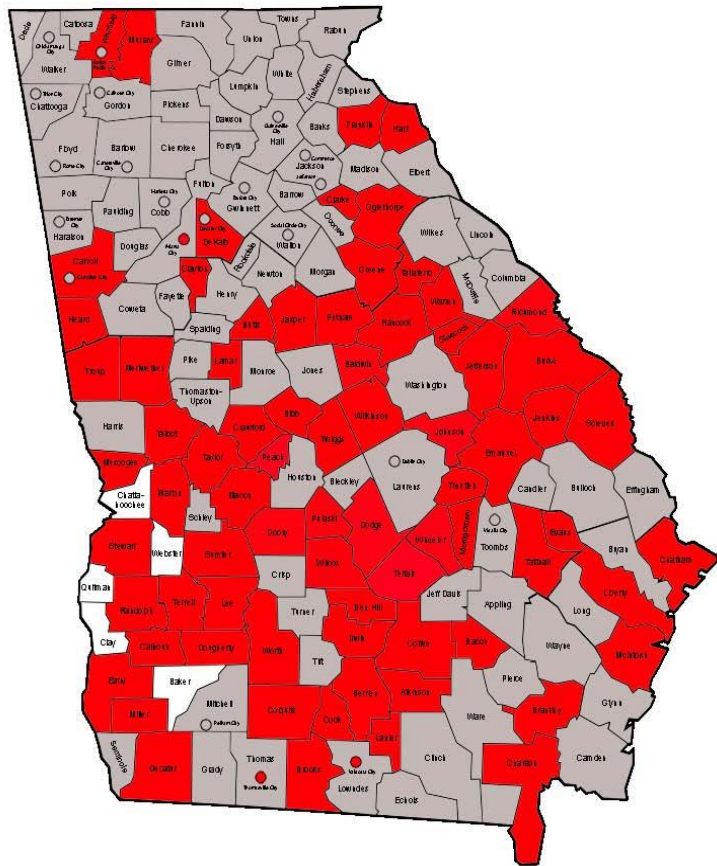
Example: Georgia science pass rates by district, 2005



Reprinted with permission from Kathy Cox, former School Superintendent, Georgia

# They began targeted work with districts and schools based on the data

Example: Georgia science pass rates by district, 2006

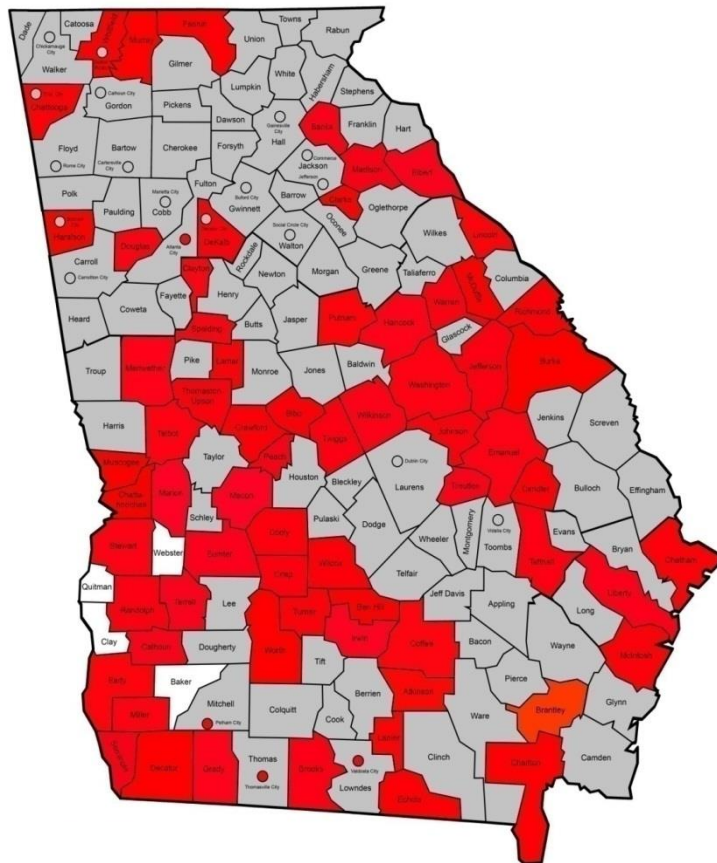


- The majority of high schools had LESS than 70% of students pass the Georgia High School Graduation Test in Science
- The majority of high schools had MORE than 70% of students pass the Georgia High School Graduation Test in Science

