

Encouraging Curiosity

Trends in Data Presentation for an Engaged Public.

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Big Trends in Data

We are living through a veritable 'data deluge':

kilo – mega – giga – tera – peta – exa

Data visualization is hot right now.

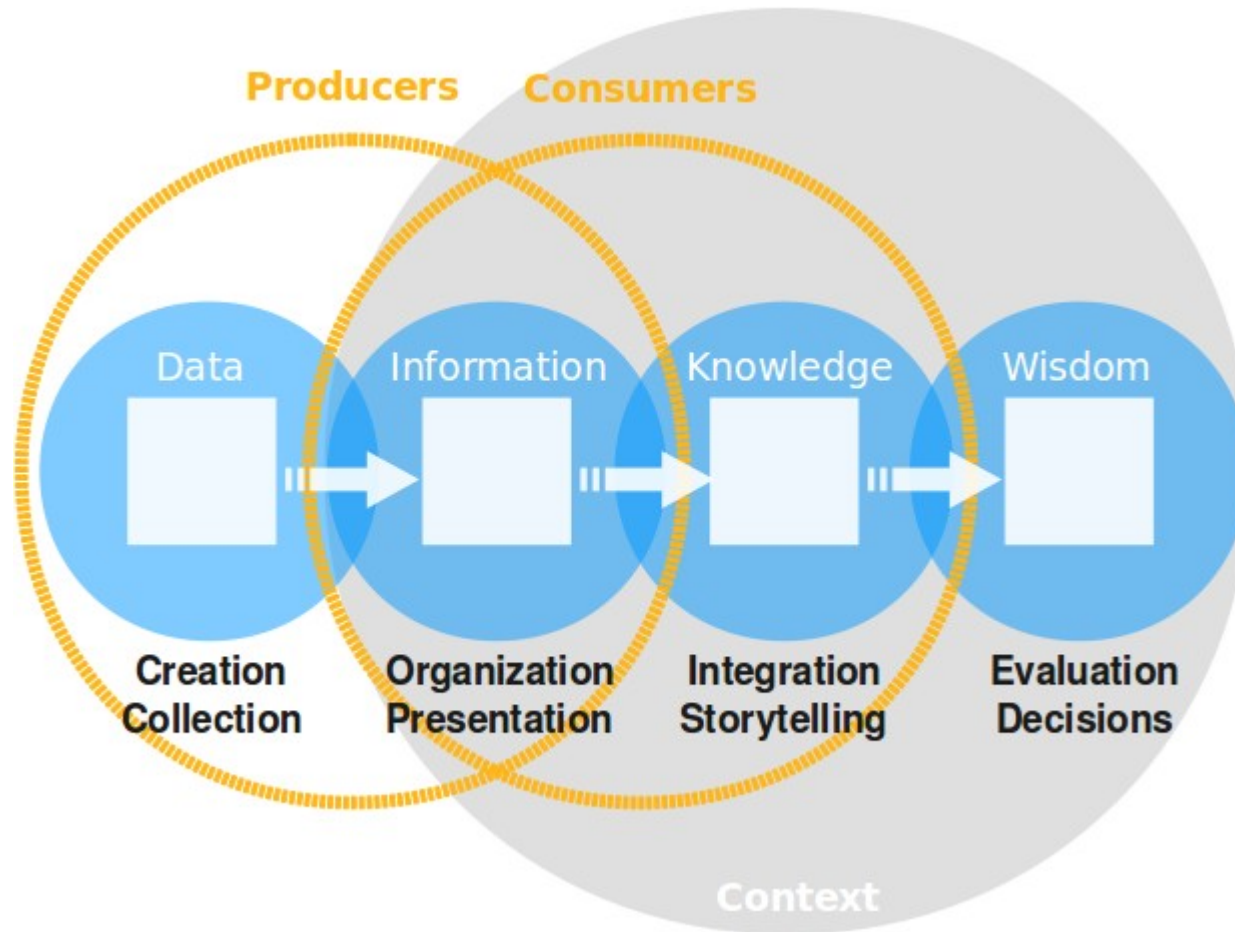
Everyone is connected all the time.

A younger generation is much more comfortable with data.

The cost of publishing has dropped to zero.

But these are details. Our overall relationship to data is unchanged.