Reprinted with permission from Kathy Cox, former School Superintendent, Georgia

# Results improved quickly and significantly within the first two years

Example: Georgia science pass rates by district, 2007



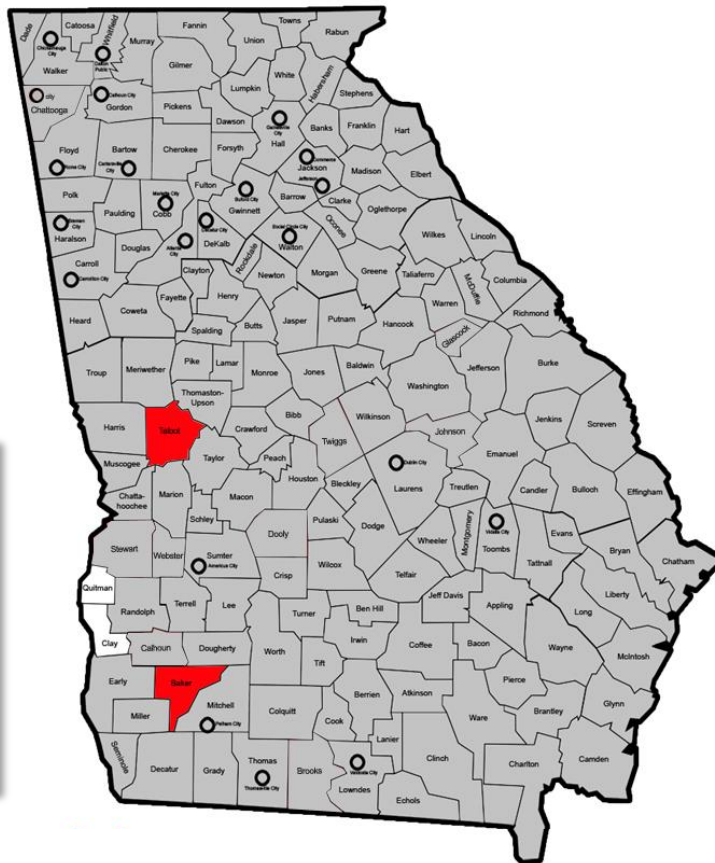
- The majority of high schools had LESS than 70% of students pass the Georgia High School Graduation Test in Science
- The majority of high schools had MORE than 70% of students pass the Georgia High School Graduation Test in Science

Reprinted with permission from Kathy Cox, former School Superintendent, Georgia



# ...And continued to improve

Example: Georgia science pass rates by district, 2009



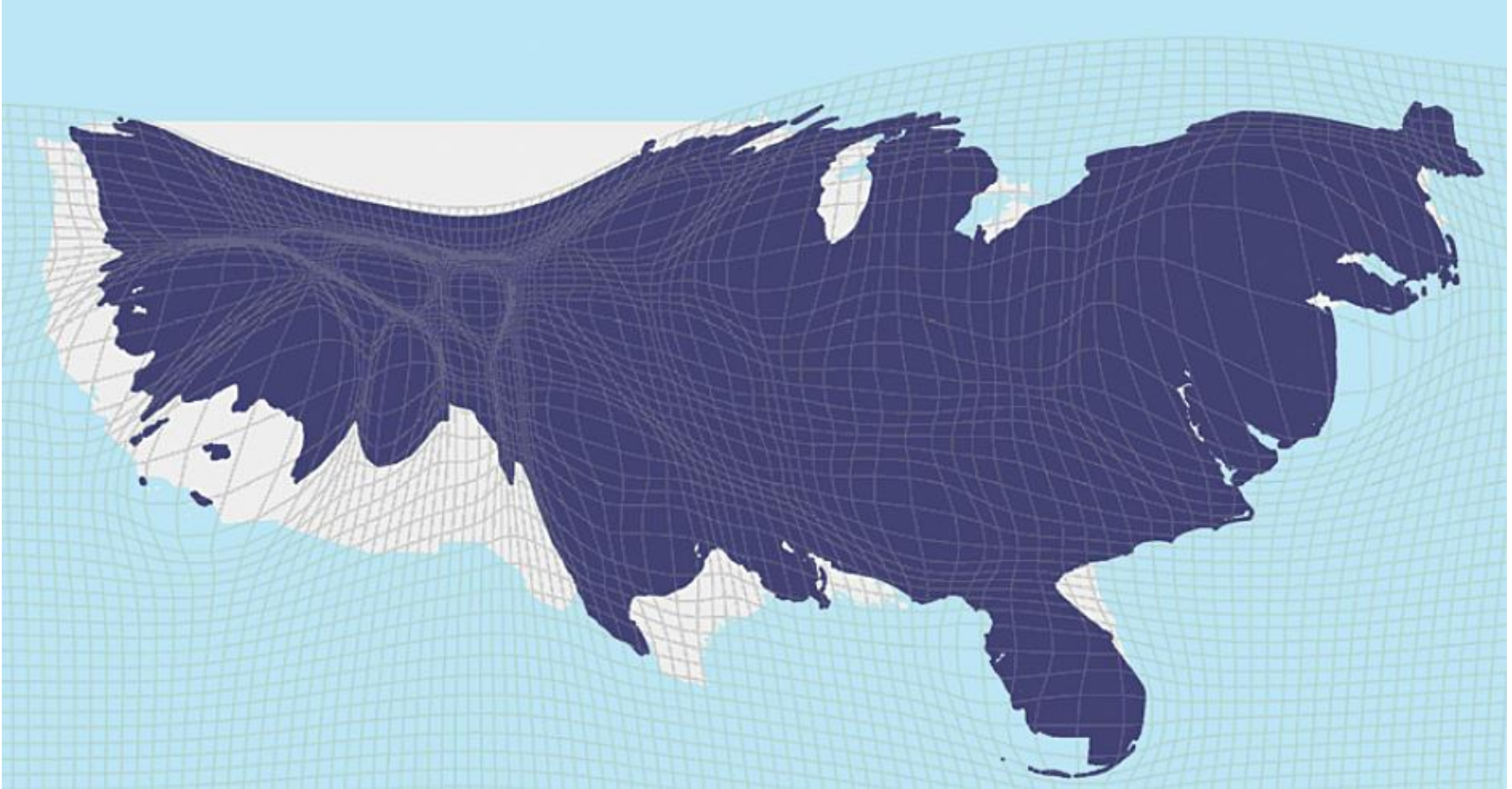
- The majority of high schools had LESS than 70% of students pass the Georgia High School Graduation Test in Science
- The majority of high schools had MORE than 70% of students pass the Georgia High School Graduation Test in Science

This map was a hit with legislators – they loved being able to show how their districts improved in science over time.

Reprinted with permission from Kathy Cox, former School Superintendent, Georgia

# A major challenge of mapping is the representation of population - keep your objective in mind when using a map and know the map's limitations

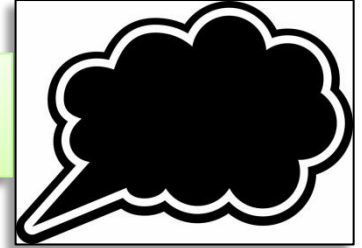
This is a cartogram of the contiguous United States based on population



Source: <http://www.esri.com/news/arcuser/0110/cartograms.html>

# Interactive maps, such as those available on Google, hold several advantages over the static images

Tooltips allow users to click on shapes or points and learn details about the associated data.



Zooming in and out makes it easier to see more detail or the bigger picture. The map never becomes pixilated like a JPEG.