Data – Information – Knowledge pathway



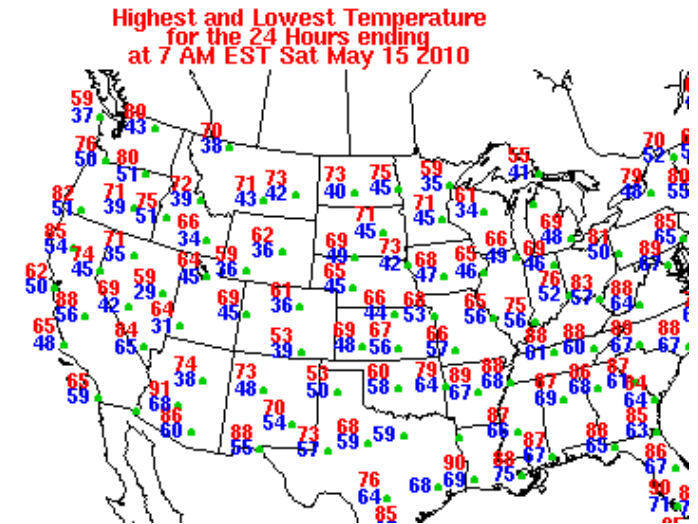
Graphic concept from nathan.com

From Data to Decision

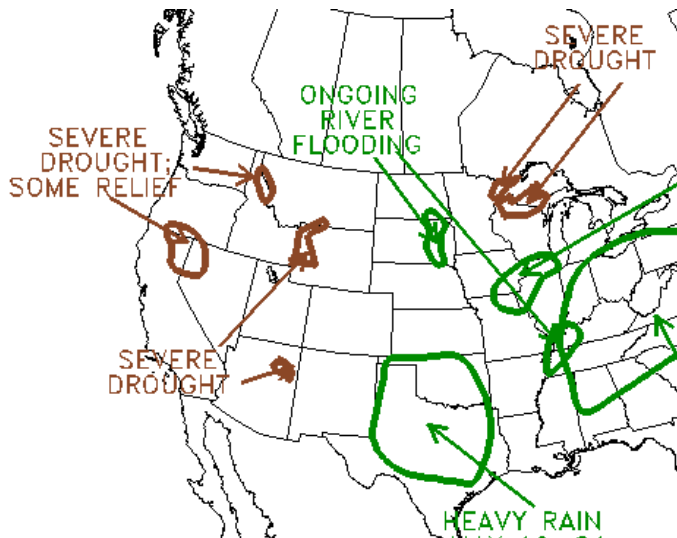
data



information



knowledge



wisdom



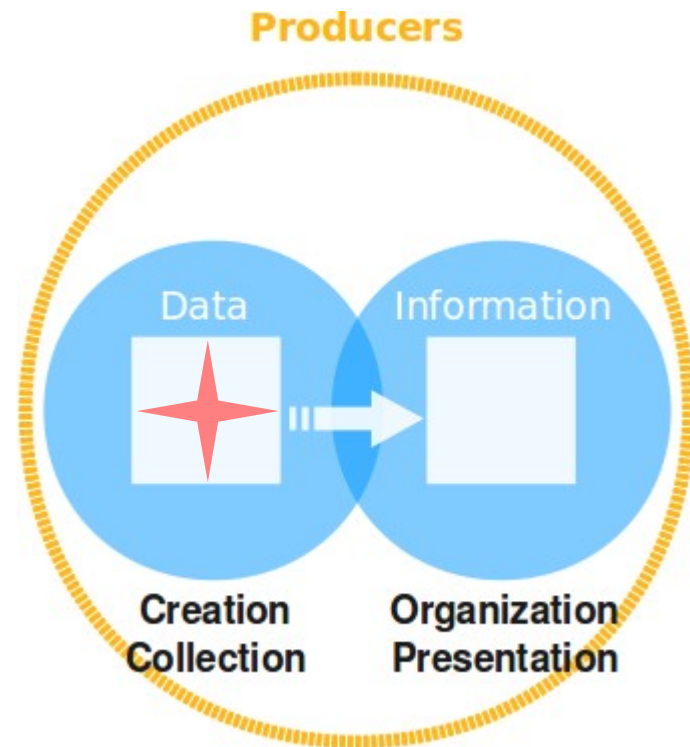
Evolution of Data

From:

- Hard to collect
- Hard to find
- Non-standard formats

To:

- data.gov
- data.worldbank.org
- 'open data'



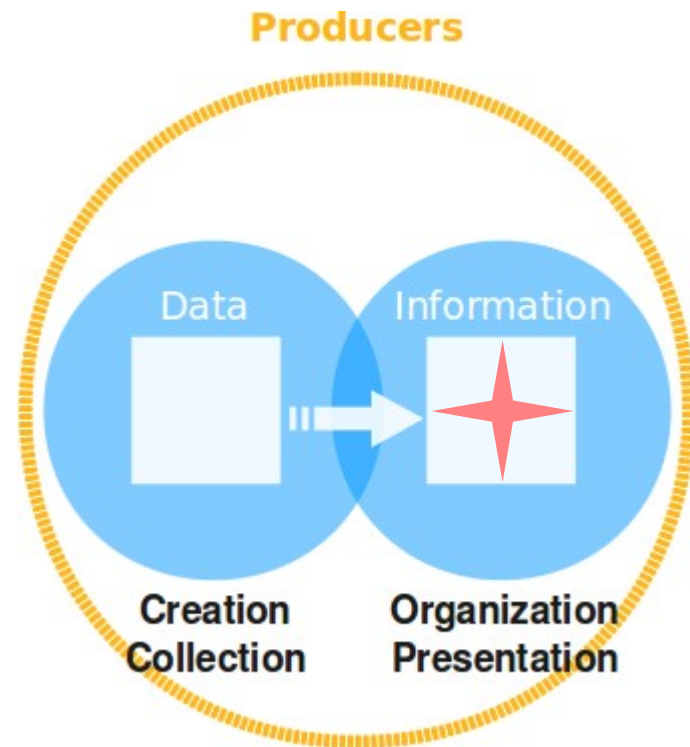
Evolution of Information

From:

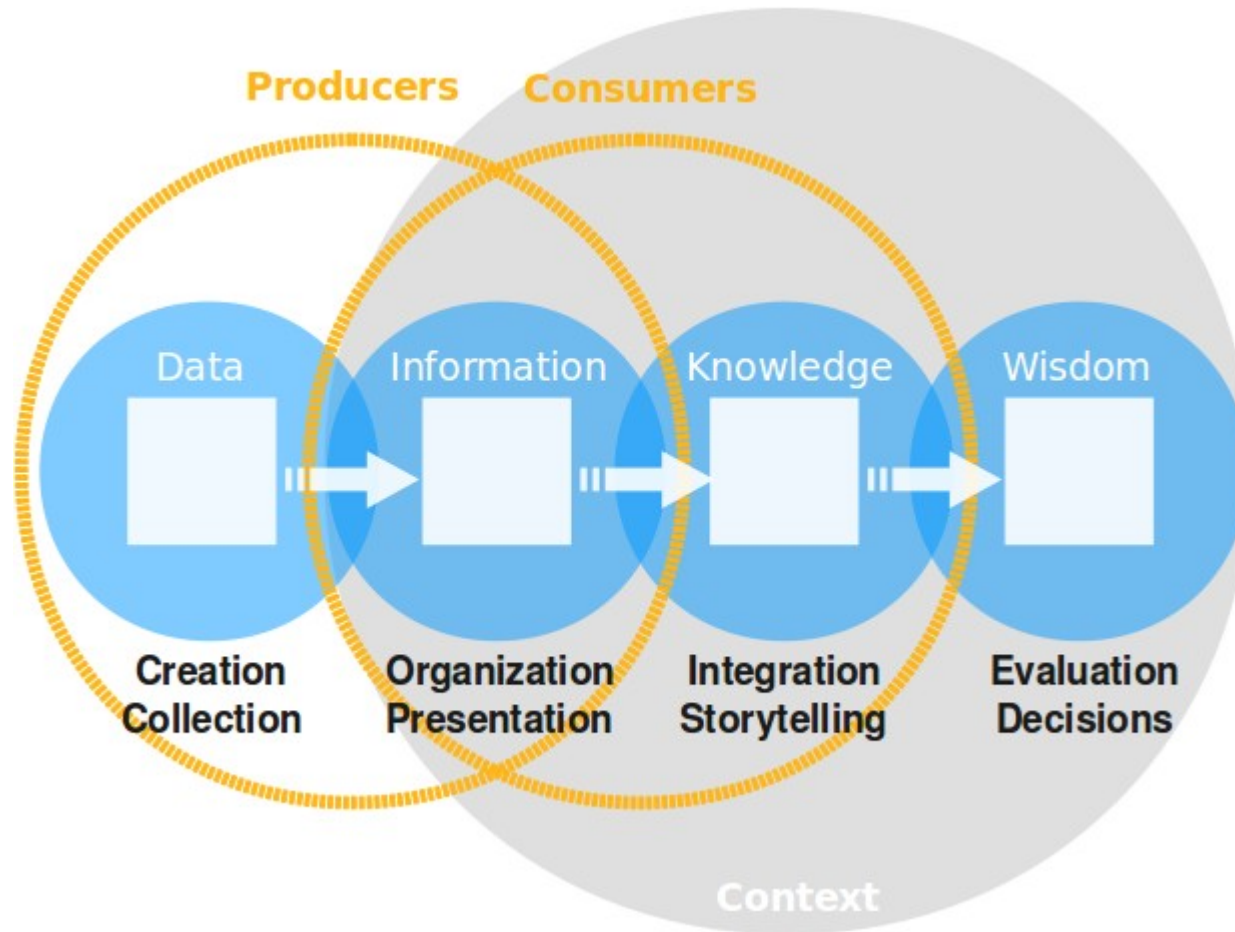
- Microsoft Excel
- Limited memory
- Text, tables and basic charts