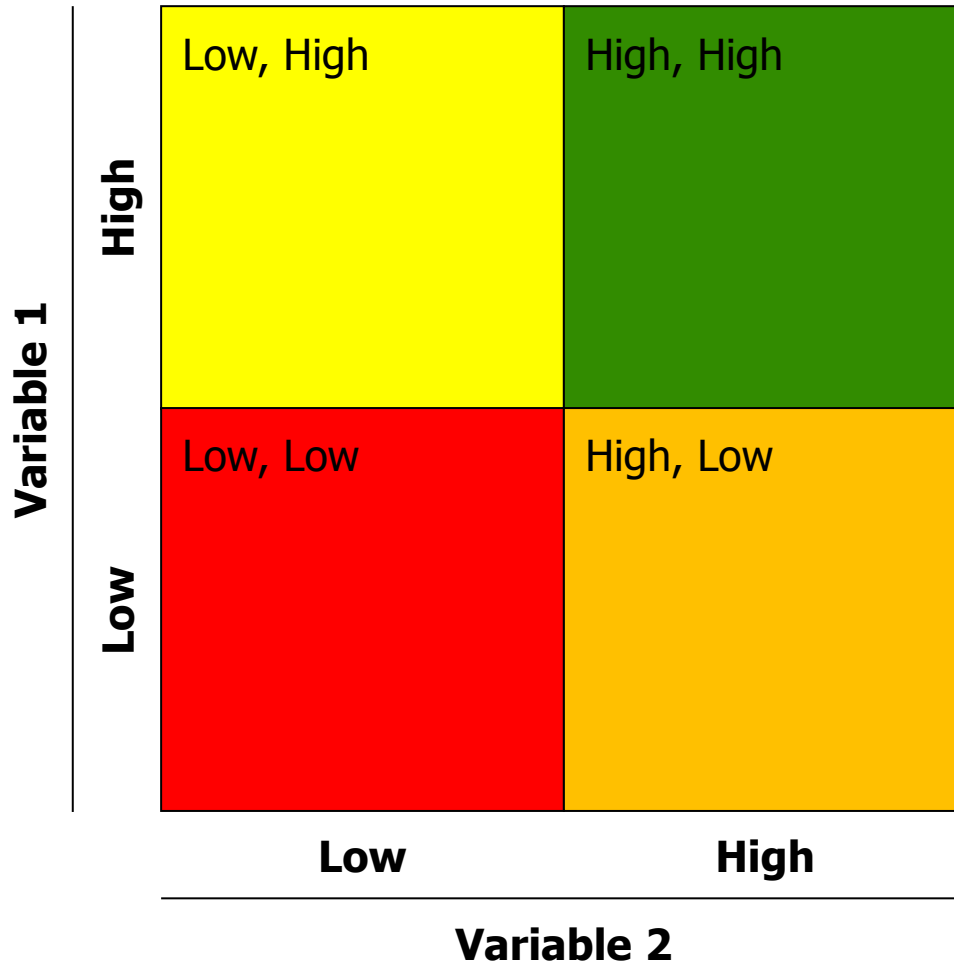
Embedding the map in a website allows users to share with links. If the map is updated, all users will automatically have access to the latest version.



The Google Maps API gives the creator access to a wide variety of tools that make the map easier to navigate, such as points of interest and a search feature.

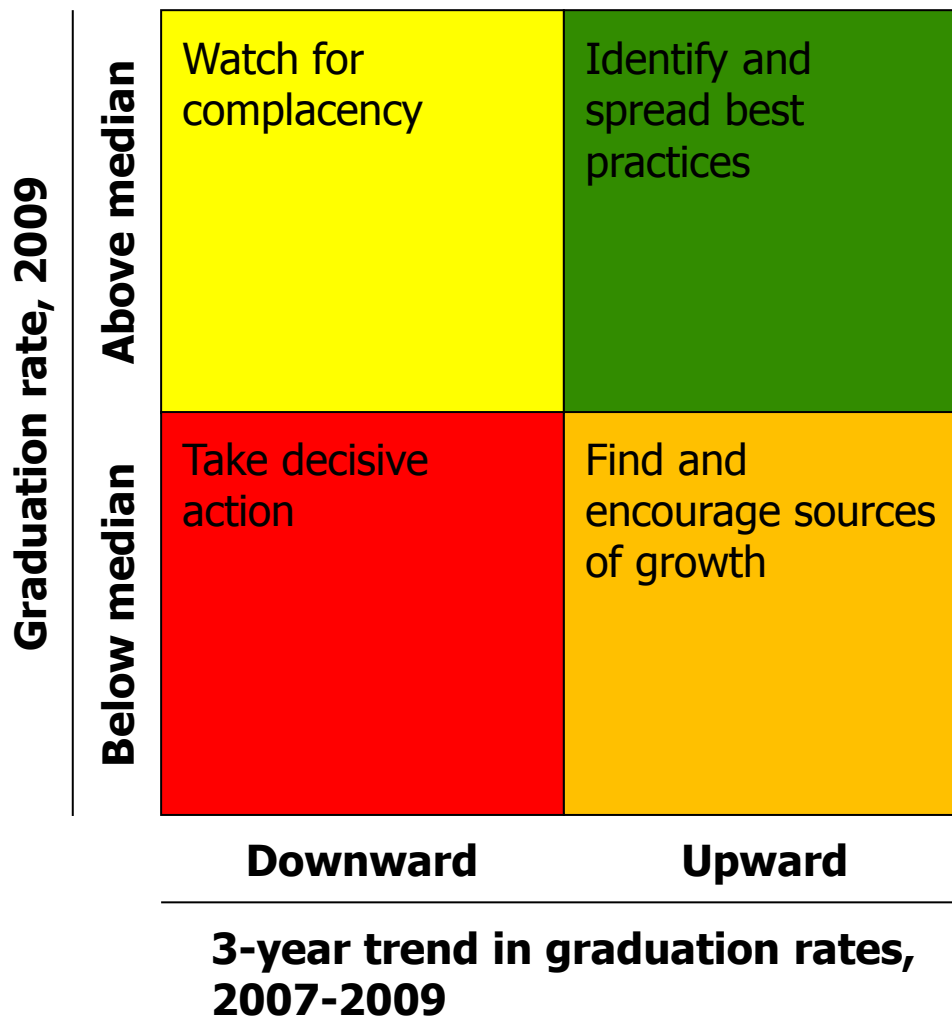
## One of EDI's most common and useful tools is a 2x2 comparison of two variables