To:

- Open-source R
- Gigabytes of RAM
- Tufte, FlowingData



Data – Information – Knowledge pathway



Graphic concept from nathan.com

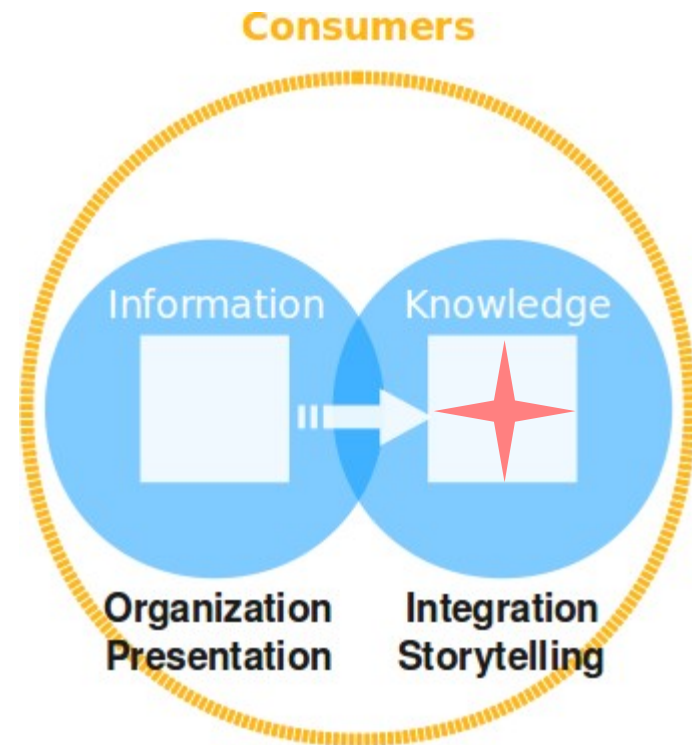
Evolution of Knowledge

From:

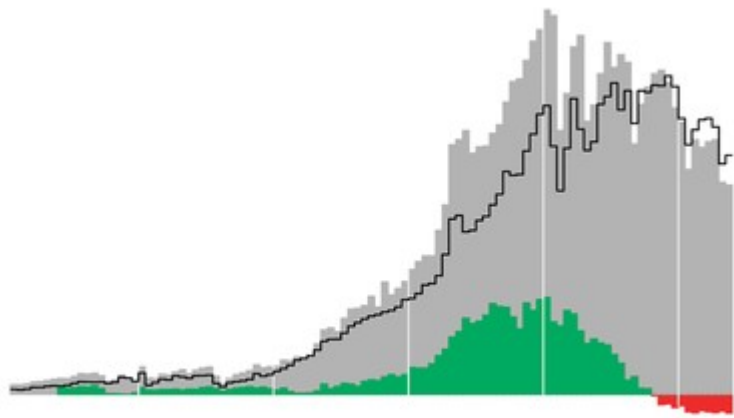
- Experts define the context.
- Experts do the analysis.
- Experts publish papers.

To:

- *Who will choose a context?*
- *Who will integrate?*
- *Who will tell stories?*



The story behind this presentation.



**Number Crunchers
Pattern Recognizers
& Story Tellers**

Number Crunchers

- Fast
- Accurate
- Consistent
- > 50 years of evolution



Very good at what they do!

Pattern Recognizers

- Fast!
- Accurate ~
- Creative!!
- > 50K years of evolution



Awesome at what we do!

Pattern Recognition

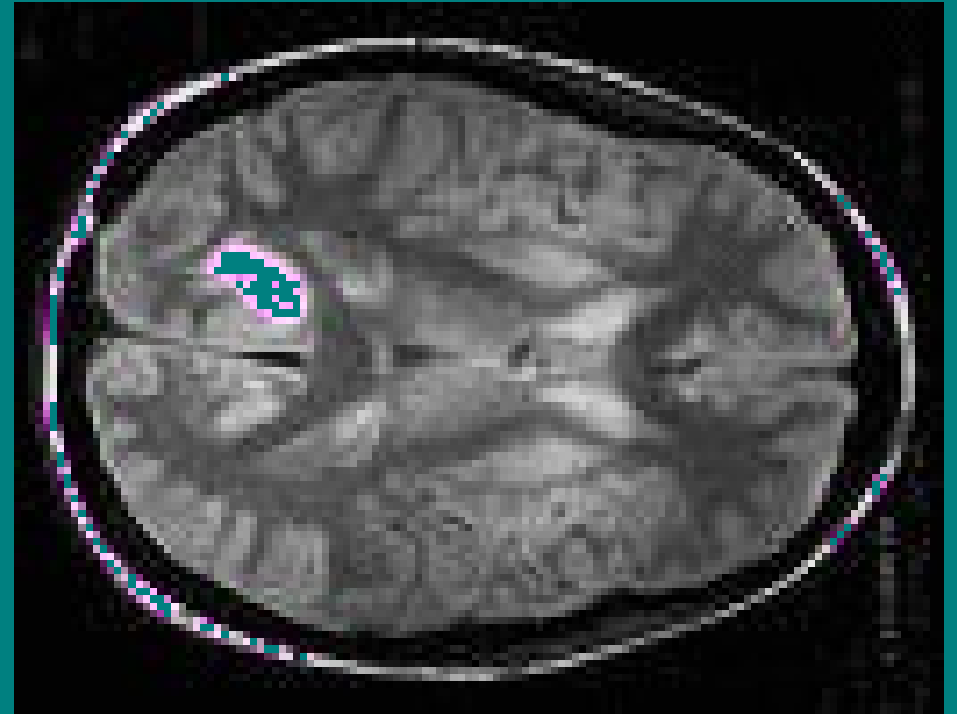
Humans are better than computers are recognizing patterns.



Pattern Recognition

Sensors can generate and computers can process millions of measurements.

When presented visually, humans recognize patterns instantly.



Pattern Recognition

Even abstract concepts can be displayed visually.

Some claim to see patterns even here!