Example: plotting 2 variables can make it easy to segment schools or districts



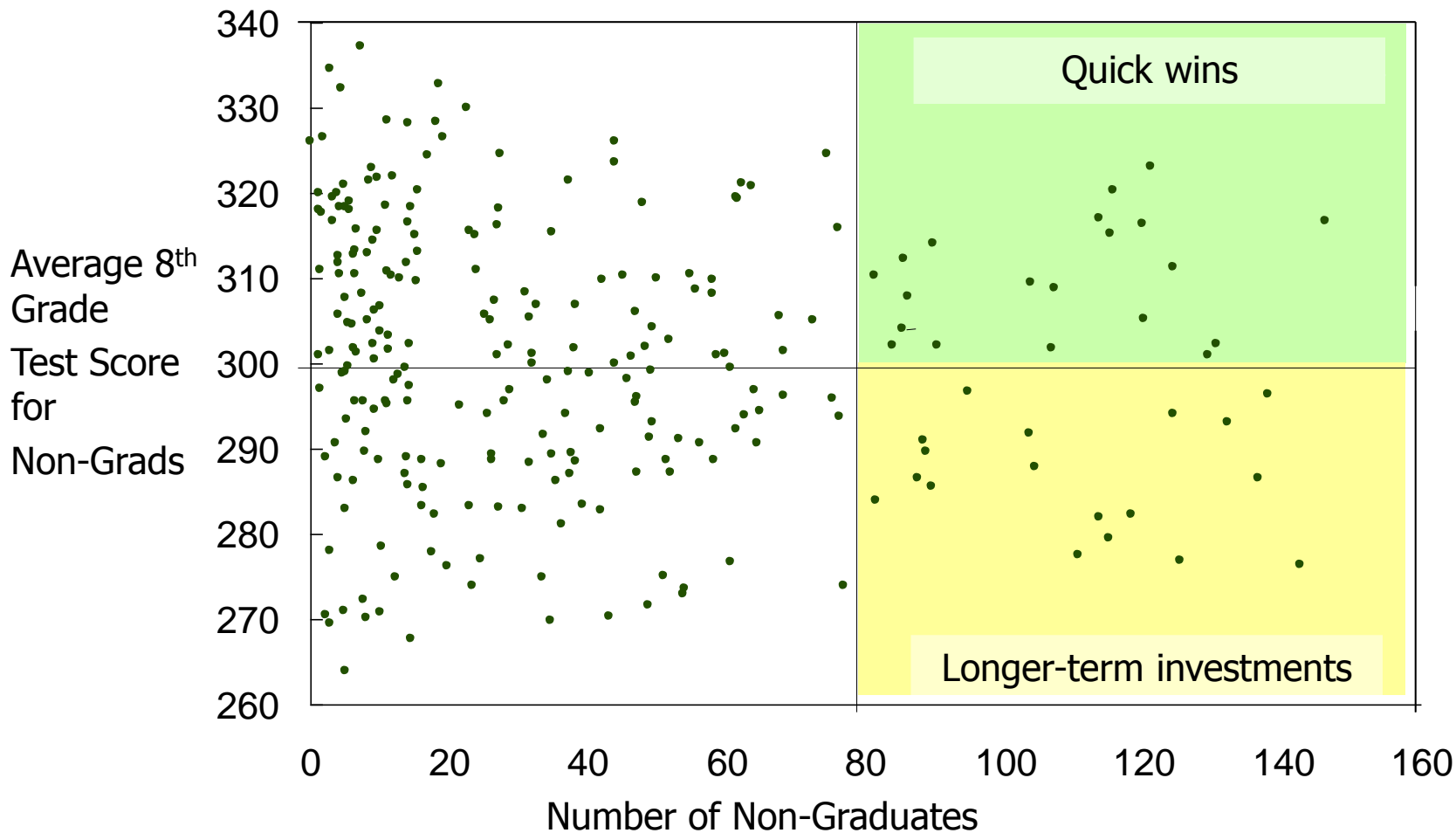
# Using quadrants to categorize districts can be a helpful organizing tool

Example: Graduation rate vs. trend segmentation



# Segmenting districts according to multiple variables can tease out important differences between them

Number of Non-Graduates vs. Average Test Score for Non-Graduates



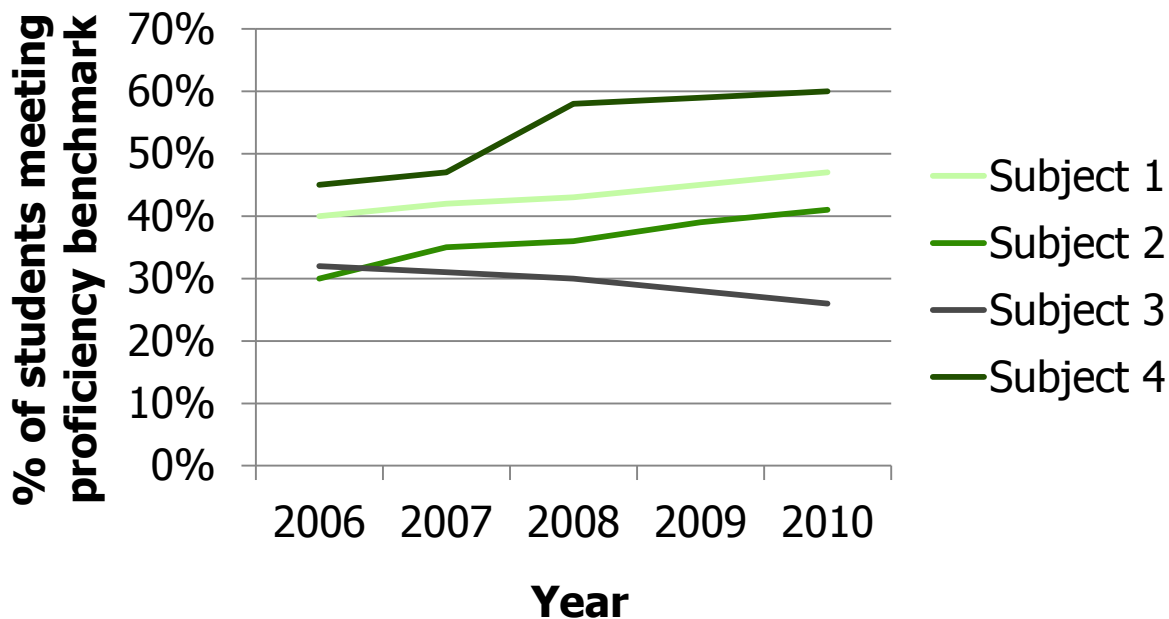
# How you present the data matters – charts and handouts should be clean and follow a uniform format where applicable