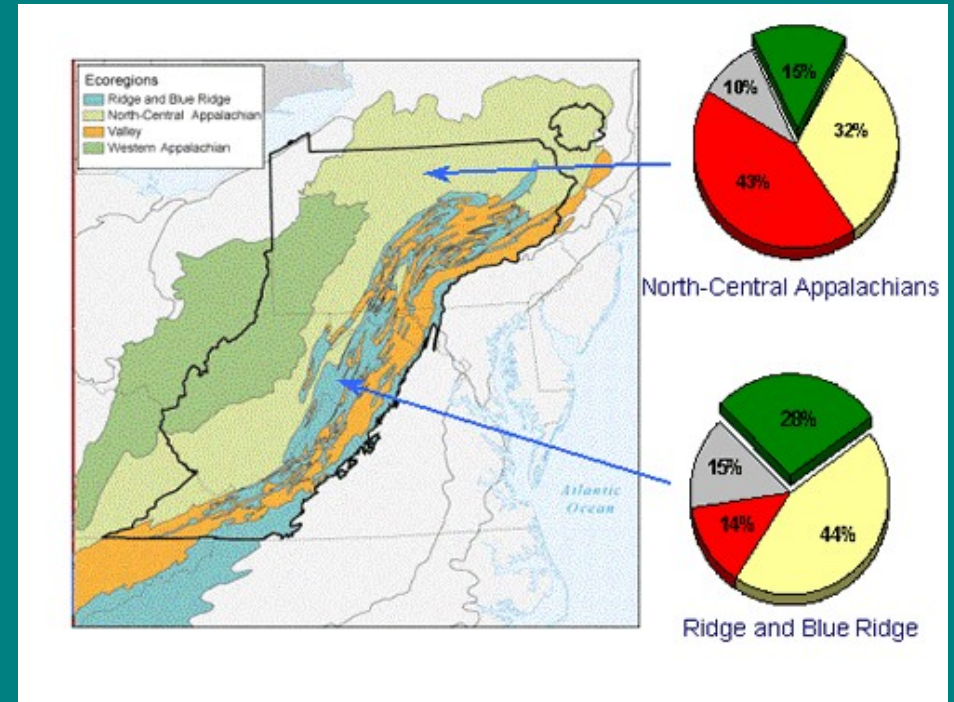


Pattern Recognition

When we want to tell stories with data we use graphics.

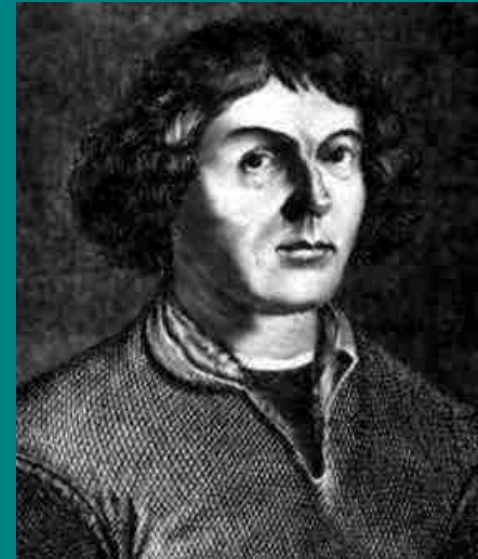
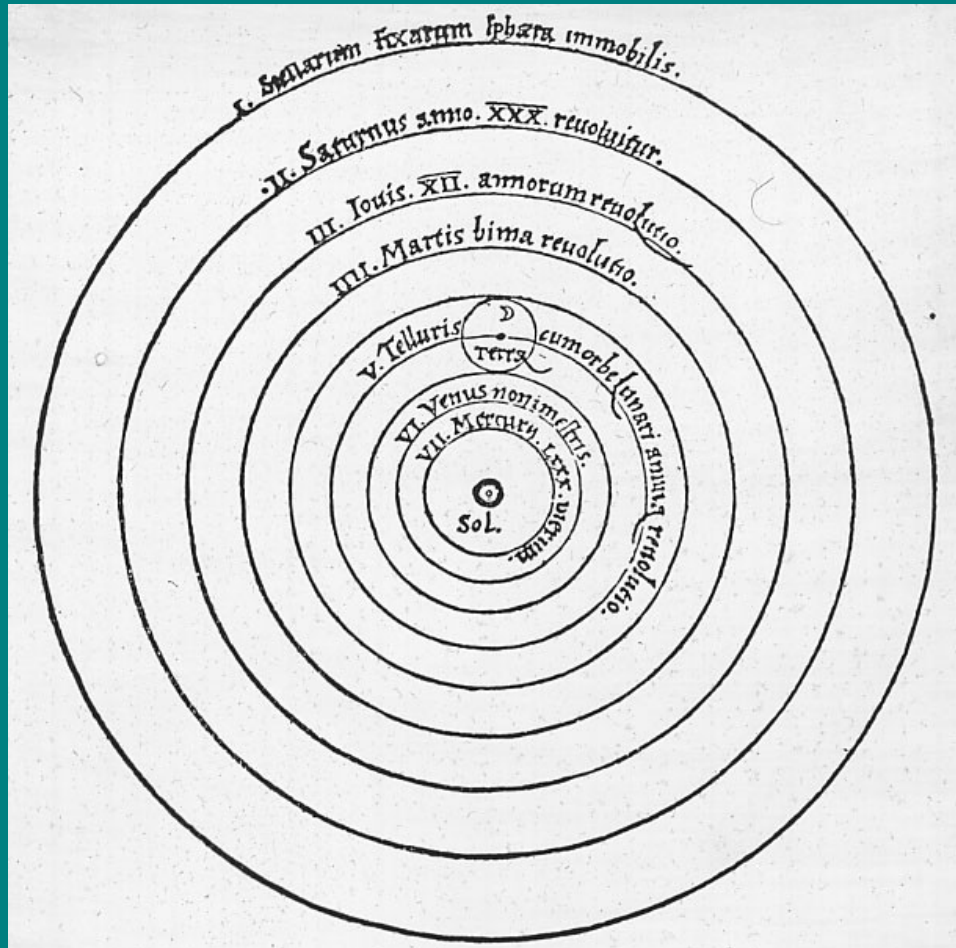
Including visualizations that map onto the real world.

And charts that are completely abstract.



Telling stories with data requires data visualization.

Story Tellers

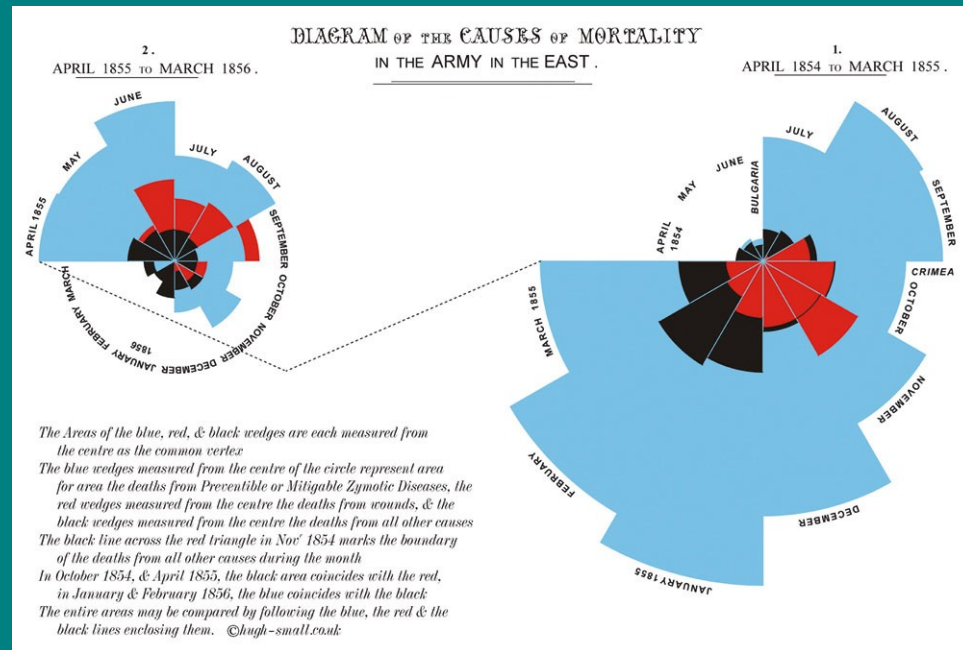


Copernicus

Story Tellers



Florence Nightingale



Story Tellers



Hans Rosling

gapminder.org

Data Visualization

- Each of our Story Tellers started with reliable data.
- Examining the data they found truths that sometimes ran counter to common knowledge.
- They were able to communicate these new truths by telling stories with compelling data visualizations.
- When done properly, a picture can be worth much more than a thousand words.
- Web-based, interactive data visualization opens up a new possibilities.