# Percent of students proficient increased from 2006 to 2011 in all but one subject

ILLUSTRATIVE EXAMPLE

Percent of students meeting proficiency benchmarks by subject, 2006-2011

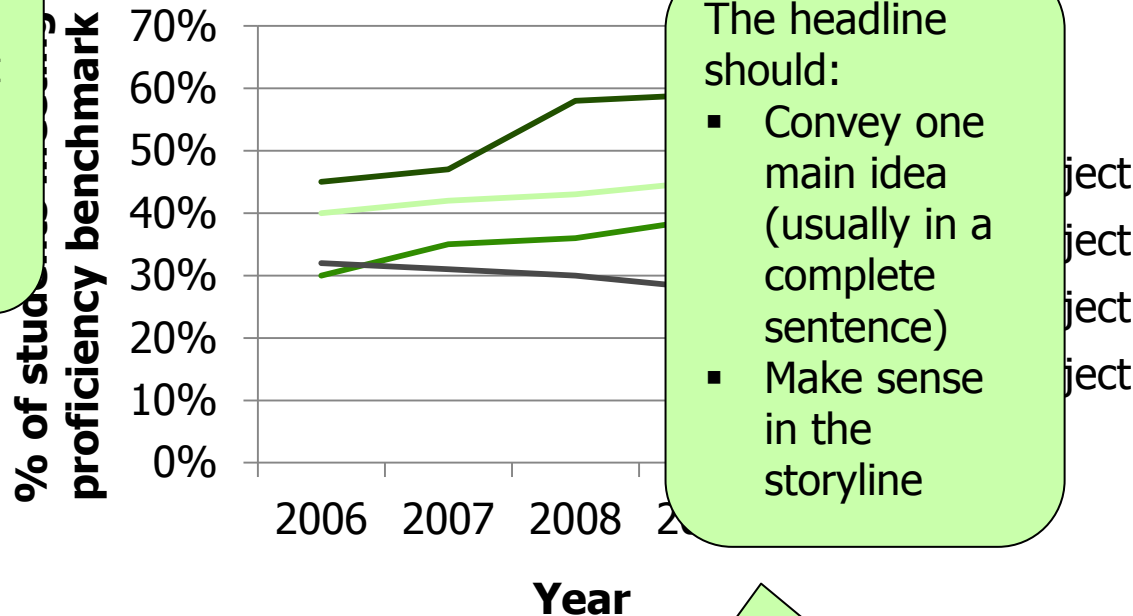


Source: ...

# Percent of students proficient increased from 2006 to 2011 in all but one subject

ILLUSTRATIVE EXAMPLE

Percent of students meeting proficiency benchmark by subject, 2006-2011



The subtitle describes exactly what the information on the page is

The headline should:

- Convey one main idea (usually in a complete sentence)
- Make sense in the storyline

“Stamps” can provide more information about the page – it’s intent (“example,” “illustrative”) or it’s stage of completion (“draft”)

If applicable, include a source and footnote at least 2pts smaller than text

Use the same style and size font (12, 14, 16) for all the content text

Source: ...

# The data visualization checklist is a good tool to keep on hand when presenting data

## Before creating the visual

- What is the appropriate chart type for this story?
- How will I use color?
- How will I use data labels?
- How will I use callouts, circles, or simple animation to make the story clearer?
- Is there a simpler way to tell this story?
- What argument do I want to support with this chart, if any?

## Proofreading the visualization

- Are the fonts consistent and readable?
- Have I used data labels, where possible?
- If data are labeled, have I removed or at least lightened grid lines?
- Does the graph have an appropriate title that accurately describes the data?
- Have I included a separate headline, which explains the point of my visualization?
- Are both axes clearly defined and labeled?

## Proofreading the visualization, cont.

- Have I used color consistently? If used, do green and red make sense?
- Have I used size consistently?
- Is there a color or size legend, if applicable?
- If there is a legend, is it easy to find and read?
- Are percentages labeled with %?
- Is the number of decimal places used appropriate for the data?
- If an axis shows a continuous value, does it include 0? If not, is there a good cause? Are the axis values clearly labeled?
- If the chart shows negative values, are negative and positive values clearly distinguishable?
- If an axis shows percentages, does it start at 0 and end at 100?
- If an axis shows categories, is the axis label or legend redundant?
- Have I noted the data source?

## Once you have completed data analysis, you can use storyboarding to think about how to tell your story

### **What is a storyboard?**

A storyboard is a visual layout of the pictures and text you want on each slide of a presentation.

Storyboarding is particularly important when:

- You have to present complex and tough messages
- Your presentation consists of several data components (charts, graphs, tables, maps, etc.)
- A persuasive argument is needed to gain support for an idea or recommendation
- You are not familiar with the subject matter

# No matter how you storyboard, the process will have a similar overall frame

## Establish Context

- Determine objectives
- Consider audience
- Establish logistical parameters

## Brainstorm

- Get everything relevant on paper
- Identify questions to be resolved
- Gather relevant data

## Organize

- Organize concepts into pyramids (see following slides)
- Draft headlines
- Check for flow and logic

## Fill In

- Determine content for each headline
- Edit for length
- Make visualizations as needed

# First, establish context for your presentation

## Establish Context

- Determine objectives
- Consider audience
- Establish logistical parameters

## Brainstorm

- Get everything relevant on paper
- Identify questions to be resolved
- Gather relevant data