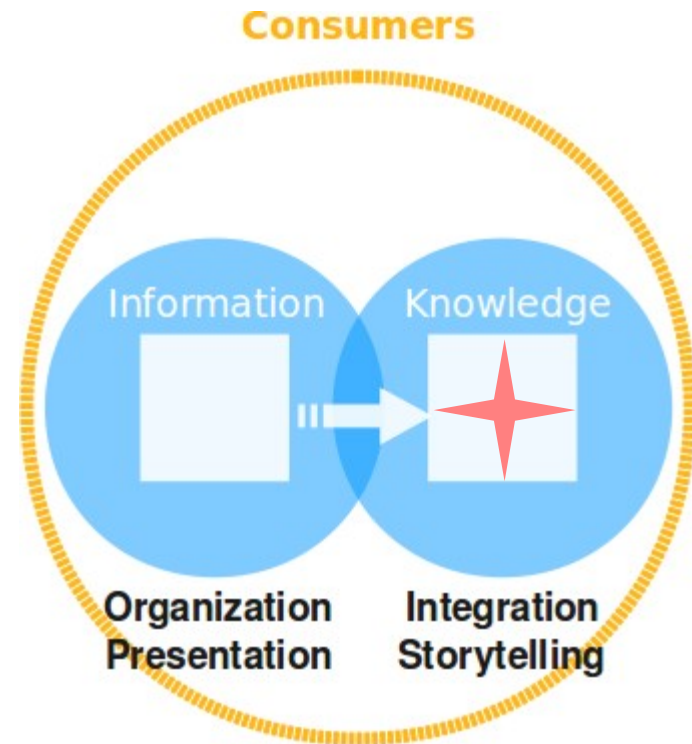
Evolution of Knowledge

From:

- Experts define the context.
- Experts do the analysis.
- Experts publish papers.

To:

- **Anyone can choose context.**
- **Anyone can investigate.**
- **Anyone can learn.**
- **Anyone can tell stories.**



Understanding News Headlines.

- Headlines say all kinds of things that may be true or not.
- The article attached to a headline may or may not provide adequate information for the truly interested reader.
- To know what to believe, one has to have access to the backstory behind the article.
- That backstory is told with *information* derived from *data*.

Let's examine some of the backstory for a scary headline.

Can Peak Phosphorus be real?



The image is a screenshot of a web page from Foreign Policy magazine. At the top left is the 'FP' logo in a red box, with 'Foreign Policy' written below it. To the right of the logo are links for 'MAGAZINE' and 'ARCHIVE', followed by a search bar. Below these links is a navigation bar with the date 'MAY 17, 2010' and several category links: 'PASSPORT', 'DREZNER', 'RICKS', 'WALT', and 'AFPAKCHANNEL'. Below the navigation bar, on the left, is a red arrow pointing to the word 'ARGUMENT'. On the right, there are links for 'PRINT', 'TEXT SIZE' (with minus and plus icons), 'EMAIL', and 'SINGLE PAGE'. The main title of the article is 'Peak Phosphorus' in a large, bold, black font. Below the title is a short paragraph: 'It's an essential, if underappreciated component of our daily lives, and a key link in the global food chain. And it's running out.' The first part of this paragraph is highlighted with a yellow box. Below the paragraph, the author information reads 'BY JAMES ELSER, STUART WHITE' followed by a vertical bar and the date 'APRIL 20, 2010'.

FP
Foreign Policy®

MAGAZINE | ARCHIVE |

MAY 17, 2010 | PASSPORT | DREZNER | RICKS | WALT | AFPAKCHANNEL

► **ARGUMENT** | PRINT | TEXT SIZE - + | EMAIL | SINGLE PAGE

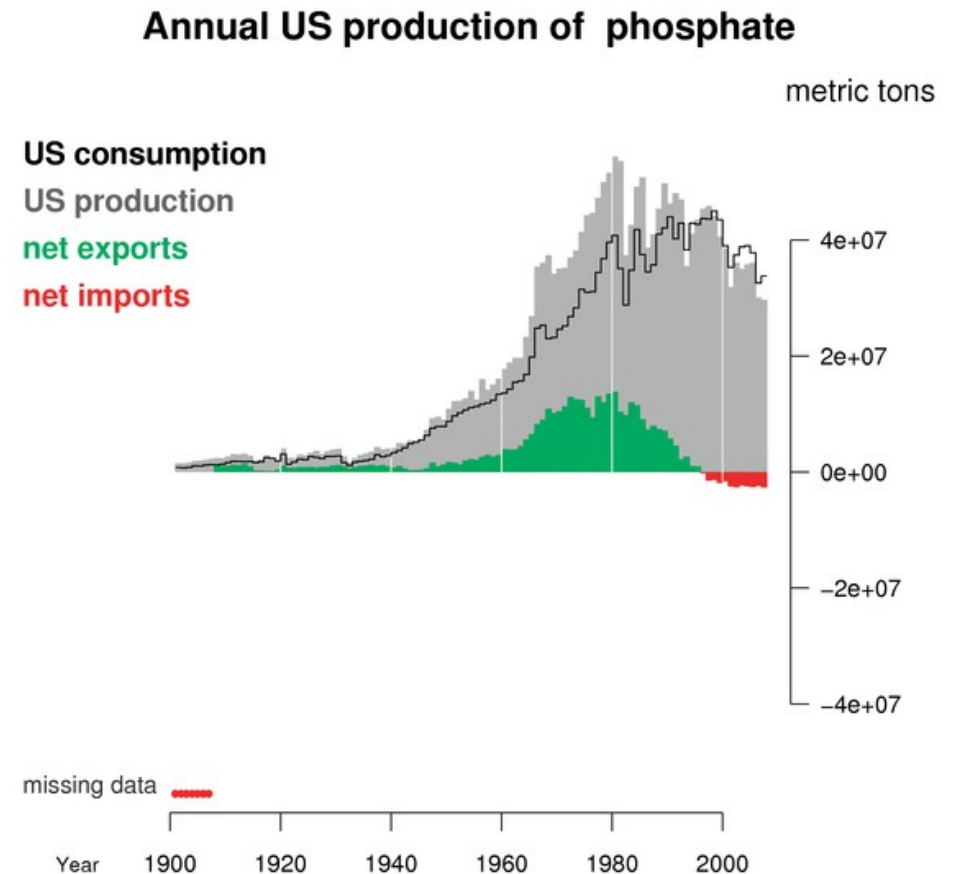
Peak Phosphorus

It's an essential, if underappreciated component of our daily lives, and a key link in the global food chain. And it's running out.

BY JAMES ELSER, STUART WHITE | APRIL 20, 2010

Phosphate – US Production

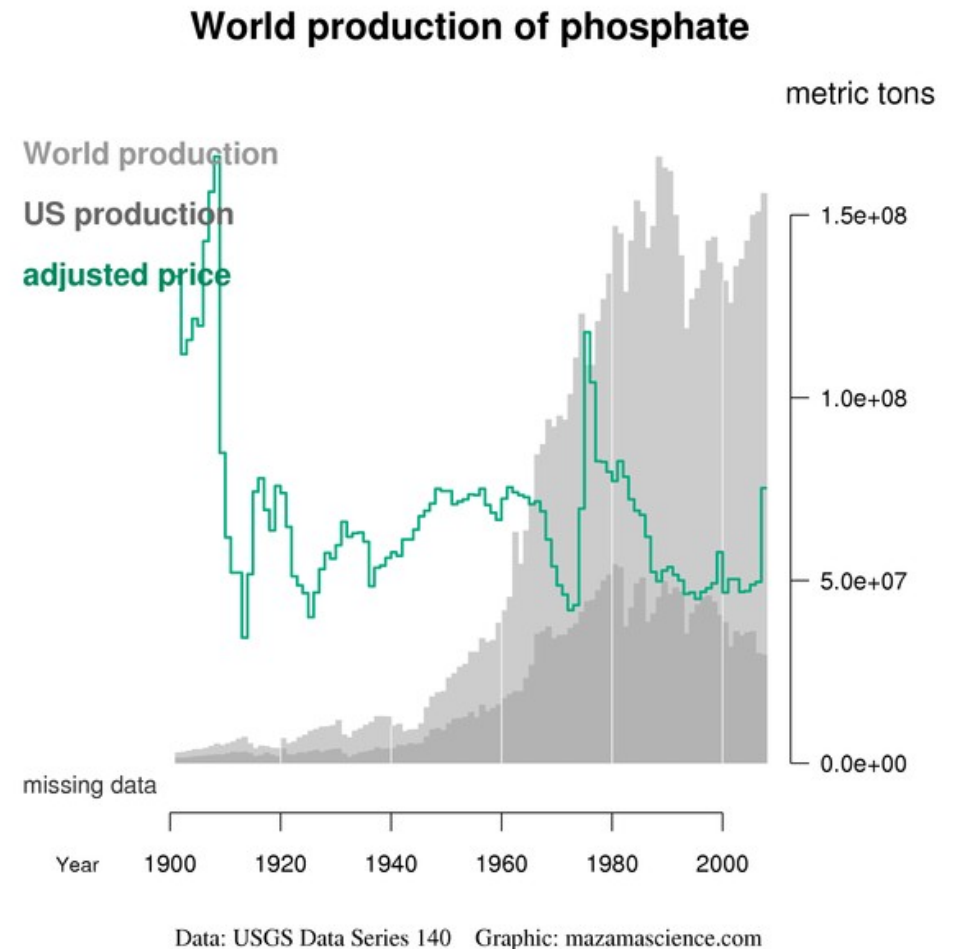
- After WWII, US phosphate production (green revolution) increased steadily, peaking in 1980.
- Consumption also increased, peaking in 1999.
- After decades of exporting the US is now an importer of phosphate.



Data: USGS Data Series 140 Graphic: mazamascience.com

Phosphate – World Production

- After WWII, world phosphate production (green revolution) increased steadily, peaking in 1988.
- US contribution to world production is decreasing.
- In 1975 prices saw a dramatic spike
- We are spiking again.
- Peak Phosphate sure looks real.



This is Good Information!

- Information comes from a reputable source.
- Information is rich in detail (leading to further questions).
- Information is easy to understand.
- Information answers the questions being asked.
 - Is the US at/past peak phosphate production?
 - Is the US dependent upon imports?
 - Is the world at/past peak phosphate production?
 - Do current price jumps have any precedent?

What the heck is gallium used for?

UN warns rare metal shortage could derail clean tech boom

Failure to improve recycling rates of metals such as lithium and gallium could leave them "essentially unavailable" for use in solar panels, electric cars and other clean technologies

BusinessGreen.com Staff, [BusinessGreen](#), 14 May 2010



The UN yesterday issued a stark warning that the adoption of low carbon technologies such as solar panels, electric cars and energy efficient lights could stall unless the recycling rates for "speciality metals" used by the electronics industry drastically increases.

Metals such as **lithium, neodymium and gallium** all play crucial roles in the development of many clean technologies. But according to a new preliminary report from the UN's International Panel for Sustainable Resource Management, recycling rates for these metals currently stand at around one per cent.

It warns that currently recycling policies are failing to stop huge quantities of valuable metals being lost each year when the electronic equipment that also makes use of "speciality metals" is disposed of.

The report, *Metals Recycling Rates*, argues that unless recycling rates for rare earth metals are significantly increased they could become "essentially unavailable for use in modern technology".

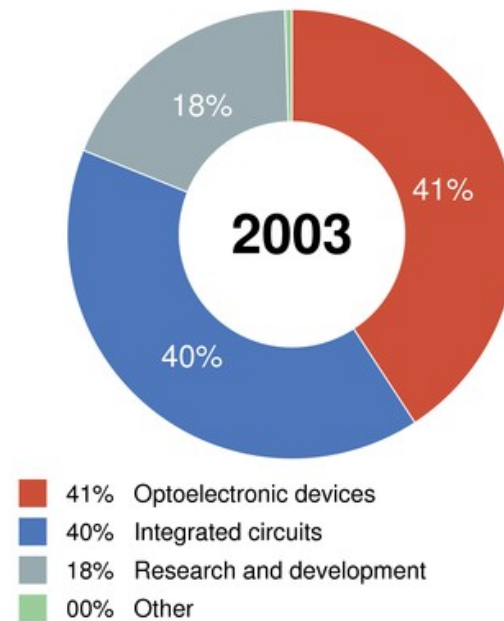
Gallium – Usage

- All the uses are high tech.
- 41% optoelectronics
- 40% integrated circuits
- 18% R & D

How have consumption patterns evolved?