## Organize

- Organize concepts into pyramids (see following slides)
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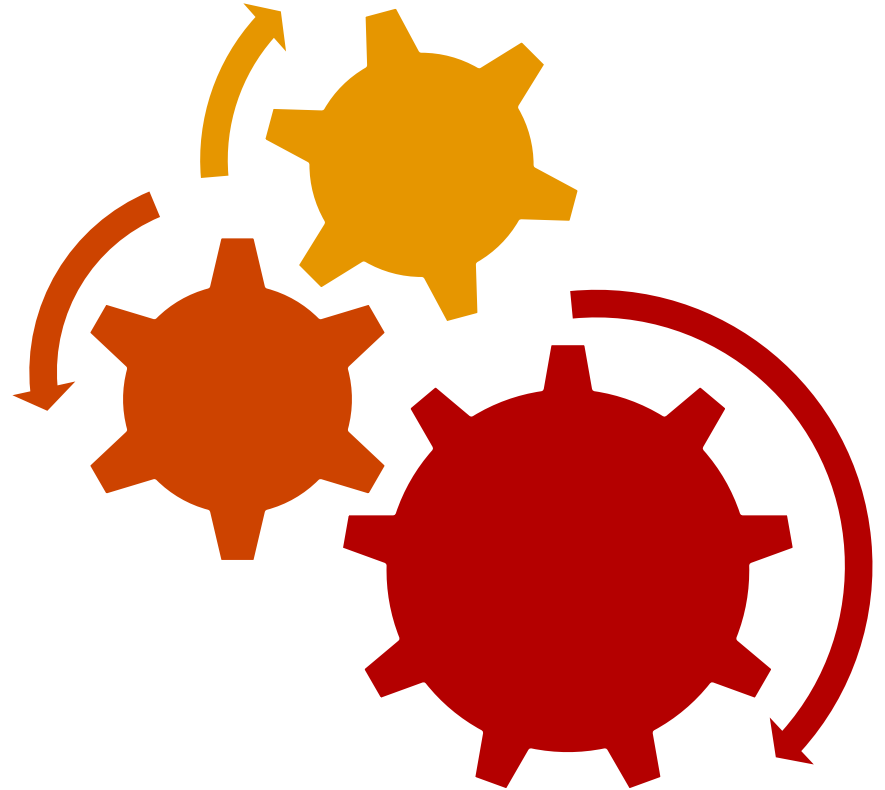
## Fill In

- Determine content for each headline
- Edit for length
- Make visualizations as needed

# There are several contextual and logistical issues to consider when storyboarding

Things to consider when storyboarding:

- ✓ Audience
- ✓ Presentation length
- ✓ Level of expertise or awareness of subject matter – of both the audience and the presenter
- ✓ Overall purpose/intended use of slide deck
- ✓ Proper balance of content and data
- ✓ Method of presentation delivery
- ✓ Flow and logic



# Next, brainstorm the questions to be resolved as part of your analysis

## Establish Context

- Determine objectives
- Consider audience
- Establish logistical parameters

## Brainstorm

- Get everything relevant on paper
- Identify questions to be resolved
- Gather relevant data

## Organize

- Organize concepts into pyramids (see following slides)
- Draft headlines
- Check for flow and logic

## Fill In

- Determine content for each headline
- Edit for length
- Make visualizations as needed

## It can be helpful to have all potential parts of your story available before organizing your story

- Brainstorm potential parts of your story and be sure to get input from relevant members of your team
- Once that brainstorm has happened, think about what data might be relevant to these story elements, and what questions still need to be resolved
- Be prepared to leave out a lot of the brainstorm! All of these elements might be true and interesting, but for your presentation you must focus on the best way to tell your story and convince your audience of the actions that need to happen



# The third step is to organize your brainstorm into a clear story

## Establish Context

- Determine objectives
- Consider audience
- Establish logistical parameters

## Brainstorm

- Get everything relevant on paper
- Identify questions to be resolved
- Gather relevant data

## Organize

- Organize concepts into pyramids (see following slides)
- Draft headlines
- Check for flow and logic

## Fill In

- Determine content for each headline
- Edit for length
- Make visualizations as needed

# Finally, craft “headlines” for each data slide to tell your story and fill in the rest of the presentation

## Establish Context

- Determine objectives
- Consider audience
- Establish logistical parameters

## Brainstorm

- Get everything relevant on paper
- Identify questions to be resolved
- Gather relevant data

## Organize

- Organize concepts into pyramids (see following slides)
- Draft headlines
- Check for flow and logic

## Fill In

- Determine content for each headline
- Edit for length
- Make visualizations as needed

**The final presentation should guide your audience through an abridged version of your own journey to clear next steps**





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**Thank You**