US 2003 gallium usage

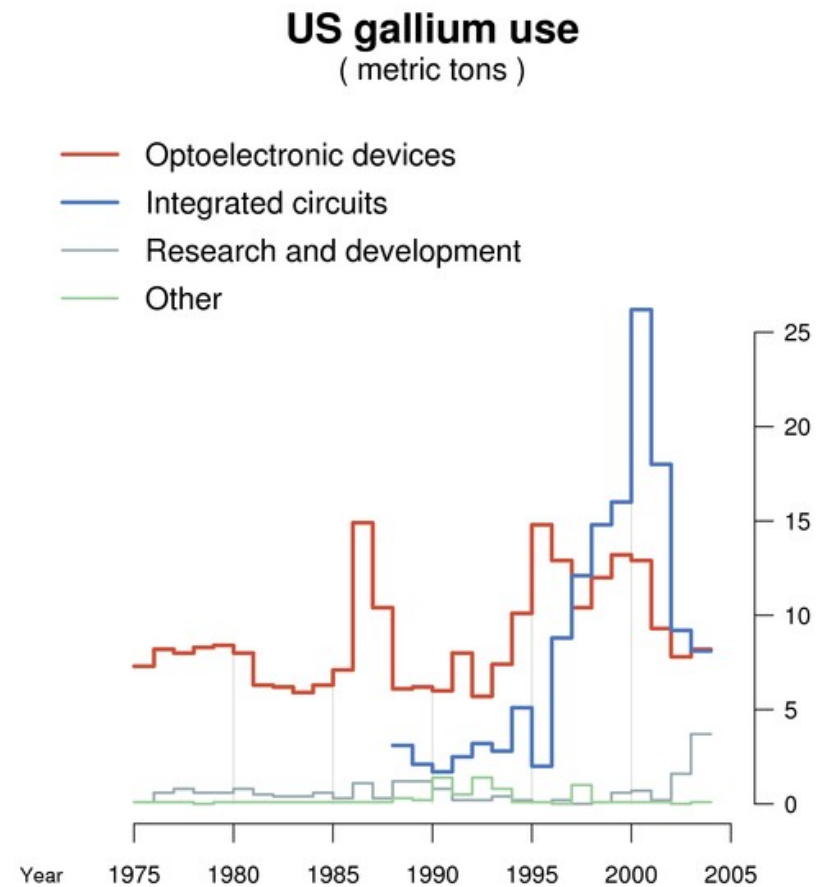
(20.1 metric tons)



Data: USGS Data Series 140 Graphic: mazamascience.com

Gallium – Usage

- Usage is highly variable.
- US gallium usage is declining.



Data: USGS Data Series 140 Graphic: mazamascience.com

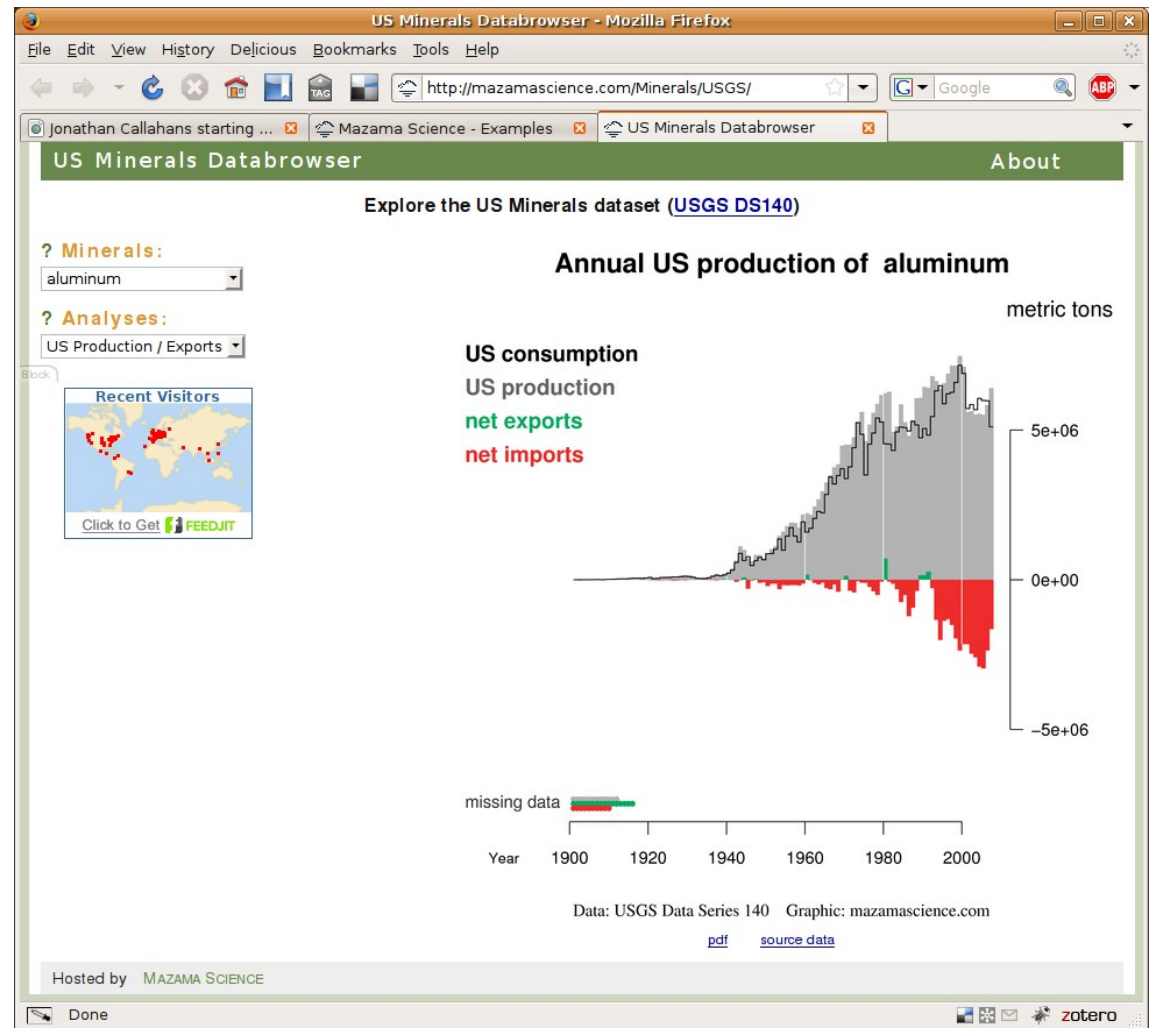
Encouraging Curiosity

- Wouldn't it be nice if people had access to these plots whenever they had a question about a mineral headline?
- How much of X do we produce?
- How much does the world produce
- How much do we import/export?
- How much of X do we consume?
- What is it used for?
- What is our import dependency?
- What kind of reserves exist?
- How expensive has X been in the past?

US Minerals Databrowser

- Simple
- Web based
- Interactive
- Informative

Lets **anyone**
ask questions,
recognize patterns
and tell stories.



mazamascience.com/Minerals/USGS

Encouraging Curiosity

Databrowsers should be:

- Simple
- Interactive
- User focused
- Open-ended
- Engaging

Harnessing Human Nature

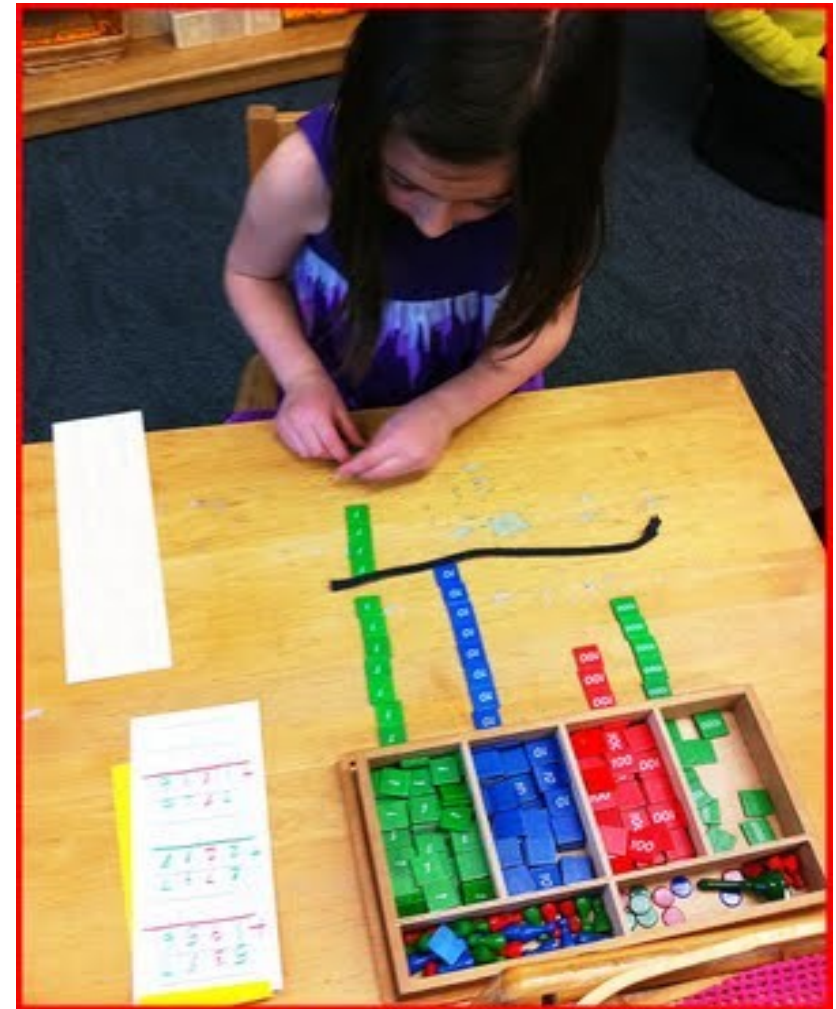
We all like to explore.

We like to recognize patterns.

We like to discover.

We like to learn through
discovery.

Learning that comes through
discovery is the most powerful.



How to Build an Interactive Data System.

- Start with an important topic and some base questions.
- Assemble a rich set of data to answer these questions.
- Interrogate/explore the data to uncover any additional stories.
- Ask as many questions as you can.
- Gather additional data to answer these questions.
- Design data visualization(s) first. Then figure out how to create them.
- Allow users to subset the data in meaningful ways.
- **Make exploring data fun!**

Interactive Data Examples

Mazama Science databrowsers

GapMinder.org

Google Fusion Tables

Tableau

Many Eyes

Find a dataset you're interested in and poke around.

See what it feels like to discover things in someone else's data.

Data Visualization Inspiration

Edward Tufte

Flowing Data

New York Times

But don't get caught up with the slickest, coolest, latest thing.
Just find something that tells the stories found in the data.

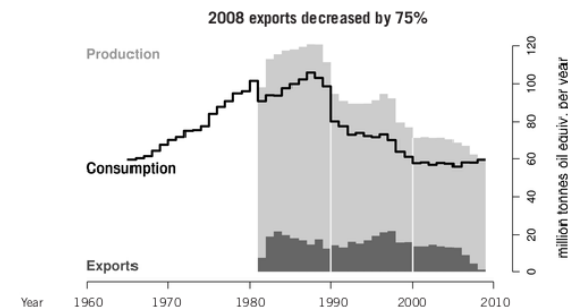
Examples of an 'engaged public'.

2. THE USE OF COAL-MINING SUBSIDIES IN POLAND

Subsidies for coal mining were widespread in Europe until the mid-1990s when the coal industry faced increasing competitiveness from imports. Many arguments were used to justify these subsidies—mainly energy security, social stability and the dependence of related sectors on the continuance of coal mining (Fronzel, Kambeck & Schmidt, 2007).² In poorer or transitional countries, where electricity generated from fossil fuels represented a substantial share of total energy production, subsidies that frequently took the form of low coal prices³ were justified as a way to moderate inflationary pressures. However, as an anti-inflationary policy it was poorly targeted; a 10 per cent increase in coal prices would lead to a 5 per cent increase in the cost of producing electricity in a coal-fired power station and a much smaller cost increase passed on to the consumer.⁴

Poland is one of only a few countries in the world with a coal-based energy economy. Hard coal and lignite provide more than 55 per cent of Poland's primary energy supply, and 95 per cent of its electricity is generated from these fuels. Poland has a large domestic endowment of coal, but its heavy dependence on coal also has historical roots. During the period when its economy was centrally planned (1945–1989) in particular, Poland had limited foreign exchange earnings with which it could import oil and natural gas. But because coal mining was considered one of the country's most important sectors, it was subsidized and coal prices were regulated to keep them affordable. The table below provides further information about Poland's coal sector.

FIGURE 1. POLAND COAL PRODUCTION



Date: BP Statistical Review 2009

Graphic provided by Mazama Science: <http://mazamascience.com/OilExport/>

² In 1994 there was a special session of SNS Energy Stockholm devoted to various aspects of coal subsidies. Papers can be found in *Energy Policy*, vol. 23, 1995, No. 6.

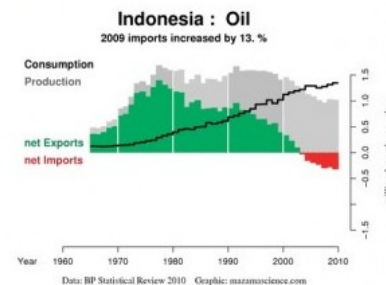
³ Coal costs are balanced by governmental subsidies, such as is the case in Ukraine.

⁴ The electricity price for the final consumer consists of the energy price as well as capital recovery and the cost of transmission and distribution fees, which together constitute a substantial share of total costs.



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Qualcuno sta usando il nostro petrolio



Mi arrivano continue segnalazioni per una breve news pubblicata venerdì dal *Sole 24 Ore*: il Fondo Monetario Internazionale avrebbe lanciato un allarme sulla prossima **“crescente scarsità” di petrolio**. Questo significa forse che l'economia, dopo la geologia, si è resa conto del picco di produzione ormai raggiunto. *“Allarme dell'Fmi sull'offerta”*, titola significativamente il *Sole*. Così, sono andata a verificare di persona.

Il documento, una sintesi di un capitolo del *World Economic Outlook* di prossima uscita, [si trova qui](#). Il

punto che mi preme sottolineare è il seguente: i mercati mondiali del petrolio si trovano in un periodo di crescente scarsità, che riflette la **rapida crescita nella domanda** di petrolio delle economie emergenti e un **calo nella crescita dell'offerta**.

Si fa naturalmente riferimento all'inesausta e mai abbastanza discussa questione della gigantesca domanda petrolifera cinese, indiana e di tutti gli altri Paesi manifatturieri. Ma l'ultima frase è quella più indicativa: **non si parla di produzione, ma di offerta**. Si tratta forse di una censura involontaria verso il problema del picco produttivo, quell'elefante nella stanza che si fa tanta fatica a vedere? Non ne sarei tanto sicura.